A STUDY OF SELECTED VARIABLES ASSOCIATED WITH ACHIEVEMENT IN MATHEMATICS

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By

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To

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I

Dedicate

This Humble Work

To The Loving Memory Of

My Beloved Father Late K. Kamluai

Who Has Been An Invisible But

Strong Source Of Inspiration And

Strength Throughout My Studies

CERTIFICATE

I certify that the thesis entitled "**A Study of Selected Variables Associated with Achievement in Mathematics**" submitted by **Ms Caroline Ngailiankim** for the **Degree of Doctor of Philosophy** of the North-Eastern Hill University, Shillong, embodies the record of original investigation carried out by her. She has been duly registered and the thesis presented is worthy of being considered for the award of the **Ph.D. Degree**. This work has not been submitted for any Degree of any other University.

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Caroline Ngailiankim 20/3/91
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CHAPTER I

INTRODUCTION

INTRODUCTION

1.1.0. Introduction

Mathematics is said to be the numerical and calculation part of man's life and knowledge. It helps man to give the exact interpretation of his ideas and conclusions. It deals with quantitative facts and relationships as well as with problems involving space and form. It deals with relationship between magnitudes and enables man to study various phenomena in space and to establish relationships between them.

Mathematics can be seen in various ways, as a body of knowledge, a collection of techniques and methods, the product of human activity, and even as the activity itself, namely, the solving of problems. Although Mathematics is often considered to be a collection of facts and procedure, current thinking in the field supports a view of Mathematics as the activity of constructing patterns and relationships (National Council of Teachers of Mathematics, Commission on Standards for School Mathematics, Curriculum and Evaluation, 1989; National Research Council, 1989).

Lovers of Mathematics have given it many a epithet and described in numerous ways. It is the 'epitome to human

thought' exclaim some, while others visualise it as, 'a symbol of pure beauty'. Some have experienced ecstacy and perceived in Mathematics the eternal glow of truth, while others consider it as the final stage in God-realisation. Enthralled by its beauty, a lover once said that if you wish to realise Truth and Beauty, it is this grand garden where even a stroll is like a great yatra for the realisation of reality, for Mathematics is Truth and Truth the God personified (Sharma, 1985).

To most people, Mathematics is the process of counting, calculating, measurement and so on, and is considered to be the science of numbers only. To scientists, it is the 'Queen of all the Sciences' or 'a Vehicle of Sciences'. To others, it is a process of free invention.

Mathematics is the science of measurement, quality and magnitude. According to New English Dictionary, "Mathematics in a strict sense is the abstract science which investigates deductively the conclusions implicit in the elementary conceptions of spatial and numerical relations" (Sidhu,1984).

The New Oxford Encyclopedic Dictionary (1983) defines Mathematics as the "abstract science of space and number".

According to Servais, "Mathematics is an abstract

science; we could say, it is the science of abstraction". Learning Mathematics, he believes, is learning to abstract and to handle abstractions (Rappaport, 1977).

In the words of Sidhu (1984),

> "Mathematics is the science of abstract form. The discernment of structure is essential no less to the appreciation of a painting or a symphony than to understand the behaviour of a physical system; no less in economics than in astronomy. Mathematics studies order abstracted from the particular objects and phenomena which exhibit it and in a generalised form."

According to Everyman's Encyclopedia (Volume 8, 1967),

> "Mathematics is the basis of all other sciences. For practical purposes Mathematics is divided into Pure Mathematics, of which the principle branches are arithmetic, algebra, geometry, trigonometry and calculus and Applied Mathematics, which includes mechanics, kinetics, thermodynamics, the theories of light and electricity, astronomy, statistics, relativity, quantum theory and indeed every branch of physics. Pure Mathematics is abstract and can be developed and studied without reference to physical laws, whereas Applied Mathematics is frequently based on experimental discovery, and is designed to elucidate it, but is also often the precursor of new advances in natural sciences."

Hirst & Peters (1970) regarded Mathematics as one of the seven forms of knowledge. Mathematics is characterised by its distinctive concepts, propositions, and the method

of verifying its propositions, namely, logical proof. This can be described as an abstracted, theoretical view of knowledge, in which knowledge is regarded as a product.

Lindsay says, "Mathematics is the language of physical sciences and certainly no more marvellous language was ever created by the mind of man", whereas Locke has said, "Mathematics is a way to settle in the mind a habit of reasoning" (Sidhu, 1984).

Mathematics is exact and true to the point knowledge. It trains or disciplines the mind. Its study results in the development of power rather than the acquisition of knowledge; and knowledge comes as a natural consequence or by-product.

It has also been said that, Mathematics is the "mirror of civilization". It has got its cultural value, and this value is steadily increasing day-by-day. It helps man to overcome difficulties in the way of his progress. It has played a major role in bringing him to such an advanced stage of development. The prosperity of man and his cultural advancement have depended considerably upon the advancement of Mathematics.

1.2.0. Importance of Mathematics in Life

The knowledge of Mathematics was born out of the felt needs of man. Right from human existence on this earth, it has been a faithful companion. When man first wanted to answer the questions like- How many? How much? How big? How long? etc., – he invented arithmetic. Algebra was devised to simplify arithmetical computations. For measurement and form geometry was invented. To find the position of high mountains and stars trigonometry was invented and developed, and so on in the case of numerous other branches of Mathematics. The knowledge of Mathematics is therefore indispensable. As the needs grow, the knowledge is bound to grow. Mathematics has become the basis of the world's entire business and commercial system.

The tremendous impact of Mathematics in the modern era is significantly visible in every aspect of human activity. Even a mere carpenter, driver, mason, farmer, chowkidar, labourer, cleaner, vendor, salesman, clerk, etc., or to say, any earning person has to calculate his/her wages and buy things from the market and adjust the expenditure to his/her income. Any person ignorant of Mathematics will be at the mercy of others and will be easily cheated. An elementary knowledge of the simplest branch of Mathematics, 'arithmetic', is the daily requirement of every man and

woman in the ordinary affairs of life. The knowledge of its fundamental processes and the skill to use them are the preliminary necessities these days. Thus, it is clear that without having some knowledge of Mathematics, a modern man is a total misfit in this affluent society.

In many occupations such as accountancy, banking, taxation, insurance, business, postal jobs etc., by which the needs of man are fulfilled, direct or indirect use of Mathematics is made. These social agencies depend upon Mathematics for their successful functioning. Also most individual and group projects in life fail for want of sense of calculation. Mathematics is useful for people as workers, as consumers, and as educated citizens. The study of Mathematics helps people to develop the ability to reason which in turn helps them to become better problem solvers. Not only students should see how Mathematics is applied in the real world, but they should observe how Mathematics grows from the world around them.

With the increased complexity of modern living and the pressure of economic circumstances, it has become impossible for any individual to conform to the society without having some knowledge about Mathematics. It has played an outstanding role and has become a part of our life. Its

importance and influence has increased considerably in the present century. Today almost all the disciplines need a strong foundation in Mathematics. The knowledge of Mathematics helps us to a better understanding of the process in nature and society. It is also used directly or indirectly in industry and business, as it solves not only technological problems but also commercial and organisational problems through operations research and computers. Mathematics pervades every study, technique and profession in our present computer age which sharply brings into focus the responsibility laid upon those whose difficult task is to teach Mathematics.

During the age of education of Three R's, Mathematics was one of the three subjects of study. Its importance in the present is no less. There can be no true schooling without Mathematics because it is an indispensable part of education. Mathematics is essential for efficient and successful living. Man utilises knowledge of Mathematics in one form or another. The need of a good command over arithmetic by even a housewife is too obvious to need any discussion. Counting, notation, addition, subtraction, multiplication, division, weighing, measuring, selling and buying are the mathematical operations that needs systematisation and simplification with greater diversification of man's

economic activities. They are the fundamental processes of Mathematics which have got an immense practical value in life. Whosoever earns and spends uses Mathematics. A person can get on sometimes very well without learning how to read and write but he/she can never pull on without learning how to count and calculate.

As we move from the industrial society of the 20th Century to the information society of the 21st Century, knowledge of Mathematics is becoming increasingly important for individuals who wish to have options for careers and higher education. Almost all careers require a background in Mathematics as most majors involve some statistics. Knowledge of Mathematics is essential for all members of our society. To participate fully in our democratic processes and to be unrestricted in career choice and advancement, people must be able to understand and apply mathematical ideas. As it is a sequential subject, unless one is clear about the previous units, it will not be possible for him/her to understand the next unit. The schools have generally been responsible to the needs of society. Because society demands acceptable levels of numeracy from all its members, Mathematics is compulsory in classrooms throughout the world. Society needs the maximum cultivation and utilization of this human talent wherever found and in all fields of human

endeavour in order to improve the quality of life for all of us.

Mathematics is so intimately related with man's life that a close relationship and interdependence is seen between the advances in Mathematics and in civilization. In fact, all civilizations flourished on the strong foundations of Mathematics laid by its thinkers. Mathematics is also playing a crucial role in the wonders of modern science. That is why sometimes Mathematics is eulogised as the 'Queen of all Sciences' but sometimes it is also designated as the 'Maid of all Sciences'. Mathematics is the Queen and also the Maid rolled in one. It is the epitome of all human thought, easily the first among all sciences. Mathematics is essential in all sciences for even ordinary purposes. In physical sciences a very high order of Mathematics is absolutely necessary. Mathematics has entered the arena of many a social science as well, like economics, in which it is not possible to move beyond a point without a good knowledge of Mathematics.

As knowledge was gathered by man bit by bit and as its stock grew, the use of Mathematics became inevitable to provide it in elegant forms and make it amenable to comprehension. It cuts short the lengthy statements and helps

the expression of ideas or things in exact form. The scientific advances which have captured people's imagination such as space travel, the harnessing of atomic power, and so on, would have been impossible without Mathematics. Also without Mathematics, statistical records cannot be kept accurately and hence the study of history will be impossible. There will be no economic development without Mathematics.

At the base of all the scientific and technological knowledge lies the learning of Mathematics. It sharpens the reasoning powers of a person and increases his mental alertness. On the whole, a mathematically minded man is usually more dependable than one who is otherwise disposed. The application of Mathematics in different fields like navigation, warfare, astronomy, economics, biology, physics, chemistry and geology need not be over-emphasized. It has also become the fundamental basis of medicine, engineering and technology. Thus, with the increasing quantitative base in all facets of our life, the knowledge of Mathematics amongst common people is bound to increase at a great pace.

Mathematics has acquired a special significance in the modern world. Sidhu (1984) cites what Napoleon had said, "The progress and the improvement of Mathematics are linked to the prosperity of the State." There can be no

doubt about the validity of the statement that mathematical processes were invented in accordance with the requirements of mankind. Human beings cannot pull on without satisfying his/her needs. In all major and minor activities of life, the number imparts system to our life. Ignorance of Mathematics among the masses is a formidable obstacle in the way of a country's progress. Thus, Mathematics will continue to occupy a prominent place in man's life.

1.3.0. Place of Mathematics in School Curriculum

Mathematics commands the highest subject priority rating in a school. The nature of the subject makes it worthy of a place for its own sake. Mathematics is a self-contained mental discipline, with its own language and structure. It acts as a mental tool for the training and exercise of intellectual functions. It provides methods which, when applied to a mass of data, can extract broad generalizations resulting in the economy of human time and thought. Besides being an individual subject, it is a medium of instruction for almost all other subjects. Secondary school Mathematics lays the foundation on which the superstructure of higher Mathematics may be built. Due to its unique role in solving every day problems, it has acquired special significance in the school curriculum.

As far back as 1802, the Universities of Oxford and Cambridge realized the significance of Mathematics and gave it a prominent position by making it compulsory for any one who desired to obtain the B.A. degree (Onyemunwa, 1989).

In 1901, Perry advanced many obvious reasons why Mathematics must be taught in schools and colleges. According to him, among others, they are useful in:

i) Producing the higher emotion and giving mental pleasure.

ii) Brain development and producing logical views of thinking.

iii) Teaching a man the importance of thinking things out for himself and so delivering him from the present dreadful yoke of authority, and convincing him that whether he obeys or commands others, he is one of the highest of beings (Education Pamphlet, Number 36, 1968).

Sir Wilfred Cockcroft, (The Times of India, January 25, 1989) Chairman of the Secondary Examinations Council, the U.K., has justified the learning of Mathematics in schools because it plays a special role as a means of precise, unambiguous communication.

The importance that Mathematics claims in the school education is brought out by Bazzini (1988) as,

> "Mathematical education helps in forming a child's thought in its various aspects, as it concerns intuition, imagination, the act of planning, of making a conjecture, of reasoning and of verifying a hypothesis. It specifically develops concepts as well as methods and attitudes which enable the children to produce skills of ordering, quantifying and measuring real events and making a critical examination of reality".

Mathematics should be visualised as the vehicle to train a child to think, reason, analyse and to articulate logically. Apart from being a specific subject, it should be treated as a concomitant to any subject involving analysis and reasoning (Caption 8.16, National Policy on Education, 1986).

The days when a student could say good-bye to Mathematics at the lower level of education and switch over to other disciplines are gone. Now, in almost all States of our country, Mathematics is one of the core subjects to be studied upto 10 years of schooling. This can be said by quoting from the National Policy on Education (1986),

> "Perhaps the most notable development has been the acceptance of a common structure of education throughout the country and the introduction of the 10+2+3 system by most States. In the school curricula, in

> addition to laying down a common scheme of studies for boys and girls, Science and Mathematics were incorporated as compulsory subjects and work experience assigned a place of importance." (Caption 1.6)

Discussing over the teaching of Mathematics in Schools, Sir Wilfred Cockcroft (1989) said,

> "Mathematics teaching at all levels should include opportunities for exposition by the teacher, discussion between the teacher and the pupils, appropriate practical work, consolidation and practice of fundamental skills, problem solving, and investigation".

The National Policy on Education (1986) claims,

> "with the recent introduction of computers in schools, educational computing and the emergence of learning through the understanding of cause – effect relationships and the interplay of variables, the teaching of Mathematics will be suitably redesigned to bring it in line with modern technological devices." (Caption 8.17)

For the promotion of interest in Science and Mathematics among students, the Department of Education, Government of Meghalaya, has announced incentive awards for Science and Mathematics teachers in Primary and Middle English Schools of the State. The criteria for award being the performance of students from the concerned schools in their respective School Leaving Certificate Examinations. The Government hopes that the awards will generate a spirit of competition

among teachers to improve the teaching of Science and Mathematics and to strive for better results from their students (The Shillong Times, March 29, 1989).

1.4.0. Aims of Teaching Mathematics

The following are the major aims of teaching Mathematics in secondary schools:

1. To help students to know the mathematical terms, concepts, principles and processes required in carrying out their day-to-day problems.
2. To develop an awareness among students of the importance of Mathematics in their future work.
3. To prepare the students for economic, productive, purposeful, creative and constructive living.
4. To inculcate in students the habits of regularity, practice, patience, self-reliance and discovery.
5. To develop in students the power of concentration, critical thinking, reasoning, efficiency and hard work.
6. To acquaint students with mathematical language and symbolism.
7. To provide students the necessary background for the study of higher Mathematics.
8. To train students in approaching and solving problems, in making suitable representations and in interpreting and verifying results.

9. To develop in students those powers of understanding and of analysing relations of quantity and of space which are needed to develop an insight into and control over our environment.
10. To impart a working knowledge of practical arithmetical applications which are useful in life.
11. To enable the students to possess a mind informed by a body of organized knowledge, to have curiosity aroused, powers of observation trained and their judgement developed.
12. To promote habits of accuracy, exactitude and systematic thinking among students.
13. To develop in students an appreciation towards the role of Mathematics in the present day world.
14. To teach students the skills that would enable them to face life with courage and confidence.
15. To create in students a desire to continue the study of Mathematics and offer their contribution towards the advancement of civilization.

1.5.0. Achievement: Its Meaning

In a general sense the term 'to achieve' conveys the meaning 'to accomplish' or 'to attain'. In the field of education it is referred with respect to the success in the school subjects. The term is defined by many in different ways. Some of these definitions are given under:

According to Micheels and Karnes (1950), the term 'achievement' means relative accomplishment in a specified area of work.

Academic achievement is seen by Mellinger and Heggard (1959), "as an expression of one way the individual learns to utilize his energies, given certain innate potentials and a particular patterns of a socializing pressure." Wolman's Dictionary of Behavioural Sciences defines that "academic achievement is the level of proficiency attained in scholastic or academic work" (Mohan & Gulati, 1986).

Achievement is defined by Stagner (1962) "as the degree of proficiency or progress made by pupils in the mastery of school subjects."

According to Aggarwal and Bhushan (1967), "scholastic achievement is the achievement of the individual student in the subjects in which he is interested and possesses the capability of making his best performance to the best of his potentialities."

In the words of Crow and Crow (1969),

> "Achievement means the extent to which a learner is profiting from instructions in a given area of learning, i.e., achievement is reflected by the extent to which skill or knowledge has been acquired by a person from the training imparted to him."

According to the Encyclopedia of Psychology (Volume I, 1972), 'achievement' means:

i) General term for the successful attainment of some goal requiring a certain effort.

ii) The degree of success attained in a task, e.g., solving a test.

iii) The result of a certain intellectual or physical activity defined according to individual and or objective (organizational) pre-requisites, i.e., proficiency.

Saxena and Dwivedi (1979), consider that the term 'scholastic achievement' refers to the attainment or accomplishment (what a person has done) in the field where a subject receives some instruction or training. It is personal motive as well. Thus, achievement is a motivating force which helps the subjects to do 'what he has done'. Without a need felt for achieving some goal performance is difficult, if not possible.

Verma and Upadhyay (1981) define,

> "Achievement as the attainment or the accomplishment of an individual in some or particular branch of knowledge after a certain period of training. The achievement score of a student indicates towards the future success of the individual."

Spratt suggests that achievement in any field of life is a function of the interaction of various personality factors, whereas Cohen and Mark observed 'the competence to achieve' and 'will to achieve' are the twin factors which have been identified by the social scientists as bases for achievement (Cartnell, 1983).

Various factors, both intellectual and non-intellectual, may affect in the positive or negative way, the achievement of an individual. The prediction of academic achievement has assumed enormous importance in view of its practical view. It forms the main basis for admission and promotion in a class. It is also important for attaining a degree or getting a job. So, it has drawn the attention of investigators and one of the recurrent themes to be found in educational research involves the attempt to unravel the complex determinants of academic achievement.

1.5.1. Factors Influencing Academic Achievement

Academic achievement is of paramount importance particularly in the socio-educational context. Education has always been concerned with the prediction of academic achievement. It has probably received more public attention than any other single problem in education. Now-a-days academic achievement of students has been the main focus of educa-

tionists. It is assuming greater importance day by day, and is designed to identify the outstanding talents of the students.

Many researches have been conducted to identify the various factors which influence the academic achievement of students. Available studies indicate that academic achievement is influenced by a host of factors. These studies have examined the relationships between academic achievement and a large number of factors. Although several researchers have worked in this area, not much has been done to establish the association of factors like attitude, aspirations, aptitude, and personality characteristics with the achievement in Mathematics in particular. Since the present study intends to study this, the meaning of these variables and their relationship with academic achievement are discussed further.

1.6.0. Attitude: Its Meaning

Attitudes have been defined by various authors in different ways. Attitudes are basically expressed feelings of an individual towards certain objects which he/she is confronted with. What a person feels, thinks and believes is expressed in his/her attitudes towards that particular object.

According to Thurstone and Chave (1928), "Attitude denotes the sum total of man's inclinations and feelings, prejudices or biases, preconceived notions, ideas, fears, threats and conviction about any specific topic."

Thurstone (1936) states that "Attitude is a generalized reaction for or against a specific psychological object." The same author in 1946 defines an attitude "as the degree of positive or negative affect associated with some psychological object." By a psychological object, he means any symbol, phrase, slogan, person, institution, ideaal or idea towards which people can differ with respect to positive or negative affect.

Murphy, Murphy & Newcomb (1937) views "Attitude as primarily a way of being 'set' towards or against certain things."

According to Kretch & Crutchfield (1948), an attitude can be defined as "an enduring organization of motivational, emotional, perceptual, and cognitive process with respect to some aspect of the individual's world." McKeachie & Doyle (1966) put it as "an organization of concepts, beliefs, habits, and motives associated with a particular object." Katz (1967) reiterates a similar meaning by defining "Attitude as a predisposition of the individual to evaluate some

symbol or object or aspect of his world in a favourable or unfavourable manner."

Newcomb (1952) states, "An attitude is not a response but a more or less persistent set to respond in a given way to an object or situation. The concept of attitude relates the individual to any aspect of his environment which has positive or negative value for him." This view has been supported by MacDonald (1965) who points out that "An attitude is a predisposition to act in a positive or negative way towards persons, objects, ideas, and events."

Attitude has been defined by Cronbach (1954) as, "a readiness to react toward or against some situation, person, or thing, in a particular manner, for example, with love or hate, or fear or resentment, to a particular degree of intensity." In his work in (1963), he explains that "An attitude consists of the meanings that one associates with a certain object (or abstraction) and that influences his acceptance of it."

Rosenberg (1960) considers an attitude "as a relatively stable affective response to an object."

While Allen (1960) states, "Attitude is an arrangement of mental processes, a mental set, an internal disposi-

tion or the way certain mental processes are organised in a person to make him act in a particular way."

Allport (1967) views attitude as a "mental and neural state of readiness, organised through experience and exerting a directive or dynamic influence upon the individual's response to all objects and situations with which it is related."

According to the International Encyclopedia of the Social Sciences (Volume I, 1968), "An attitude is a relatively enduring organization of beliefs around an object or situation predisposing one to respond in some preferential manner."

In the words of Whittaker (1970), "An attitude is a predisposition or readiness to respond in a predetermined manner to relevant stimuli", while Travers (1973) considers an attitude "as a readiness to respond in such a way that behaviour is given a certain direction."

Encyclopedia of Psychology (Volume I, 1972) has given "Attitude is a perceptual orientation and response readiness in relation to a particular object or class of objects."

Garrett (1975) states, "Attitude is primarily an inner state rather than an outer expression. It is an impli-

cit response toward or away from an individual value or social value. An attitude is always a stand or position which an individual takes towards a person or an issue."

According to Anastasi (1976), "Attitude is a tendency to react favourably or unfavourably towards a designated class of stimuli, such as, a national or racial group, a custom, or an institution."

Sorenson (1977) views that,

> "An Attitude is a particular feeling about something. It therefore involves a tendency to behave in a certain way in situations which involve that something, whether it be a person, idea or object. It is partially rational and partially emotional and is acquired, not inherent, in an individual."

A look into the various ways an attitude is defined brings out that attitudes have both cognitive as well as emotional components towards the psychological object. They are, to a great extent, responsible for the behaviour of a person towards the psychological object under question. The degree of a person's attitude may vary from extremely negative through a gradation to extremely positive position. Positive or favourable attitudes are developed towards those psychological objects which satisfy individual needs, whereas negative or unfavourable attitudes are developed towards

those psychological objects which obstruct or thwart the satisfaction of the individual needs. Attitudes develop through various sources, such as, specific experiences, communication from others, imitation of models and institutional factors.

A positive attitude towards a subject of study will strengthen a student's learning and will promote greater efforts on his part to strive towards mastery in that subject. This is expected to result in a higher achievement by the student. Attitudes are, to a great extent, responsible for the particular behaviour of a person about an object, idea or person. It makes the individual respond in a particular way to the particular stimuli. Therefore, we may understand attitude as a determining acquired feeling which prepares a person to behave in a certain way toward a specific psychological object.

1.6.1. Attitude and Academic Achievement

Attitude and academic achievement are both identified as important areas for student growth in the school curriculum. Attitudes determine the directions in which one strives and makes use of what he/she knows and can do. It also determines the character of one's motive power. If the students find Mathematics useful in their daily lives, then

the students are more likely to consider it to be a creative subject. It is plausible to consider that the more confident a person is, the better is his/her performance, especially in academic subjects like Mathematics.

It may be argued that attitude of an individual plays a critical role in enhancing one's academic achievement. Learning which is accompanied by specific attitude is meaningful, pleasant and impells one to continue the learning and thereby achieve higher. A person having a positive attitude towards Mathematics will try to achieve his/her goals and overcome all obstacles; but one who has a negative attitude towards it will try to avoid it. Negative attitude will surely hinder the effectiveness of the study. Thus, it may be expected that a relationship between attitude towards Mathematics and achievement in Mathematics exists.

1.7.0. Aspiration: Its Meaning

Aspiration refers to one's desire or ambition, specially to aim at high things, to mount up. It involves striving to achieve success in difficult tasks and circumstances. A brief compilation of the definition for the term 'aspiration' as given by different persons is provided below.

According to *Encyclopedia of Psychology* (Volume I, 1972), "The level of aspiration is the possible goal

(score) an individual sets for himself in his performance", while Webster's New Collegiate Dictionary (1983) gives the meaning of the term as "a strong desire to achieve something high or great."

Good (1959) says that "Aspiration is the level of performance or the goal that a person (or group) desires or hopes to reach in a specified activity."

Hurlock (1973) describes aspirations "as the goal the individual sets for himself/herself in a task which has intense personal significance for him/her or in which he/she is ego-involved". Further, she says that because aspirations are ego-involved, success leads to increased self-esteem, while failure brings embarassment, remorse and feelings of personal inadequacy and inferiority.

Many researchers and psychologists have explained the term 'level of aspiration'.

Hope (1930) and Eysenck (1972) consider "Level of aspiration as the possible goal which an individual sets for himself."

Frank (1935) views "Level of aspiration as the level of future performance in a familiar task which an individual knowing his level of past performance in that task explicitly

Going further, Stacy & DeMartino (1958) describe "Level of aspiration as to the goal which the individual selects for himself and attempts to achieve."

The terms 'aspiration' and 'level of aspiration' have been extended to specific areas of human endeavours.

Level of occupational aspiration has been defined by Haller & Miller (1963) "as an orientation towards occupational goal". Grewal (1984) while constructing the Occupational Aspiration Scale (OAS) has accepted the same definition.

Sharma & Gupta (1980) explain level of educational aspiration, "as a concept, referring orientation towards educational goal, spaced in continuum of difficulty and social prestige, and arranged in educational hierarchy."

Therefore, aspirations are goal statements concerning future level of achievement. Aspiration refers to a person's orientation towards a goal, mostly idealistic ones, while a person's expectations may be termed as his realistic goals. People adjust their level of aspiration in such a way that they are not totally out of line with the prospects of attaining those goals. The goal setting behaviour as well as the process of attaining the goal are consequences of their

past experiences, whether failure oriented or success oriented, level of efforts made by them in that direction, and their capacity to pursue the goal.

1.7.1. Aspiration and Academic Achievement

Aspiration and academic achievement are closely related. Aspiration refers to a student's aims, goals, hopes, targets that he/she sets for himself/herself. Naturally this would differ from person to person. One may aspire to secure an A-1 class in his/her examination results or abilities and capacities in one or more or all the subjects of the curriculum or other academic pursuits, while another may be satisfied simply with pass grades. Achievement depends on the opportunity to learn and attainment of skill or knowledge is a result of learning.

It can be assumed that high aspirations motivate people to make efforts towards the realization of their ambitions. In advanced societies high aspiration in terms of success is a dominant cultural value as well as a major theme which influences the total life pattern of an individual. Aspirations play an important role in the field of education. It leads to activities to make the maximum possible use of the resources and facilities provided by the school in academic matters for one's personal growth and

development so as to score high in academic achievement. High aspiration would result in careful study and preparation for examinations, maintaining oneself in a state of readiness to compete with others, to face and undertake challenging tasks, extensive reading, intensive concentration and assimilation, and, above all, gathering material from any source (lectures, debates, newspapers, broadcasts, etc.) with a view to transfer that knowledge and understanding to one's own practical purpose in solving problems or in excelling others.

1.8.0. Aptitude: Its Meaning

Aptitude is an ability to acquire skills or gain proficiency in a specific field.

Bingham (1937), whose contribution to reasearch in aptitude is pioneering, defines "Aptitude as a condition symptomatic of a person's fitness, of which one essential aspect is his readiness to acquire proficiency in his potential ability, and another is his readiness to develop an interest in exercising his ability".

Traxler (1957) considers,

> "Aptitude as a condition, a quality or a set of qualities in an individual which is indicative of the probable extent to which he will be able to acquire under suitable training, some knowledge, skill or

> composite of knowledge, understanding and skill, such as ability to contribute to art or music, mechanical ability, mathematical ability or ability to read and speak a foreign language".

In the words of Freeman (1971),

> "An aptitude is a combination of characteristics indicative of an individual's capacity to acquire (with training) some specific knowledge, skill, or set of organised responses, such as the ability to speak a language, to become a musician, to do mechanical work".

Mangal (1983) states, "An aptitude is a special ability or specific capacity besides the general intellectual ability, which helps an individual to acquire a required degree of proficiency or achievement in a specific field."

According to Chauhan (1984),

> "An individual's aptitude for a given type of activity indicates his capacity to acquire proficiency in it under appropriate conditions. Further, his potentialities at present as revealed by his performance on selected tests have predictive value. It reveals an individual's promise or essential teachability in a given area."

Hence, aptitude is a combination of characteristics indicative of an individual's capacity to acquire some specific knowledge, skill or set of organized responses such as the ability to become an artist or to be a mechanic.

The knowledge of one's aptitude helps us in predicting the future success of the individual, when given suitable training or experiences, in a particular area or activity.

1.8.1. Aptitude and Academic Achievement

Aptitude is an important determinant of academic achievement. It tries to make an estimate of one's future success or failure. Aptitude has future reference and it tries to predict the degree of attainment or success of an individual in an area or activity after adequate training.

Aptitude tests, in all their forms, measure only the present ability or capacity of an individual which can be exploited for making prediction about the future attainments. Aptitudes are concerned with specific abilities. The knowledge of aptitudes acquaints us with those specific abilities and capacities of an individual which give an indication of his ability or capacity to succeed in a special field or activity. Therefore, in predicting achievement in some particular job, training, courses or specialized instruction, one needs to know more about a person's aptitudes.

To get a desirable success in a given activity, a person must have an aptitude for that activity. Various aptitude tests have been devised to measure aptitudes of

the individual in various specific fields. The results of these tests enable us to locate, with a reasonable degree of certainty, the fields of activity in which an individual is most likely or least likely to be successful.

1.9.0. *Personality: Its Meaning*

The term 'personality' has been defined in various ways by psychologists who worked on the problem of personality and the variables influencing its development.

While accepting the role of both heredity and environment, Prince (1929) states,"Personality is the sum total of all the biological innate dispositions, impulses, tendencies, appetites and distincts of the individual and the dispositions and tendencies acquired by experience."

According to Watson (1930), "Personality is the sum of activities that can be discovered by actual observations over a long enough period of time to give reliable information."

Allport (1950), who devoted most of his time for research on personality defined it, "as a dynamic organisation within the individual of those psycho-physical systems that determine his unique adjustment to his environment." A similar idea is conveyed by Hartman who says, "Personality

is integrated organization of all the pervasive characteristics of an individual as it manifests itself in focal distinctiveness to others" (Chauhan, 1984).

Guilford (1959) considers one's "Personality as his unique pattern of traits, where a trait is any distinguishable, relatively enduring way in which one individual differs from another."

McDougal views "Personality as a synthetic unity of all mental features and functions in their innate interplay" (Kundu, 1976).

In the words of Cattell (1970), "Personality is that which permits a prediction of what a person will do in a given situation."

The term 'Personality' as given by Eysenck (1971), "is the more or less stable and enduring organisation of a person's character, temperament, intellect, and physique, which determine his unique adjustment to the environment."

Sherman (1979) states, "Personality as the characteristic pattern of behaviours, cognitions, and emotions which may be experienced by the individual and/or manifest to others."

Fredenburgh (1971) tries to summarize the various definitions in a single definition which runs as, "Personality is a stable system of complex characteristics by which the life pattern of the individual may be identified."

Bhatia (1984) says that psychologically speaking, "Personality is the sum total of all that an individual is, of everything that constitutes a person's physical, mental, emotional and temperamental make-up."

Personality is defined by Rao (1985), "as the characteristic patterns of behaviour and models of the thinking that determine a person's adjustment to the environment". The term characteristic in the definition implies some consistency in behaviour that people have tendencies to act or think in certain ways regardless of the situation.

Thus, it can be concluded that one's personality manifests itself in all aspects of one's life. Our personal appearance, dress, manners, physical constitution, speech, gait, taste, understanding, enthusiasms, ambitions, principles of life and conduct and the like colour our personality. It is those characteristics or traits which distinguish one individual from the other.

1.9.1. Personality and Academic Achievement

Personality is a forceful determinant of human activities and hence also of achievement. The amount and quality of achievement in the different walks of life are certainly the output of distinct organization of different traits of personality. Our unique composite of the temperament traits, needs, interests, values, problems, adjustment, attitude, aptitude, tests and talents decide our achievement, not only in the academic field but in every area.

The personality factors have an important bearing on academic achievement. The individual self esteem may depend greatly on academic progress in school as it is a substantial indication of his potential for later years. Psychologists and educators have shown their interest around the study of person in relation to academic achievement which is considered as a function of one's personality. Paul Centi (1962) agreed with this view and remarks,

> "Recently more and more attention has been directed to the effect on achievement of selected personality variables. This new emphasis has stemmed from the new generally accepted belief that the academic performance of the students is another aspect of his total behaviour and as such is determined and influenced by the dynamic process of personality."

1.10.0. Need for the Study

The modern world is accredited with explosion of knowledge. As civilization becomes more complicated, Mathematics is a must to man's existence. Every citizen needs to know sufficient quantum of Mathematics to cope with the practical problems one encounters in day-to-day life. To meet the challenge, students must be trained thoroughly to understand the mathematical concepts and principles, to reason clearly and communicate effectively to recognize mathematical applications in the world around them, to approach mathematical problems with confidence, to develop proficiency in problem solving and higher order thinking, to develop the fundamental skills, that will enable them to apply their knowledge to new situations and to take control of their own lifelong learning. As Mathematics has pervaded into every dimension of human life, its importance is realised greater than ever before.

It is often said that of all the subjects included in the school curriculum, Mathematics is the one most disliked by a good number of pupils. Many students view mathematical problems as insurmountable obstacles. It is often argued that Mathematics is an exceptionally difficult subject i.e., its study requires special ability and intelligence and therefore everybody should not be burdened with the

study of this subject. References are made to low pass percentage in the subject. But it is felt that man's knowledge in this world is incomplete without Mathematics. If students continue to fail in Mathematics in large numbers, it will be difficult to have qualified economists, scientists, doctors, engineers, and statisticians since these categories of students cannot gain admission into any of the universities in the country, without being qualified in the subject. Failure to produce skilled personnel in these areas will slow down the technological advancement of the country. Thus, ignorance of Mathematics at this stage will be a great handicap to the progress of the nation. Realising this need, educationists have made Mathematics as a compulsory subject till the completion of the school level of education.

The scientific and technological development of our country has placed a new demand on Mathematics. The subject offers plenty of scope for the development of logical reasoning and is a very useful subject for most vocations and higher specialised courses of learning. The duty of the school is to give students a broad view of what he/she is capable of achieving in future and enable him/her to choose a suitable line out of that. At the university stage, most of the physical and social sciences require the application of Mathematics. Discoveries in the subjects including

industries rely heavily on mathematical techniques. Therefore, a student will find his future choice of specialisation narrowed indeed if he is unable to tackle Mathematics.

To function effectively in the 21st century, students irrespective of sex will need proficiency in an enriched body of Mathematics. It is important to provide preparation of the highest quality for those who are to be nation's discoverers, innovators and interpreters in every field of competence, in science and technology, in arts, trade, business, industry, professions and in public service and statesmanship. India cannot hope to become a leading power in the world unless it has a regular supply of talented young men and women to various positions that lie vacant in our institutions of learning and work. Therefore, promotion of Mathematics is an important factor in the progress, welfare, and security of our nation.

Though numerous studies have been conducted with regard to the academic achievement of students, very few are carried out with regard to the students' achievement in Mathematics in particular. To mention some such studies are Balasubramanian & Feroze (1966), Sathiyagirirajan & Rao (1967), Elamaran & Kandaraj (1967), Kulkarni, Naidu & Arya (1970), Khenglawt (1982), Kumar (1986), Jain (1986), Singh (1986) and Caroline Ngailiankim (1988).

Balasubramanian & Feroze (1966) made a comparative study of achievement in Mathematics of rural and urban students of standard X in some of the high schools in Coimbatore. The study showed no real difference between the achievement of urban boys and girls in Mathematics. In the study of Sathiyagirirajan and Rao (1967), it was found that boys were superior to girls in achievement in composite Mathematics. Pupil's attitude towards the subject was suggested as a factor in the achievement of mathematical concepts by Elamaran & Kandaraj (1967). The All India Survey of Achievement in Mathematics for primary, middle, and high school students conducted by Kulkarni, Naidu & Arya (1970) reported the relationship of aspirations and attitude towards Mathematics to be significant variables related with achievement in Mathematics. Khenglawt (1982) indicated that some of the personality characteristics as measured on the Cattell's Jr-Sr 14 HSPQ differentiated the low, normal, and high achievers in Mathematics. Kumar (1986) assessed the amount of contribution made by ego-involvement, level of aspiration, intelligence and socio-economic status to the academic attainment of the students. The study revealed that correlation between the examination scores and the four correlates to be positive. Jain (1986) noted sex as a variable in achievement in Mathematics. The study of Singh

(1986) demonstrated intelligence, study attitudes and socio-economic status to contribute in this order of importance to discriminate between high and low achieving groups with respect to Mathematics. Caroline Ngailiankim (1988) studied the existence of any difference in the two variables, namely, student's attitude towards Mathematics and study habits, among high achievers, average achievers and low achievers in Mathematics. There were some indications in the results of the study that attitude towards Mathematics could contribute to some extent towards the achievement of boys in Mathematics, but study habits were not found to have any relationship with Mathematics.

A perusal of the studies conducted highlights the need for a deeper research to understand the variables that are associated with achievement in Mathematics. It is in this thinking that the present study is envisaged.

1.11.0. Statement of the Problem

The title of the problem under study is, "A Study of Selected Variables Associated with Achievement in Mathematics".

The study considers under its purview the following variables which may be associated with the achievement in Mathematics.

i) Attitude towards Mathematics.

ii) Aspirations (Educational and Occupational).

iii) Specific Abilities for Mathematics – These abilities are selected from those drafted for the Differential Aptitude Tests, on the consideration that they would be associated with achievement in Mathematics. These are:

a) Numerical Ability.

b) Abstract Reasoning, and

c) Space Relations.

Hence, they are nomenclatured as Specific Abilities for Mathematics instead of Aptitude in Mathematics.

iv) Personality Characteristics.

1.11.1. Conceptual Definitions of the Terms Used

Conceptual definitions of the variables considered in the study are as follows:

A. Achievement

It is the extent to which proficiency is obtained in Mathematics as a school subject.

B. (i) Attitude

It is the degree of positive or negative affect associated with some psychological object.

ii) Aspirations

It is the goal the individual sets for himself/herself in a task which has intense personal significance for him/her or in which he/she is ego-involved.

iii) Specific Abilities for Mathematics

They refer to some Specific Abilities which are expected to promote Achievement in Mathematics.

iv) Personality Characteristics

They may be stated as those which permit a prediction of what a person will do in a given situation.

1.11.2. Operational Definitions of the Terms Used

Operational definitions of the variables considered in the study are as follows:

A. Achievement

It is the Achievement in Mathematics as indicated by the score obtained on the Achievement Test in Mathematics developed by the investigator for the purpose of the study.

B.(i) Attitude

It refers to the score obtained on the Attitude Scale developed by the investigator (Caroline Ngailiankim, 1988) to measure the Attitude of students towards Mathematics.

(ii) Aspirations

(a) **Educational Aspiration** - It is represented by the scores obtained on the Educational Aspiration Scale (EAS) Form V, developed by Sharma and Gupta (1980).

(b) **Occupational Aspiration** - It is represented by the scores obtained on the Occupational Aspiration Scale (OAS), developed by Grewal (1975).

(iii) Specific Abilities for Mathematics

(a) **Numerical Ability** - It refers to the score obtained on the Numerical Ability Test of Differential Aptitude Tests (DAT) Form - A, adapted to the Indian conditions by J.M. Ojha.

(b) **Abstract Reasoning** - It refers to the score obtained on the Abstract Reasoning Test of Differential Aptitude Tests (DAT) Form - A, adapted to the Indian conditions by J.M. Ojha.

(c) **Space Relations** - It refers to the score obtained on the Space Relations Test of Differential Aptitude Tests (DAT) Form - A, adapted to the Indian conditions by J.M. Ojha.

(iv) Personality Characteristics

They refer to the scores obtained on the Jr-Sr 14 High School Personality Questionnaire (14 HSPQ) developed by Cattell and Cattell (1968).

1.12.0. Objectives

The following were the objectives of the study:

(i) To find out whether any significant association exists between Attitude towards Mathematics and Achievement in Mathematics.

(ii) To find out whether any significant association exists between Educational Aspiration and Achievement in Mathematics.

(iii) To find out whether any significant association exists between Occupational Aspiration and Achievement in Mathematics.

(iv) To find out whether any significant association exists between Numerical Ability and Achievement in Mathematics.

(v) To find out whether any significant association exists between Abstract Reasoning and Achievement in Mathematics.

(vi) To find out whether any significant association exists between Space Relations and Achievement in Mathematics.

(vii) To find out whether any significant association exists between each of the 14 Personality Characteristics, namely, Factors A, B, C, D, E, F, G, H, I, J, O, Q_2, Q_3, and Q_4 (as given in the Cattell's HSPQ), and Achievement in Mathematics.

1.13.0. Hypotheses

The following were the hypotheses of the study:

(i) There is no significant association between Attitude towards Mathematics and Achievement in Mathematics.

(ii) There is no significant association between Educational Aspiration and Achievement in Mathematics.

(iii) There is no significant association between Occupational Aspiration and Achievement in Mathematics.

(iv) There is no significance association between Numerical Ability and Achievement in Mathematics.

(v) There is no significant association between Abstract Reasoning and Achievement in Mathematics.

(vi) There is no significant association between Space Relations and Achievement in Mathematics.

(vii) There is no significant association between each of the 14 Personality characteristics, namely, Factors A, B, C, D, E, F, G. H, I, J, O, Q_2, Q_3 and Q_4 (as given in the Cattell's HSPQ) and Achievement in Mathematics.

1.14.0. Delimitation of the Study

The study was confined to only the students of Class IX (following the CBSE pattern) in the three States of the North Eastern Region of India, namely, Nagaland, Meghalaya and Manipur.

CHAPTER II

REVIEW OF RELATED LITERATURE

REVIEW OF RELATED LITERATURE

2.1.0. Introduction

The present study is undertaken to investigate into the association of Attitude towards Mathematics, Aspirations, Aptitudes (Specific Abilities for Mathematics), and Personality Characteristics with Achievement in Mathematics. The further presentation is a brief review of related research conducted in India and abroad and which have a bearing on the problem under investigation. The studies are grouped under the following headings.

i) Attitude and Academic Achievement.

ii) Aspirations and Academic Achievement.

iii) Aptitudes and Academic Achievement.

iv) Personality Characteristics and Academic Achievement.

2.2.0. Attitude and Academic Achievement

Studies have been conducted on the relationships between Attitude towards various Psychological Objects and Achievement in general. They are presented further.

Achievers and non-achievers have been found to differ with respect to their attitude towards outlook on life (Eckert, 1935), future occupations (Himmelweit & Summerfield,

1951), and parents (Cooper & Lewis, 1962). Groff (1962), Askov & Fischbach (1973), and Nielson (1978) reported significant positive associations between Attitude and Achievement.

A number of studies like Woodman (1952), Malpass (1953), Bendig & Hughes (1954), Weigand (1957), Frankel (1960), French (1960), Baraheni (1962), Passow & Goldberg (1962), Wilson & Morrow (1962), Finger & Schlesser (1963) have been conducted to find out the attitudinal concomitants of scholastic achievement. It has been generally observed that positive attitudes towards schools and colleges, subjects of study, teachers, etc., are associated with high academic achievement.

A Study of Some Factors Related to Scholastic Achievement Among 500 VIIIth Grade Pupils Selected From 12 Higher Secondary Schools of Delhi was made by Rao (1968). The study demonstrated that there is a low positive correlation between school attitude and scholastic achievement ($r = 0.11$).

Saxena (1972) conducted a Study on Interests, Need Patterns and Adjustment Problems of Over and Under Achievers Among 1769 Boys of Class XI Higher Secondary Institutions of Allahabad. The results revealed that positive attitude towards school, study, peers and school work characterized the over achievers.

According to Zacharia (1977), Attitude is one of the important correlates of Achievement. Students' attitude and academic achievements are shown to be positively related.

Reddy (1978) found attitude to self, learning, achievement, parents, teachers and peers to be positively related to academic adjustment and scholastic performance.

In a study by Chopra (1982), students' home, health, social and emotional adjustment, study habits, and their attitude towards education figured as some of the non-intellectual correlates of academic achievement. The findings showed that academic achievement had a positive relationship with attitude towards education.

Patil (1984) carried out a Study on Post Graduate Pupil-Teachers of the Colleges of Education Affiliated to Nagpur University. The study revealed that the coefficient of correlation between the attitude of pupil-teachers (as measured on the Teacher Attitude Inventory by Ahluwalia) and their achievement was 0.16 which was found to be positive and significant.

In his Comparative Study of the Attitude of the High School Drop-outs Towards School Subjects, Subject Teachers and Subject Achievement. Pathy (1989) noted that a

favourable attitude towards the school subject resulted in better achievmeent in terms of marks secured in the subject and vice-versa.

Desai (1978) concluded that high school low-achievers of high ability had less favourable attitude to the subject. They kept very busy in domestic work, did not receive any outside help for study and described themselves as less regular in work.

But Rowell (1972, 1973) found few significant relationships between Attitude and Achievement and at times found an inverse relationship between Attitude and Achievement as had been reported in the studies of (Greenberg, Gervers, Chall & Davidson (1965) and Deck & Barnette (1976).

The above studies consider the relationship between Attitude and Achievement in general. There are some studies which have considered the Achievement in particular school subjects. Studies which have considered these school subjects other than Mathematics are taken as a group and the latter as a separate group. They are presented below.

Perumal & Visvesvaran (1968) carried out an investigation on a Study of Scientific Attitude of Pupils of Standard IX in Relation to their Achievement in Science in Some

High Schools in Coimbatore. The results showed that there is a significant relationship between scientific Attitude scores and Achievement in Science. Shinde's (1982) study revealed that students with high Academic Achievement had high scientific Attitude, students with average Academic Achievement had average scientific Attitude and the low Achievers had low scientific Attitude, the Achievement being in the subject Science. Hounshell & Hill (1989) examined the microcomputer and Achievement and Attitudes in high school biology. They reported that those who have positive Attitude towards Science score higher than those who do not. Sundararajan & Krishnamurthy (1988) attempted to study higher secondary students' Attitude towards the study of History and their achievement in it. It was indicated that though the relationship between Attitude scores and Achievement scores was found to be positive, it was very low (r=0.23).

The studies which are presented further have considered the relationship between Attitudes and Achievement in Mathematics specifically. They are as follows.

Much of the work on Attitudes towards Mathematics per se and on the relationships between Attitudes and Achievement in Mathematics has been based on the assumption or conviction or expectation that Attitudes affect Achievement

(Suydam & Weaver (1975), Fennema & Sherman (1976), Betz (1977), Gilbert (1977), Haladyna & Thomas (1977), and Schofield & Start (1978).

Samant (1944) who undertook a Survey of Teaching of Mathematics in Secondary Schools of Bombay Province reported that students' dislike for Mathematics was found to be one of the main causes for their failure in that subject and the dislike for the subject was more noticed in higher classes than in lower classes. Peskin (1965) and Ohuche (1980) realized that Attitude is a significant factor in Mathematics learning. While preparing instructional material for teaching Mathematics in Standard X, Elamaran & Kandaraj (1967) recognized the weakness of pupils in mathematical concepts and they found it to be related to pupils' Attitude towards the subject. Neale (1969) reviewed three studies concerning Mathematics Attitude and Achievement that were conducted between 1967 and 1968. Each study showed positive correlations between the two variables. The value of the correlations ranged between 0.20 and 0.40.

Sherman (1980) reported that in eighth grade, the only significant sex related difference in Attitude was girls' stronger denial that Mathematics was a male domain. By eleventh grade, boys and girls differed significantly

in many areas. Boys were significantly more confident of themselves as learners of Mathematics and regarded it as more useful and continued to regard it as more of a male domain. As a result boys were performing significantly better than girls in tests of problem solving and mathematical concepts. Schofield (1982) studied sex, grade level, and the relationship between Mathematics Attitude and Achievement in children. It was observed that the correlation between Mathematics Attitude and Achievement within girls was very low, which ranged from - 0.16 to 0.24, only intermittently significant and at times negative. However, a somewhat more consistent positive relationship was found between these factors for boys, with correlations ranging from - 0.11 to 0.45. While studying a structural model of Mathematics Achievement for men and women, Ethington & Wolfle (1986) indicated Attitude to have a significant influence on Achievement that is stronger for men than for women.

Singh (1986) conducted a Study of Some Possible Contributing Factors to High and Low Achievement in Mathematics of the High School Students of Orissa. The study showed that Achievement in Mathematics was positively and significantly related with intelligence, socio-economic status and study attitudes. Further, high Achievers scored high in the study Attitudes survey while low Achievers scored low.

Kulkarni, Naidu & Arya (1970) undertook an All India Survey of Achievement in Mathematics for Primary, Middle and High School Students. The findings related to students' Attitude and related variables revealed that students who considered Mathematics as necessary for developments in other fields scored higher and students who had favourable Attitude towards Mathematics scored better than those who had unfavourable Attitudes. Cheung (1988) studied the outcomes of schooling, Mathematics Achievement and Attitude towards Mathematics learning in Hongkong. The findings indicated that the correlation between the Attitude dimension and Mathematics Achievements were positive, showing that the more positive the students' Attitude towards Mathematics, the higher their Achievement in Mathematics.

But, Aiken (1970, 1976) in reviewing studies examining the relationship between Attitude and Achievement in Mathematics through elementary, high school, and college levels, usually found low positive correlations, which did not always reach the level of statistical significance. In the study of Robinson (1975), it appears that the correlation of Mathematics Attitude and Achievement observed 15% or less common variance between these variables. Wolf & Blixt (1981) commented that the correlations between Mathematics Attitude and Achievement ranging from - 0.06 to 0.25

with a median of 0.11, indicating a median of only 1% common variance between them. Benbow & Stanley (1982) also reported little relationship between Attitude and Mathematics Achievement.

While studying the Teaching of Elementary School Mathematics, Riedesel & Burns (1973) contended that although it would seem that Attitudes to and Achievement in Mathematics should be positively and substantially related, there was at present no body of research to support such a relationship.

The researches by Bendging & Hughes (1954), Aiken & Dreger (1961), and Bassham et al. (1964) to relate Attitude towards Mathematics with Achievement in Mathematics have not led to substantial relationships (Kaul, 1978).

Quinn & Jadav (1987) examined a study of causal relationship between Attitude and Achievement for elementary grade Mathematics and reading. The study showed that there was no significant predominant causal relationship between Attitude and Achievement.

An investigation into the Attitude and Study Habits related to Achievement in Mathematics of Class IX students in Shillong was undertaken by Caroline Ngailiankim (1988).

The study concluded that there was no significant difference among high, average, and low Achievers in their Attitude towards Mathematics.

2.3.0. Aspirations and Academic Achievement

Clear and definite educational and occupational aspirations are expected to have motivational effects on the performance of students, and as such, to be conducive to high academic achievement. Though most of the studies show that high achievers not only have more definite educational and occupational aspirations, there are a few studies which take an exception. Below are presented studies grouped according to what they indicate in their results about the relationship between aspirations and achievement. The studies which show a positive relation are presented first, followed by no relation studies, and further by negative relation studies. The studies which show a positive relation are as follows.

Several investigators namely, Marshall & Simpson (1943), Weitz, Clarke & Jones (1955), Krippner (1961), Todd, Terrell & Frank (1962), and Jamuar (1963), have shown that students having definite educational and vocational goals are high achievers.

Studies of Myers (1950), Preston & Botel (1952),

and Malloy (1955), have indicated a clear relationship between aspirations and academic achievement. Further, they also found high achievers to have high aspirations. Uhlinger & Stephens (1960) observed greater expectancy for academic success and higher minimal grade goals in high achievers than in low achievers. Similarly, Wilson & Morrow (1962) studying bright high school students reported high achievers to possess higher and more academically oriented career aspirations, and Jones (1962) concluded lower grade aspirations in poor students.

Pierce (1952) carried out a study among 222 bright students of high school. Students were divided into high and low achieving groups by sex and grade level. It was contended that low achievers had less will to adjust, liked school less, and had lower educational and occupational aspirations than their high achieving peers.

While studying two college groups of probationers, Weigand (1953) mentioned that goal-orientation (definiteness of vocational choice) and goal involvement (students' personal interest in the goal) were powerful motivating forces which influenced the academic performance of students.

Teahan (1958) undertook a study of future time perspective, optimism, and academic achievement and reported

that high academic achievers tended to look mostly to the future. They were predominantly "anteverts" in so far as their recent thoughts and conversations were concerned.

In a comparative study of achievers and under-achievers, Frankel (1960) found that more achievers planned to enter fields of science while under-achievers tended in the direction of technical and applied fields.

Davids & Sidman (1962) studied high ability high school boys and noted that high achievers were more future-oriented in their fantasies and imaginal processes and were less concerned with immediate gratifications. They were better able to plan future goals.

Studies made by Austin (1964), and Nichols & Davis (1964) have observed that the Merit Scholars have plans and goals which are different from others. They mentioned such ambitious plans as to be professors, research workers, etc.

Sinha (1965) conducted a Study Among 185 High Achievers and 190 Low Achievers. The high achievers were students who scored 55% and above, while the low achievers were repeaters and those passing in 3rd division. The results revealed that high achievers had clear and definite vocational plans,

while the low achievers displayed considerable vagueness about the nature of the stated vocations. Also the high achievers displayed greater reliance on their own thinking and placed a premium of novelty in expression and often valued research as a career.

The findings of the study by Vanarase (1970) showed that as compared with the under-achievers, greater number of normal-achievers reported disparity between their aspiration and achievement. Further, the under-achievers aspired for immediate gratification, while the normal achievers could delay it.

In their All India Survey of Achievement in Mathematics for Primary, Middle, and High School Students, Kulkarni Naidu & Arya (1970) found that students with higher aspirations performed better. Sewell & Hauser (1972) noted aspirations to have the strongest relationship to educational attainment, mediating much to the impact of family background and the other independent variables.

Prenter & Steward (1972) studied Educational and Vocational Aspiration of New Zealand Adolescent Girls in Relation to Achievement Motivation, and concluded that high I.Q. and superior classroom performance were positively related to high vocational aspirations.

While making a comparative study of personality characteristics of over-achievers and under-achievers of high ability, Menon (1973) reported that job satisfaction, educational aspiration and general ambition were strongly associated with high achievement, particularly for girls.

Hoppe (1930) proposed that success or failure at any task is related to the level of aspiration and the level of achievement. Uniyal & Shukla (1973) investigated a study of academic achievement and behaviour in level of aspiration situations. They indicated that level of aspiration determines the limit of academic achievement.

While studying academic adjustment in relation to scholastic achievement of secondary school pupils, Reddy (1978) observed that scholastic performance and consistency in vocational preference were unrelated.

Sharma (1978) conducted attributes of underachieving undergraduate students and concluded that irrealistic level of aspiration adversely affected the academic achievement.

Tiwari & Morbhatt (1980) studied the effect of anxiety and aspiration on academic achievement. The findings revealed that high level of aspiration promotes achievement.

The level of aspiration of teacher-trainees of rural

and urban areas in relation to their achievement was undertaken by Uniyal & Sah (1981). The study showed that high achievers are negligent in respect to their aspiration, while low achievers are over-anxious in respect to their aspiration. It also observed that one's level of aspiration is more affected by his/her academic achievement (high/low) rather than his social belongingness (rural/urban).

Deka (1985) made a causal-comparative study of high and low achievers. Results indicated that incidence of school success and failure was positively associated with study facilities at home and future vocational plans. High achievers preferred to enter some standard vocations like medicine, engineering and high school and college teaching, while low achievers contemplated to become primary teachers, nurses, clerks, businessmen and technical workers.

Das (1986) studied peer influence and educational aspiration of secondary school students in relation to their academic achievement and reported that educational aspiration was the second powerful predictor of academic achievement with a contribution of 8.58% of variance.

The above studies have shown a positive relation between aspirations and achievement. Below are studies which claim no evidence of such a relationship.

Gould & Kaplan (1940), Holt (1946), Schultz & Ricciutti (1954), Red, McCary & Johnson (1962), Roberts (1962), however, do not support the relationship between level of aspiration measures and academic achievement. While comparing 19 achievers and 16 non-achievers of high ability college freshmen, Dowd (1952) found no significant difference in respect of their level of aspiration. Sharma (1978) undertook a study of self-concept, level of aspiration and mental health as factors in academic achievement, and contended that the level of aspiration did not influence academic achievement.

In contrast to both the groups of studies, namely, those showing a positive relationship and those showing no relationship, the following studies show a negative relation between the variables under consideration.

Muthayya (1965) while studying some correlates of achievement motive among high and low achievers in the scholastic field, found no difference between the two groups with regard to their aspiration level.

The study of Rai (1974) attempted to find out whether level of aspiration could be one of the variables to differentiate between the low and high achievers. The study concluded that level of aspiration was not a significant correlate of achievement.

Dwivedi (1983) carried out a study of performance on linear programme in a segment of biology in relation to level of aspiration and socio-economic status and reported that level of aspiration did not influence performance of students.

The above discussions show that though there are many studies conducted, still the gaps call for an attempt to find out how aspirations and achievement are related and in particular with reference to the achievement in Mathematics.

2.4.0. Aptitude and Academic Achievement

Aptitudes are the specific abilities in an individual that promote attainment in a particular field. Researchers have identified certain specific abilities in relation to achievement in certain subjects of study. Following are the studies which have been worked in that direction.

Menon (1982) looked into the performance of students belonging to two government run polytechnics in Haryana. The results showed that numerical ability, general mental ability, abstract reasoning, mechanical reasoning, academic achievement (at matriculation examination) and language usage (spelling) accounted for 38.23 per cent of the variance in the criterion variables (scores obtained by the students in their final examinations of the first year of the polytechnic course).

An Investigation into Some Factors Related to Achiement in Science by Students in Secondary Schools was done by Jha (1970). The findings revealed that there was a significant positive relationship between achievement in science and scientific aptitude. Pal (1982) made an inquiry into the factors involved in the learning of science by adolescent pupils and observed that general ability, scientific aptitude, reasoning, speed and precision and problem-solving ability were significantly responsible for the learning of science. In the study of Mehna (1986), scientific aptitude is indicated as a significant predictor of academic achievement in science.

Agrawal (1973) identified aptitude as an important correlate towards academic success in certain specific fields. Further, medical aptitude was found as a contributing factor for proficiency in medical examination.

With regard to achievement in Mathematics in particular, Jain (1979) reported that for learning Mathematics at the high school stage, the factors playing a vital role were intelligence, abstract reasoning, numerical ability, mathematical background, attitude towards Mathematics, degree of motivation, study hours and the status of Mathematics in the family. While studying the academic achievement of

high school boys, Thakur (1974) concluded that there was a positive correlation between aptitude and achievement in Mathematics. Those who had aptitude but disliked the subject did not show significant achievement.

Researches have also been conducted with particular abilities in consideration. Chhikara (1985) arrived at a positive relationship between reasoning abilities and achievement of concepts. The study of Tiwari (1986) suggested a similar conclusion. While using Spatial Relations Test of the Differential Aptitude Tests (DAT), Fennema & Sherman (1977) reported that the correlations between Mathematics achievement and spatial visualization were approximately as high ($r = 0.5$) as the correlations between Mathematics achievement and verbal ability.

Sex differences in the aptitude and the specific abilities have drawn the attention of researchers quite often. Fennema (1974) and Kelly (1978) have indicated that in most studies of mathematical aptitude and achievement, the sex differences have increased at higher achievement and age levels. But, the study conducted on Palestinian students in the Israeli occupied West Bank by Awartani & Gray (1989) showed no significant difference between Mathematics aptitude and achievement scores of men and women university students.

Stallings (1979) undertook a study of factors influencing women's decisions to enroll in advanced Mathematics courses. The findings revealed that spatial ability distinguished between those girls who continued their mathematical study and those who did not. This has been supported by Sherman (1980) who concluded that spatial visualization scores were more highly predictive of mathematical attainment for girls than for boys.

From 1972 through 1979, the Study of Mathematically Precautious Youth (SMPY) conducted six talent searches for students having aptitude for Mathematics. The data for these searches reported large sex differences in mathematical reasoning ability by grade seven (Benbow & Stanley, 1980, 1983). Since SMPY was a longitudinal study of its participants, the consequences of this sex difference was assessed at different junctures. Utilizing results from SMPY's first follow up of its students (i.e., after high school), a relationship between sex differences in achievement in Mathematics in high school and the earlier sex difference in mathematical reasoning ability was detected (Benbow & Stanley, 1982).

Pattison & Grieve (1984) attempted to find out whether spatial skills contribute to sex differences in different

types of mathematical problems. Results indicated that boys excel in problems dealing with measurement and proportion and in spatial problems, whereas girls perform better on more abstract deductive problems.

From an overview of the studies mentioned above, it seems appropriate to consider that there are some specific abilities which may be related with the achievement in Mathematics. The most conspicious of these specific abilities seem to be numerical ability, abstract reasoning, and space relations.

2.5.0. Personality Characteristics and Academic Achievement

A host of studies have attempted to find out the relationship between different personality characteristics and academic achievement. A brief account of some of the studies is given below.

Garrett (1949) mentioned about 63 studies in which personality factors were studied as predictors of academic achievement. The reported correlation of these factors with college grades varied between 0.30 and 0.64. Rao (1968) conducted a study of some factors related to scholastic achievement. The results showed that certain personality factors affect academic achievement. In one of their studies Cattell, Barton and Dielman (1972) found that personality factors also predict the academic performance.

Numerous investigators like Tiebout (1943), Wedemeyer (1953), Parnell (1954), Gough (1955), Egner & Obelsky (1957), Hershey (1958), Ryan & Davie (1958), Teraoka (1958), Pierce (1959), Witherspoon & Melberg (1959), Butcher & Gorsuch (1960), Keimowitz & Ansbacher (1960), Erb (1961), Pierce (1961), Roberts (1962), Rosenberg et al. (1962), Watley & Martin (1962), Carter (1963), Fink (1963), Warburton, Butcher & Forrest (1963), Muthayya (1964), Rao (1964), Watley & Merwin (1964), Webb (1965) and Norfleet (1968) used inventories and questionnaires of various kinds on different groups of students. Their findings are not being elaborated as they relate to varieties of personality characteristics, but most of them do point to the association between some of the personality characteristics and academic achievement.

Researches have drawn attention to personality correlates of school attainment. Cattell, Sealey & Sweeney (1966) and Eysenck & Cockson (1966) have indicated low but statistically significant correlations between pupils' achievement and scores on various personality scales. A study of the causes of failure in the high school examination was made by the Department of Education, Allahabad University (1961). The study revealed that certain aspects of personality and scholastic achievement have definite relationship. Pal (1961) and Bhatnagar (1968) carried out studies to find out whether

different personality factors have any association with achievement in general and scholastic achievement in particular. They proposed that there is some association between scholastic achievement and personality factors. While using Jr-Sr High School Personality Questionnaire, Butcher et al. (1963) observed that thirteen variables of the questionnaire correlated with academic achievement. Goodstein, Crites & Heilbrun Jr. (1963) concluded that personality does contribute to college achievement but in a general rather than specific way. No identifiable patterns of personality characteristics was consistently related to success in college other than a tendency of more intellectually-oriented males to obtain higher grades.

According to McClelland et al. (1953), and Entwistle (1968), personality traits, motivation, inter-personal relations and such other factors play a significant role in the academic achievement of students. Buxton (1966) reported a significant relationship between personality characteristics and academic achievement. Studying the effects of personality characteristics on academic achievement of boys reading in Class X, Srivastava (1974) found that personality traits of 'reserve-outgoing', and 'less intelligent - more intelligent', were significantly correlated with academic achievement at 0.01 level of significance. Seetha (1975)

attempted an inquiry into the psychological and social factors affecting academic achievement and contended that out of Cattell's 16 personality factors, only three factors namely, A, B, and L had significant relationship with academic achievement. Some psychological correlates of school achievement was investigated by Verma & Upadhyay (1981) and indicated that certain personality factors are significant determiners of the educational achievement of the individual.

Studies have been conducted to compare the personality characteristics of over-achievers and under-achievers or high-achievers and low-achievers. Burgess (1953) studied the personality of over-achievers and under-achievers and found over-achievers to be more intellectually adaptive, more constricted and inhibited, more cautious and realistic in approach to problems and having greater need for achievement and self-improvement whereas under-achievers were found to be more on dependency needs and need to be free from restraint. Bhaduri (1971) carried out a comparative study of certain psychological characteristics of the over and under-achievers indicating over-achieving students to be less neurotic and less anxious than the under-achievers. Saxena (1972) mentioned that over-achievers had sufficient endurance and possessed a capacity for fighting out their

case while the under-achievers were meek, submissive, timid, brooding, impulsive and dependent type of immature individuals. Ghuman (1976) attributed over-achievement primarily to non-intellective personality variables and under-achievement to intellective factors. The study by Gupta (1983) showed that over-achieving boys were less expedient, less shy and had less undisciplinary self-conflict than the under-achieving boys, whereas, over-achieving girls were less affected by feelings, more emotionally stable, less shy, more vigorous, zestful and had less undisciplined self-conflict than the under-achieving girls.

Pierce (1952) conducted a Study Among 222 Bright High School Students and Divided Them into High and Low Achieving Groups by Sex and Grade Level. The study revealed that high achieving students are less aggressive possessing more leadership ability whereas low achieving students are more aggressive developing less leadership ability. While undertaking the prediction of college grades from personality and aptitude variables, Holland (1960) noted that only high achieving girls were characterised by lack of tension and that the result was not valid for boys. Sinha (1966) attempted a psychological analysis of some factors associated with success and failure in university education among 185 high achievers and 190 low achievers. The findings showed

that the high achievers were more persistent and enthusiastic than the low achievers. The study of Jayagopal (1974) found high achievers to be reserved, humble and tough-minded in comparison with under-achievers whose personality profile reported that they were characterised by spontaneity, vigour, spirit to associate with the group readily and uninhibited and zestful in nature. Srivastava (1976) made a study of personality factors as predictors of academic achievement of high school students and indicated that reserved, intelligent, submissive, adventurous, zestful, tender-minded and high strength of self-sentiment were the typical personality characteristics of high achievers among high school students. Vanarase (1970) studied ability and scholastic under-achievement and observed achievers to be more self-confident, more independent, more mature, emotionally more stable and more conscientious when compared with the under-achievers.

While investigating the self-concept of bright under-achieving high school students as revealed by an objective check list, Bell (1960) found that male under-achievers have more negative feelings towards themselves than did the achievers. Agarwal (1975) examined a psycho-social study of academic under-achievement. The results demonstrated under-achievers to be comparatively less emotionally mature, less calm, less placid, less prone to getting into difficul-

ties, less able to face reality and possessing less ego-strength than over-achievers. Beedawat (1976) undertook a study of academic under-achievement among Class IX secondary school students of Bikaner division in Rajasthan. The study reported under-achievers to be out-going, warm-hearted and easy going. Attributes of under-achieving undergraduate students were studied by Sharma (1978). It was noted that personality traits namely, sizothymic, threctia, acetia, guilt proneness, low integration, high ergic tension contributed significantly to academic under-achievement. Conducting a psychological and ecological study of under-achievers, Tandon (1978) indicated that male group of under-achievers were easy-going, out-going, emotionally less stable, low in frustration, shy, apt to inferiority feeling, diffident, pessimistic, moody, depressed, highly anxious, not deligent, and gossip monging. Further, they took less interest in studies, spent time in roaming, were not obedient, were not regular in attendance and did not have sophisticated friends circle. On the other hand, female group of under-achievers were pessimistic, harsh, assertive, highly anxious, and not deligent. Further, they took less interest in studies, spent more time in roaming and had less sophisticated friends. Deka (1985) investigated school failure by making a causal comparative study of high and low achievers. The study concluded that low scholastic

achievement was significantly and positively associated with inferior leadership qualities and less adventurousness.

Studies by Harris (1931, 1940), Muthayya (1965), Ainsworth (1967), Lall (1984), and Gopalacharyulu (1984) draw particular attention for researchers. Harris (1931) made review of 147 studies conducted prior to 1930. In many of these studies an attempt was made to correlate selected personality characteristics of students with their college grades. The reviewer reported that the findings upto that time had been conflicting and inconclusive. Another survey of such literature was published by the same author in 1940, in which 328 studies of academic prediction, investigated mostly between 1930 and 1937, were reviewed. From the review of these studies, Harris concluded that in order of importance the factors of achievements were ability, effort, circumstances (personal, social, economic and academic). Some personality factors were found related to academic achievement in some ways. While comparing high achievers with low achievers in scholastic field, Muthayya (1965) observed achievement to be negatively related to obstacle dominance among high achieving groups and ego-defence response among low achieving groups. Ainsworth (1967) indicated that none of the 14 personality factors under investigation correlated significantly with school attainment. Lall (1984)

noted that academic success was negatively and significantly related to personal problem and sensitivity, anxiety and neuroticism. Gopalacharyulu (1984) studied relationship between certain psycho-sociological factors and achievement of student-teachers in teacher training institutes of Andhra Pradesh. The results revealed that the 16 personality factors could not discriminate between high and low achievers either in theory or practicals or the combined subjects.

The personality characteristic of introversion-extroversion in particular has drawn the attention of many investigators. Many of them have reported that attainment is related positively to introversion. Among them are Himmelweit (1946), Eysenck (1947), Franks (1957), Lynn & Gordon (1961), Savage (1962) and Kline (1966). Similar idea has been given by Entwistle & Shirley (1961), Dotson & Templer (1969), Finlayson (1970), Kline & Gale (1971), Wilson (1971), Mohan & Nehru (1972), Mohan et al. (1975), Bierhoff-Alfernon (1976), Brar (1976), Mohan (1976), Goh & Moore (1978), Masqad (1980), Chandra & Kundu (1981) and Mohan et al. (1981, 1982), when they suggested that low accumulation of reactive inhibition and its faster dissipation ought to be advantageous to the introverts during the examination which results into better achievement by introverts. Further, Eysenck (1957) contends that extroversion is associated with fast accumulation and

slow dissipation of reactive inhibition. So, an extroverted person is not expected to perform well on a sustained work. Accordingly, in educational settings also, it is hypothesized that introverts would be better achievers than extroverts. Lynn & Gordon (1961) observed four reasons for the better academic achievement of introverts than of extroverts. They are:

i) Introverts form conditioned response more quickly than extroverts, so they possess a larger vocabulary and greater learning speed.

ii) Neurotic introverts tend to be more intelligent.

iii) Introverts are more capable of doing sustained work.

iv) Introverts tackle tasks slowly and accurately, whereas extroverts are quick and inaccurate.

A good number of researchers like White (1931, 1932), Stagner (1933), Owens & Johnson (1949), Furneaux (1957), Broadbent (1958), Lynn (1959), Bendig (1960), Holmes (1960), Warburton & Hadley (1960), Jamuar (1961), and Child (1964) have studied school and college students with various questionnaires and have found introverts to be better achievers than extroverts. While studying the prediction of scholastic success through the use of a forced choice problems and attitude inventory, Bloomberge (1955) noted that college

students showing high academic performance are somewhat more introverted than students with low achievement. Using a personality scale measuring introversion to predict grades, Fleeming (1932) indicated that the correlation between introversion and grades was 0.26. But in three other studies Guilford & Voas (1930), Held (1931), and Eckert (1935), the same scale correlated zero or practically so with scholarship. Neel & Mathews (1935) concluded that what is called introvert behaviour is associated with grades than its opposites. Vidhu (1968) investigated into the relationship of neuroticism and extroversion to intelligence and educational achievement at different age levels and reported that extroversion and academic achievement were negatively associated. Basu (1970) indicated that both extroversion and neuroticism have significant effect on academic performance. Menon (1973) made a comparative study of the personality characteristics of over-achievers and under-achievers of high ability in Kerala. Results showed that over-achieving groups of boys and girls of superior ability as well as the general group were found to be less extrovert and less maladjustment than under-achievers. The former also showed greater academic interest and endurance. Altus (1948) studied college achievers and non-achievers using the Minnesota Multiphasic Personality Inventory and contended that achievers revealed introversive

tendencies and non-achievers a love for and a dependence on people, i.e., social extroversion. Sinha (1967) carried out a study of intelligence and some personality factors in relation to academic achievement among male students of Class X in Patna and Gaya. The study demonstrated academic achievement to be positively and significantly related with extroversion – introversion and neuroticism at 0.05 level. While studying the influence of basic personality factors on academic achievement, Abraham (1969) observed the influence of the temperamental dimensions of neuroticism and introversion – extroversion on academic achievement indicated sex differences.

However, by undertaking a study of behaviour and background of students in college and secondary schools, Strang (1937) concluded a lack of relationship between scholarship and various measures of introversion – extroversion.

Banks & Finlayson (1973) conducted a study of success and failure in secondary schools and suggested that the type of school system and the curricular subjects studied might mediate the relationship between the personality dimensions and school achievement.

Researches have been carried out in the area considering achievement in particular subjects. Jha (1970), Mathew

(1976) and Sontakey (1986) have worked using achievement in science as the variable. Mathew (1976) made a study of some personality factors related to under-achievement in science among standard IX students in the district of Trivandrum in Kerala. The findings revealed that the mean scores of over-achievers significantly exceeded the mean scores of under-achievers in cases of self-reliance, sense of personal freedom, freedom from withdrawing tendencies, freedom from nervous symptoms, social standards, social skills, freedom from anti-social tendencies, family relations and community relations. While making a comparative study of personality factors and achievement motivation of high and low achievers in natural and biological sciences, Sontakey (1986) found that personality factors were consistently associated with achievement in natural as well as biological sciences. Factors E^-, G^-, I^+, $Q_3{}^+$, $Q_4{}^-$, and neuroticism came out as predictors of achievement in biological sciences, whereas, E^+, G^+, I^-, $Q_3{}^-$, $Q_4{}^+$, and neuroticism as predictors of achievement in natural sciences. Jha (1970) attempted to study some factors related to achievement in science on a sample of 342 boys and 104 girls drawn from two boys and two girls secondary schools. The results reported no relationship between achievement in science and extroversion.

The following studies have been conducted taking

achievement in Mathematics into consideration. Fennema & Sherman (1977) observed that confidence in Mathematics ability was strongly related to Mathematics achievement (r = 0.22 to 0.47), and the extent of relationship depended on sex and grade level. The studies by Perl (1979), Reyes (1984), and Hunt (1985) have shown that students who are confident of their ability to learn mathematics are more likely to take Mathematics in school when it becomes optional. Kloosterman (1988) undertook a study of self-confidence and motivation in Mathematics and indicated that in general, students who are confident of their ability in Mathematics feel comfortable when confronting mathematical situations.

Elizabeth (1972) made a study of personality characteristics of high school students and found introverts to be superior in Mathematics and social studies, whereas, extroverts to be superior in science.

Ridding (1967) mentioned that over-achieving boys in arithmetic are more surgent than average or under-achieving boys whereas, over-achieving girls are more conscientious than under-achieving girls. In the study of Iyer (1977), the personality variables like self-reliance, sense of personal freedom, feeling of belonging, withdrawing tendencies,

nervous symptoms, social skills, school relations, community relations, general anxiety and test anxiety discriminated effectively between over-achievers and normal-achievers, normal-achievers and under-achievers, and over-achievers and under-achievers in relation to achievement in Mathematics. Somasundaran (1980) carried out a comparative study of certain personality variables related to over, normal and under-achievement in secondary school Mathematics. While introversion and self-reliance had significant positive relationship with achievement in Mathematics, general anxiety, test anxiety, and masculinity had negative relationship.

Kaul (1969) studied personality traits of high and low achievers in Mathematics. The study reported high-achievers to be emotionally mature, more dominant, assertive and independent minded, while low achievers to be demanding, impatient, excitable, over-active, more dependent and attention seeking. Koul (1978) investigated personality needs of high and low-achievers in Mathematics taking a sample of 1030 students from six male higher secondary schools of Ajmer city in Rajasthan. The study pointed out that students belonging to high achieving group were found to be high on the scales of n Order, n Dominance, Change and n Endurance and low on the scales of n Exhibition, n Succorance, n Heterosexuality and n Aggression. The low achieving

group in Mathematics were found to be more exhibitory, succorant, heterosexual and aggressive.

A study of certain factors related to differential patterns of achievement among bright students was examined by Kulshreshta (1981). The study concluded that the bright under-achievers in Mathematics were more warm-hearted than normal-achievers.

A careful look into the different researches which were reviewed along with discussion with experts and the researcher's own thinking led to the formulation of hypotheses of the present study, which are already given in the previous chapter.

CHAPTER III

METHODOLOGY AND PROCEDURE

METHODOLOGY AND PROCEDURE

3.1.0. Introduction

This chapter presents the details of the processes followed to achieve the objectives of the present investigation. The study is a descriptive research. The chapter describes the population and sample, tools used and their administration, collection of data, scoring processes involved and statistical measures used to analyse the data procured.

3.2.0. Population and Sample

The population of the study included all Class IX students studying in the high schools affiliated to the Central Board of Secondary Education (CBSE) in the three states of North Eastern Region of India, namely, Nagaland, Meghalaya, and Manipur. These high schools happened to be as follows:

Table - 1

Lists of High Schools from Nagaland, Meghalaya and Manipur forming the population

Name of the State	Name of the Schools	Total No. of Schools
Nagaland	1. Kendriya Vidyalaya, Dimapur	1
Meghalaya	1. B. K. Bajoria High School, Shillong 2. Kendriya Vidyalaya, Happy Valley, Shillong 3. Kendriya Vidyalaya, Upper Shillong	3

Table 1 (Contd.)

Name of the State	Name of the schools	Total No. of Schools
Manipur	1. Kendriya Vidyalaya, Loktak 2. Kendriya Vidyalaya, Leimakhong 3. Kendriya Vidyalaya, Langjing 4. Kendriya Vidyalaya, Lamphelpat	4
	Grand Total	8

The population included all Class IX students of the eight schools mentioned above.

Since the number of schools were only eight, all these schools formed the sample. The total number of Class IX students, who answered completely all the tools used for data collection, formed the sample for the study. The names of the high schools and the number of students from each of them who formed the sample are given in Table 2.

Table 2

Names of the High Schools and the Number of Students Forming the Sample of the Study

Sl. No.	Name of the School	No. of Students
1.	Kendriya Vidyalaya, Dimapur	50
2.	B.K. Bajoria High School, Shillong	30
3.	Kendriya Vidyalaya, Happy Valley, Shillong	29
4.	Kendriya Vidyalaya, Upper Shillong	72
5.	Kendriya Vidyalaya, Loktak	14
6.	Kendriya Vidyalaya, Leimakhong	17
7.	Kendriya Vidyalaya, Langjing	27
8.	Kendriya Vidyalaya, Lamphelpat.	64
	Grand Total	303

3.3.0. Tools Used

The tools employed in the study included:

1. Achievement Test in Mathematics.
2. Attitude Scale (to measure the attitude of students towards Mathematics).
3. Educational Aspiration Scale (E.A.S.).
4. Occupational Aspiration Scale (O.A.S.).
5. Numerical Ability Test.
6. Abstract Reasoning Test.
7. Space Relations Test.
8. Cattell's 14 High School Personality Questionnaire (14 HSPQ).

The first tool in the list above was developed for the purpose of the study. The further presentation gives details about the development of the tools.

3.3.1. Achievement Test in Mathematics

This test was developed for the purpose of the study. The details about the steps followed in the development of the test are given below.

3.3.1.1. Development of Items

The items of the Achievement Test in Mathematics for Class IX (following the CBSE Pattern) in Tamil Nadu and Kerala which was constructed and standardized by Sharada

(1984) formed the basis for the items to be included in the Achievement Test that was developed for the purpose of the present study. Since there were little differences in the syllabi of Mathematics for Class IX in 1988 (at the time of the present study) since 1984, the test items were presented to six teachers, two each (one teaching Class IX and the other Class X) from the three high schools of Shillong, namely, B.K. Bajoria High School, Kendriya Vidyalaya at Happy Valley, and KendriyaVidyalaya at Upper Shillong. These teachers were requested to indicate the items which fell within the purview of the present Class IX syllabus and their responses were collected. The teachers also informed that the items covered the syllabus completely. On the basis of their responses, items were selected so as to be included in the Achievement Test in Mathematics.

3.3.1.2. Validity of the Achievement Test

The items included in the Achievement Test were selected from an Achievement Test in Mathematics which was developed earlier. The items in the original test had been selected after finding out the suitability of discriminative power and difficulty index for each of the items. Further, the selection of the items for the Achievement Test of the current study was done by six Mathematics teachers of Classes IX and X who discarded those items which did not fall within

the present syllabus of Mathematics taught in the high schools affiliated to the Central Board of Secondary Education (CBSE). This involvement of Mathematics teachers themselves in the selection of items (which were found valid earlier in the original test) suggests the Test to be having Content Validity.

3.3.1.3. Reliability of the Achievement Test

To establish the reliability of the Achievement Test in Mathematics, the Test was administered to 147 students of Class X (that is, who have covered the Class IX syllabus) drawn from the three high schools of Shillong following the CBSE syllabus. The details of the sample thus selected are presented in Table 3.

Table 3

Details of Schools and the Number of Students Drawn for Establishing the Reliability of the Achievement Test in Mathematics

Sl. No.	Name of the School	No. of students
1.	B. K. Bajoria High School, Shillong	24
2.	Kendriya Vidyalaya, Happy Valley, Shillong	35
3.	Kendriya Vidyalaya, Upper Shillong	88
	Grand Total	147

Each correct response was given a score of '1' and wrong response was given a score of '0'. The odd items of the test and the even items of the test were scored separately to give odd-scores and even-scores respectively. Thus each student had an odd-score and an even-score. These odd-scores and even-scores are presented in Table 4.

Table 4

Odd-Scores and Even-Scores Obtained by the Reliability Sample on the Achievement Test in Mathematics

Sl. No. of Student	Odd Score (x)	Even Score (y)
1.	3	2
2.	1	5
3.	4	2
4.	3	5
5.	6	3
6.	8	2
7.	5	6
8.	5	6
9.	7	5
10.	8	4
11.	7	5
12.	7	6
13.	5	8
14.	6	7
15.	7	7
16.	8	6
17.	5	9
18.	9	6

Table 4 (Contd.)

Sl. No. of the Student	Odd Score (x)	Even-Score (y)
19.	8	8
20.	6	10
21.	13	5
22.	12	7
23.	12	9
24.	14	8
25.	3	2
26.	9	4
27.	7	7
28.	8	6
29.	10	5
30.	10	5
31.	11	5
32.	14	4
33.	15	3
34.	9	10
35.	16	5
36.	17	6
37.	18	6
38.	17	8
39.	19	6
40.	17	9
41.	19	10
42.	8	8
43.	9	10
44.	13	6
45.	12	7
46.	10	10

Table 4 (Contd.)

Sl.No. of the Student	Odd Score (x)	Even-Score (y)
47.	15	6
48.	9	12
49.	13	9
50.	11	11
51.	11	11
52.	16	8
53.	12	12
54.	13	12
55.	12	14
56.	18	8
57.	16	11
58.	19	10
59.	17	16
60.	11	6
61.	10	7
62.	11	7
63.	17	4
64.	14	9
65.	17	7
66.	16	9
67.	18	8
68.	16	12
69.	17	11
70.	19	10
71.	16	13
72.	18	11
73.	17	13
74.	17	13

Table 4 (Contd.)

Sl.No. of the Student	Odd-Score (x)	Even-Score (y)
75.	23	9
76.	21	12
77.	22	11
78.	19	14
79.	20	13
80.	20	13
81.	21	13
82.	23	11
83.	22	13
84.	23	13
85.	23	15
86.	24	15
87.	24	16
88.	28	13
89.	26	19
90.	27	19
91.	3	5
92.	2	6
93.	5	4
94.	7	4
95.	9	3
96.	6	8
97.	10	4
98.	5	9
99.	9	7
100.	12	4
101.	11	6
102.	11	6

Table 4 (Contd.)

Sl.No. of the Student	Odd-Score (x)	Even-Score (y)
103.	14	3
104.	9	9
105.	13	6
106.	9	10
107.	11	9
108.	12	8
109.	12	8
110.	14	8
111.	14	8
112.	14	9
113.	16	8
114.	18	6
115.	16	9
116.	19	6
117.	17	9
118.	17	9
119.	15	11
120.	18	9
121.	18	9
122.	18	10
123.	20	9
124.	10	6
125.	9	10
126.	11	8
127.	11	9
128.	15	6
129.	11	10

Table 4 (Contd.)

Sl.No. of the Student	Odd-Score (x)	Even-Score (y)
130.	9	13
131.	9	14
132.	13	10
133.	15	9
134.	13	11
135.	14	11
136.	15	10
137.	14	12
138.	16	10
139.	16	10
140.	15	11
141.	16	10
142.	17	10
143.	16	11
144.	17	10
145.	17	11
146.	19	10
147.	20	12
Total	1964	1265

The Odd-Even reliability was calculated as follows:

Odd Scores (x)	Even Scores (y)
$\Sigma x = 1964$	$\Sigma y = 1265$
$\Sigma x^2 = 30750$	$\Sigma y^2 = 12533$

$$\Sigma xy = 18548$$

$$N = 147$$

$$r = \frac{N\Sigma xy - \Sigma x \times \Sigma y}{\sqrt{[N\Sigma x^2 - (\Sigma x)^2]\,[N\Sigma y^2 - (\Sigma y)^2]}}$$

$$= \frac{(147) \times (18548) - (1964) \times (1265)}{\sqrt{[(147)x(30750)-(1964)^2]\,[(147)x(12533)-(1265)^2]}}$$

$$= \frac{2726556 - 2484460}{\sqrt{[4520250 - 3857296]\,[1842351 - 1600225]}}$$

$$= \frac{242096}{\sqrt{[662954]\,[242126]}}$$

$$= \frac{242096}{[814.21]\,[492.06]}$$

$$= \frac{242096}{400640.17}$$

$$= \underline{0.6043}$$

Applying Spearman–Brown Prophecy Formula to estimate the reliability of the full scale, the reliability of the Achievement Test in Mathematics is,

$$r_{11} = \frac{2r}{1 + r}$$

$$= \frac{2(0.6043)}{1 + 0.6043}$$

$$= \frac{1.2086}{1.6043}$$

$$= \underline{0.7534}$$

Referring to Table 25 in Garrett (1981) the obtained value of r_{11} is significant at 0.01 level.

Hence, the Odd-Even reliability of the Achievement Test in Mathematics was found to be 0.75.

Having thus established the validity and reliability, the Achievement Test in Mathematics was accepted as the tool to measure the Achievement of Class IX Students in Mathematics (A copy of the Achievement Test in Mathematics is given in Appendix - I and a copy of the Scoring Key for the same Test is given in Appendix - II).

3.3.2. Attitude Scale

The Attitude Scale to measure the Attitude of Class IX students towards Mathematics was developed by the investigator (Caroline Ngailiankim, 1988) during her M.Phil work. It consists of 24 Statements (12 positive and 12 negative). The subject is required to indicate his/her choice of response to each of the statements on a five point Scale, namely 'Strongly Agree', 'Agree', 'Undecided', 'Disagree', and 'Strongly Disagree'. There is no time limit for responding to the Attitude Scale. However, the students of Class IX could answer the items within 10 - 15 minutes. The Scoring Scheme for the positive Statements is, 4, 3, 2, 1, 0, corresponding to the five points as given above. Similarly, 0,

1, 2, 3, 4, are the scores for the corresponding points of the negative Statements. The reliability of the Attitude Scale by the Odd-Even method is 0.86. (A copy of the Attitude Scale is given in Appendix - III).

3.3.3. Educational Aspiration Scale (E.A.S.)

The present study used the Educational Aspiration Scale (E.A.S.) developed by Sharma and Gupta (1980) as its basis. As a first step, the Scale which was in Hindi was translated into English. The items were checked for the correctness of translation by three experts. The Scale was then administered to a group of ten Class IX students to find out whether there was any difficulty in understanding and answering the items. Since no difficulty was found, the Scale was accepted for use in the study.

The Scale has been designed on the strength of the lists of degrees, diplomas, certificates, and such other distinctive educational qualifications as maintained by Indian Universities and Competitive Examination Boards in Indian States and Union Services. A detailed list of different qualifications in terms of certificates, diplomas, degrees available from literature and such other sources, had served as a basis in the development of the Scale. Eight lists each consisting of ten items are randomly presented

in the Scale. The ten items in each list have prestige values ranging from 1 to 10. The maximum score on the Scale happens to be 80 and minimum happens to be 8. There is no time limit. However, 25 minutes are sufficient for taking the Test. A copy of the translated version of the Educational Aspiration Scale which was used in the study is provided in Appendix - IV. The Scoring Key for the same is provided in Appendix - V.

3.3.4. Occupational Aspiration Scale (O.A.S.)

The Occupational Aspiration Scale (O.A.S.) was developed by Grewal (1975). The Scale was administered to a group of ten Class IX students to find out whether there was any difficulty in understanding and answering the items. Since no difficulty was found, the Scale was accepted for use in the study.

The Level of Occupational Aspiration (L.O.A.) is considered as a concept which is logically a special instance of the concept level of Aspiration. Its special nature consists only in the continuum of difficulty. This continuum of difficulty is the Occupational hierarchy.

Occupational Aspiration Scale (O.A.S.) consists of eight items and each item is a list of ten different kinds of jobs. The testee has to choose one out of the ten

choices. The score for each item ranges from zero (lowest) to nine (highest). All the eight items are scored in the same way. The total score is the sum of the scores for each of the eight items. An individual's total score ranges from 0 to 72. Half an hour is a sufficient time for the administration of the Scale. This includes both the instruction and response time. A copy of the Occupational Aspiration Scale is provided in Appendix - VI and a Scoring Key for the same is given in Appendix - VII.

3.3.5. Numerical Ability Test

This Test is one of the subtests of the Differential Aptitude Tests adapted to the Indian conditions by J.M. Ojha. Directions for answering the Test is given in the Test Booklet itself. Special instructions are also given so that each student understands what he/she is to do before beginning the Test. The time limit for answering the Test is 30 minutes. Scoring involves of giving one mark for the correct response on each of the items. Since there are 40 items in the Test, the maximum possible score is 40. A copy of the Test Booklet is given in Appendix - VIII.

3.3.6. Abstract Reasoning Test

This Test is one of the subtests of the Differential Aptitude Tests adapted to the Indian conditions by J.M.

Ojha. Directions for answering the Test is given in the Test Booklet itself. Special instructions are also given so that each student understands what he/she is to do before beginning the Test. The time limit for answering the Test is 25 minutes. Scoring involves of giving one mark for the correct response on each of the items. Since there are 50 items in the Test, the maximum possible score is 50. A copy of the Test Booklet is given in Appendix - IX.

3.3.7. Space Relations Test

This Test is one of the subtests of the Differential Aptitude Tests adapted to the Indian conditions by J.M. Ojha. Directions for answering the Test is given in the Test Booklet itself. Special instructions are also given so that each student understands what he/she is to do before beginning the Test. The time limit for answering the test is 30 minutes. There are 40 items in the Test. Multiple marks are permitted for each item. The maximum possible score on the Test is 100. A copy of the Test Booklet is given in Appendix - X.

3.3.8. Cattell's 14 High School Personality Questionnaire (14 HSPQ)

The 14 High School Personality Questionnaire (14 HSPQ) was developed by Cattell and Cattell in 1968. It measures fourteen distinct dimensions of Personality which

have been found by Psychologists to come near to covering the total Personality. The Questionnaire is suitable for children of ages 12 through 18. This can be administered within a class period, either individually or in groups. The Tool measures the following 14 traits of Personality designated as Factors A, B, C, D, E, F, G, H, I, J, O, Q_2, Q_3 and Q_4. Each of these traits has a technical name, a common name (or several such names) and an alphabetic symbol for convenience of rapid reference, e.g., B, F, G, etc. Each dimension is defined by two poles, or extremes. The left hand one in descriptions is a score at the low end of the stens (1, 2, or 3) and the right hand, at the high end (8, 9, or 10). However, one should guard against assuming that high scores (e.g., 10) are necessarily "good" and low scores, "bad". This may be true of abilities, but in Personality each type of temperament usually has both its good and its bad points. For example, in dimension A the high scoring warmhearted person is rated as good-natured, attentive to people, and trustful, but his easygoingness means that his promises do not always mean as much as those of a person at the low-score pole on A. The latter is precise and dependable in his work, but his aloofness and stiffness is not so attractive socially (or in any contact work). This is but one example, both good and bad are typically found at either pole on most of the HSPQ personality factors.

There are 142 items to be answered in the 14 High School Personality Questionnaire. The Questionnaire permits the tester to explain the meanings of the word to the examinees upon request except for the Intelligence Scale items (numbers 23, 24, 43, 44, 63, 64, 83, 84, 104, and 124). The Scoring Keys provide the raw scores for each of the 14 personality factors separately. There is no time limit but usually can be completed by all but the slowest readers in about 40 to 50 minutes. A brief description of the fourteen Personality Factors are given in Table 5. A copy of 14 High School Personality Questionnaire is given in Appendix - XI.

Table 5

A Brief Description of the Fourteen Personality Factors

Low Sten Score Description (1-3) A boy or girl with low score is	Alphabetic Designation of Factor	High Sten Score Description (8-10) A boy or girl with high score is
Reserved, Detached, Critical Aloof, Stiff.	A	Warmhearted, Outgoing, Easygoing, Participating
Less-Intelligent, Concrete-Thinking, of Lower Scholastic Mental Capacity	B	More-Intelligent, Abstract-Thinking, Bright, of Higher Scholastic Mental Capacity.
Affected by Feelings, Emotionally Less Stable, Easily Upset, Changeable, of Lower Ego Strength.	C	Emotionally Stable, Mature, Faces Reality, Calm, of Higher Ego Strength (not the same as "egotistical").

Table 5 (Contd.)

Low Sten Score Description (1-3) A boy or girl with low score is	Alphabetic Designation of Factor	High Sten Score Description (8-10) A boy or girl with high score is
Undemonstrative, Deliberate, Inactive, Stodgy, Phlegmatic.	D	Excitable, Impatient, Demanding, Overactive, Unrestrained.
Obedient, Mild, Easily Led, Accommodating, Submissive	E	Assertive, Competitive, Aggressive, Stubborn, Dominant.
Sober, Taciturn, Serious	F	Enthusiastic, Heedless, Happy-Go-Lucky.
Disregards Rules, Expedient, Has Weaker Super-ego Strength	G	Conscientious, Persistent, Moralistic, Staid, Has Stronger Super-ego Strength.
Shy, Timid, Threat-Sensitive	H	Adventurous, "Thick-Skinned", Socially Bold.
Tough-Minded, Rejects Illusions	I	Tender-Minded, Sensitive, clinging, Over-Protected.
Zestful, Likes Group Action	J	Circumspect Individualism, Reflective, Internally Restrained.
Self-Assured, Placid, Secure, Complacent, Untroubled.	O	Apprehensive, Self-Reproaching, Insecure, Worrying, Guilt Prone.
Sociably Group-Dependent, A "Joiner" and Sound Follower.	Q_2	Self-Sufficient, Prefers Own Decisions, Resourceful.
Uncontrolled, Lax, Follows Own Urges, Careless of Social Rules, Has Low Integration.	Q_3	Controlled, Socially-Precise, Self Disciplined, Compulsive, Has High Self-Concept Control.

Table 5 (Contd.)

Low Sten Score Description (1-3) A boy or girl with low score is	Alphabetic Designation of Factor	High Sten Score Description (8-10) A boy or girl with high score is
Relaxed, Tranquil, Torpid, Unfrustrated, Composed.	Q_4	Tense, Driven, Overwrought, Frustrated, Fretful.

3.4.0. Collection of Data

The study required the administration of eight tools in all to the sample of students drawn for the purpose. This required a careful time scheduling for each school according to what the circumstances claimed. This was planned in consultation with the school authorities and informed well in advance to the persons concerned, after taking the permission from the heads of each school. The investigator met the classes to which the tools were to be administered and developed a rapport with the students, i.e. testees. Before the administration of each of the tools, sufficient time was given to the students to furnish their name, the name of their school, class and section, and the date of administration on the answer scripts at the beginning of each tool. While administering the tool, instructions were read out by the investigator and the illustrative examples were explained to the students where required.

It was made sure that all the students had understood the instructions fully regarding the answering of the tool. The students were also told that if they found any item difficult, they should proceed to the next item without wasting time and were advised to come back to the difficult item later. The tools were administered as per schedule. A constant vigil was kept over the class while the tool administration was made to make sure that everything went smoothly.

After the administration of all the tools to the sample of students (Refer Caption 3.2.0.), the tools were scored according to their respective Scoring Keys. These scores provided the data for the study to test the different Hypotheses proposed. The raw scores obtained on these eight tools are given in Appendix - XII.

3.5.0. Statistical Measures Employed for Analysing the Data

The data were analysed using the statistical techniques Chi-Square and Contingency Coefficients. Details of the analysis are presented in the next chapter.

CHAPTER IV

ANALYSIS AND INTERPRETATION OF DATA

ANALYSIS AND INTERPRETATION OF DATA

4.1.0. Introduction

This chapter presents the details of the analysis of the data with reference to testing the different hypotheses of the study. Chi-Square test was used for testing each of the hypotheses. Contingency Coefficient was calculated further in such cases where the Chi-Square value was found to be significant. For this purpose the data were classified into three groups, namely, High, Average, and Low, on each of the variable under consideration, thus providing a 3 x 3 Contingency Table in each case.

4.2.0. Testing of Hypotheses

Data were analysed in relation to the different Hypotheses framed in the study. Details of calculations for each of the Hypotheses are given further.

4.2.1. Hypothesis - I

The Hypothesis states, "There is no significant association between Attitude towards Mathematics and Achievement in Mathematics."

Achievement Scores		Attitude Scores	
Mean	= 21.35	Mean	= 64.02
SD	= 5.71	SD	= 9.40

N = 303

With reference to the Achievement scores, students who scored Mean + 1 Standard Deviation and above were grouped as High group; Students who scored Mean - 1 Standard Deviation and below were grouped as Low group; and students who scored between these two scores were grouped as Average group. The details of the score values for the formation of groups are shown below:

$$M + 1\ SD = 21.35 + 5.71$$
$$= 27.06 \approx 27$$
$$M - 1\ SD = 21.35 - 5.71$$
$$= 15.64 \approx 16$$

Therefore, on the Achievement Scores:

Students who scored 27 and above formed the High group.

Students who scored between 17 and 26 formed the Average group.

Students who scored 16 and below formed the Low group.

In a similar way, the students were grouped as High, Average, and Low on the Attitude scores. The details of the score values for the formation of groups are shown below:

$$M + 1\ SD = 64.02 + 9.40$$
$$= 73.42 \approx 73$$

$$M - 1\ SD = 64.02 - 9.40$$

$$= 54.62 \approx 55$$

Therefore, on the Attitude Scores:

Students who scored 73 and above formed the High group.

Students who scored between 72 and 56 formed the Average group.

Students who scored 55 and below formed the Low group.

Based on the above groupings, a 3 x 3 Contingency Table was formed between Attitude scores and Achievement scores as shown in Table - 6.

Table - 6

A 3 x 3 Contingency Table Between Attitude Scores and Achievement Scores

Attitude	Achievement			
	High	Average	Low	Total
High	13 (7.66)	28 (26.35)	2 (9.08)	43
Average	35 (35.29)	123 (120.89)	40 (41.82)	198
Low	6 (11.05)	34 (37.85)	22 (13.10)	62
Total	54	185	64	303

(Expected frequencies are indicated in the brackets in each cell).

$$\chi^2 = \Sigma \frac{(f_o - f_e)^2}{f_e}$$

Where f_o = observed frequency in each cell.

f_e = expected frequency in each cell.

On calculating, $\chi^2 = \underline{18.3848}$

$$df = (r-1)(c-1)$$
$$= (3-1)(3-1)$$
$$= 2 \times 2$$
$$= 4$$

Referring to Table E (Garrett, 1981), the obtained value of χ^2 is found to be significant at 0.01 level. Therefore, the null hypothesis is rejected.

That is, there is a significant association between Attitude towards Mathematics and Achievement in Mathematics at 0.01 level.

This calls for further analysis and for this purpose Contingency Coefficient was calculated as follows:

$$C = \sqrt{\frac{\chi^2}{N + \chi^2}}$$

$$= \sqrt{\frac{18.3848}{303 + 18.3848}}$$

$$= \sqrt{\frac{18.3848}{321.3848}}$$

$$= \sqrt{0.0572049}$$

$$= \underline{0.24}$$

From the obtained value of C it was found that there is a close association between Attitude towards Mathematics and Achievement in Mathematics.

4.2.2. Hypothesis - 2

The Hypothesis states, "There is no significant association between Educational Aspiration and Achievement in Mathematics."

Since the Achievement scores happen to be the same or were for testing Hypothesis - 1, the same groupings of High, Average, and Low (Refer Caption 4.2.1.) are maintained for testing Hypothesis - 2 also.

In a similar way, the students were grouped as High, Average, and Low on the Educational Aspiration scores. The details of the score values for the formation of groups are shown below.

$$M + 1\ SD = 33.87 + 8.92$$

$$= 42.79 \approx 43$$

$$M - 1\ SD = 33.87 - 8.92$$

$$= 24.95 \approx 25$$

Therefore, on the Educational Aspiration Scores:

Students who scored 43 and above formed the High group.

Students who scored between 42 and 26 formed the Average group.

Students who scored 25 and below formed the Low group.

Based on the above groupings, a 3 x 3 Contingency Table was formed between Educational Aspiration scores and Achievement scores as presented in Table 7.

Table - 7

A 3 x 3 Contingency Table Between Educational Aspiration Scores and Achievement Scores

Educational Aspiration	Achievement			
	High	Average	Low	Total
High	6 (9.80)	30 (33.58)	19 (11.62)	55
Average	40 (33.15)	119 (113.56)	27 (39.29)	186
Low	8 (11.05)	36 (37.85)	18 (13.10)	62
Total	54	185	64	303

(Expected frequencies are shown in the brackets in each cell).

$$\chi^2 = \Sigma \frac{(f_o - f_e)^2}{f_e}$$

Where f_o = observed frequency in each cell.

f_e = expected frequency in each cell.

On calculating, $\chi^2 = \underline{14.8278}$

$$df = (r-1)(c-1)$$
$$= (3-1)(3-1)$$
$$= 2 \times 2$$
$$= 4$$

Referring to Table E (Garrett, 1981), the obtained value of Chi-Square is found to be significant at 0.01 level. Therefore, the null hypothesis is rejected.

Hence, there is a significant association between Educational Aspiration and Achievement in Mathematics at 0.01 level.

This calls for further analysis and for this purpose Contingency Coefficient was carried out as follows:

$$C = \sqrt{\frac{\chi^2}{N + \chi^2}}$$

$$= \sqrt{\frac{14.8278}{303 + 14.8278}}$$

$$= \sqrt{\frac{14.8278}{317.8278}}$$

$$= \sqrt{0.0466535}$$

$$= \underline{0.22}$$

From the obtained value of C it is concluded that there is a close association between Educational Aspiration and Achievement in Mathematics.

4.2.3. Hypothesis - 3

The Hypothesis states: "There is no significant association between Occupational Aspiration and Achievement in Mathematics".

Since the Achievement scores happen to be the same as were for testing Hypothesis - 1, the same groupings of High, Average, and Low (Refer Caption 4.2.1.) are maintained for testing Hypothesis - 3 also.

In a similar way, the students were grouped as High, Average, and Low on the Occupational Aspiration scores. The details of the score values for the formation of groups are shown below:

$$M + 1\ SD = 52.31 + 10.00$$

$$= 62.31 \approx 62$$

$$M - 1\ SD = 52.31 - 10.00$$
$$= 42.31 \approx 42$$

Therefore, on the Occupational Aspiration Scores:

Students who scored 62 and above formed the High group.

Students who scored between 61 and 43 formed the Average group.

Students who scored 42 and below formed the Low group.

Based on the above groupings, a 3 x 3 Contingency Table was formed between Occupational Aspiration scores and Achievement scores as given in Table 8.

Table - 8

A 3 x 3 Contingency Table Between Occupational Aspiration Scores and Achievement Scores

Occupational Aspiration	Achievement			
	High	Average	Low	Total
High	9 (9.62)	31 (32.97)	14 (11.41)	54
Average	39 (35.29)	125 (120.89)	34 (41.82)	198
Low	6 (9.09)	29 (31.14)	16 (10.77)	51
Total	54	185	64	303

(Expected frequencies are presented in the brackets in each cell).

$$\chi^2 = \Sigma \frac{(f_o - f_e)^2}{f_e}$$

Where f_o = observed frequency in each cell.

f_e = expected frequency in each cell.

On calculating, χ^2 = 6.4747

$$\begin{aligned} df &= (r-1)(c-1) \\ &= (3-1)(3-1) \\ &= 2 \times 2 \\ &= 4 \end{aligned}$$

Referring to Table E (Garrett, 1981), the obtained value of Chi-Square is not significant. Thus, the null hypothesis is accepted.

Thus, there is no significant association between Occupational Aspiration and Achievement in Mathematics.

4.2.4. Hypothesis - 4

The Hypothesis states: "There is no significant association between Numerical Ability and Achievement in Mathematics".

Since the Achievement scores happen to be the same as were for testing Hypothesis - 1, the same groupings of High, Average, and Low (Refer Caption 4.2.1.) are maintained for testing Hypothesis - 4 also.

In a similar way, the students were grouped as High, Average, and Low on the Numerical Ability scores. The details of the score values for the formation of groups are shown below:

$$M + 1\ SD = 25.15 + 5.50$$
$$= 30.65 \approx 31$$
$$M - 1\ SD = 25.15 - 5.50$$
$$= 19.65 \approx 20$$

Therefore, on the Numerical Ability Scores:

Students who scored 31 and above formed the High group.

Students who scored between 30 and 21 formed the Average group.

Students who scored 20 and below formed the Low group.

Based on the above groupings, a 3 x 3 Contingency Table was formed between Numerical Ability scores and Achievement scores as shown in Table - 9.

Table - 9

A 3 x 3 Contingency Table Between Numerical Ability Scores and Achievement Scores

Numerical Ability	Achievement			
	High	Average	Low	Total
High	11 (8.20)	32 (28.09)	3 (9.72)	46
Average	37 (34.22)	115 (117.23)	40 (40.55)	192
Low	6 (11.58)	38 (39.69)	21 (13.73)	65
Total	54	185	64	303

(Expected frequencies are given in the brackets in each cell).

$$\chi^2 = \Sigma \frac{(f_o - f_e)^2}{f_e}$$

Where f_o = observed frequency in each cell.

f_e = expected frequency in each cell.

On calculating, $\chi^2 = \underline{13.0322}$

$$df = (r-1)(c-1)$$
$$= (3-1)(3-1)$$
$$= 2 \times 2$$
$$= 4$$

Referring to Table E (Garrett, 1981), the obtained value of Chi-Square is found to be significant at 0.05 level. Therefore, the null hypothesis is rejected.

That is, there is a significant association between Numerical Ability and Achievement in Mathematics at 0.05 level.

This calls for further analysis and for this purpose Contingency Coefficient was computed as follows:

$$C = \sqrt{\frac{\chi^2}{N + \chi^2}}$$

$$= \sqrt{\frac{13.0322}{303 + 13.0322}}$$

$$= \sqrt{\frac{13.0322}{316.0322}}$$

$$= \sqrt{0.0412369}$$

$$= \underline{0.20}$$

From the obtained value of C, it can be said that there is a close association between Numerical Ability and Achievement in Mathematics.

4.2.5. Hypothesis

The Hypothesis states: "There is no significant association between Abstract Reasoning and Achievement in Mathematics."

Since the Achievement scores happen to be the same as were for testing Hypothesis - 1, the same groupings of High, Average, and Low (Refer Caption 4.2.1.) are maintained for testing Hypothesis - 5 also.

In a similar way, the students were grouped as High, Average, and Low on the Abstract Reasoning scores. The details of the score values for the formation of groups are shown below:

$$M + 1\ SD = 34.30 + 7.89$$
$$= 42.19 \approx 42$$
$$M - 1\ SD = 34.30 - 7.89$$
$$= 26.41 \approx 26$$

Therefore, on the Abstract Reasoning Scores:

Students who scored 42 and above formed the High group.

Students who scored between 41 and 27 formed the Average group.

Students who scored 26 and below formed the Low group.

Based on the above groupings, a 3 x 3 Contingency Table was formed between Abstract Reasoning scores and Achievement scores as presented in Table 10.

Table - 10

A 3 x 3 Contingency Table Between Abstract Reasoning Scores and Achievement Scores

Abstract Reasoning	Achievement			
	High	Average	Low	Total
High	18 (8.02)	24 (27.48)	3 (9.50)	45
Average	33 (39.03)	143 (133.71)	43 (46.26)	219
Low	3 (6.95)	18 (23.81)	18 (8.24)	39
Total	54	185	64	303

(Expected frequencies are indicated in the brackets in each cell).

$$\chi^2 = \Sigma \frac{(f_o - f_e)^2}{f_e}$$

Where f_o = observed frequency in each cell.

f_e = expected frequency in each cell.

On calculating, $\chi^2 = \underline{34.3369}$

$$df = (r-1)(c-1)$$
$$= (3-1)(3-1)$$
$$= 2 \times 2$$
$$= 4$$

Referring to Table E (Garrett, 1981), the obtained value of Chi-Square is found to be significant at 0.01 level. Therefore, the null hypothesis is rejected.

Hence, there is a close association between Abstract Reasoning and Achievement in Mathematics at 0.01 level.

This calls for further analysis and for this purpose Contingency Coefficient was carried out as follows:

$$C = \sqrt{\frac{\chi^2}{N + \chi^2}}$$

$$= \sqrt{\frac{34.3369}{303 + 34.3369}}$$

$$= \sqrt{\frac{34.3369}{337.3369}}$$

$$= \sqrt{0.1017881}$$

$$= \underline{0.32}$$

From the obtained value of C, it was found that there exists a very good association between Abstract Reasoning and Achievement in Mathematics.

4.2.6. Hypothesis - 6

The Hypothesis states: "There is no significant association between Space Relations and Achievement in Mathematics".

Since the Achievement scores happen to be the same as were for testing Hypothesis - 1, the same groupings of

High, Average, and Low (Refer Caption 4.2.1.) are maintained for testing Hypothesis - 6 also.

In a similar way, the students were grouped as High, Average, and Low on the Space Relations scores. The details of the score values for the formation of groups are shown below.

$$M + 1\ SD = 49.54 + 4.02$$
$$= 53.56 \approx 54$$
$$M - 1\ SD = 49.54 - 4.02$$
$$= 45.52 \approx 46$$

Therefore, on the Space Relations Scores:

Students who scored 54 and above formed the High group.

Students who scored between 53 and 47 formed the Average group.

Students who scored 46 and below formed the Low group.

Based on the above groupings, a 3 x 3 Contingency Table was formed between Space Relations scores and Achievement scores as given in Table - 11.

Table - 11

A 3 x 3 Contingency Table Between Space Relations Scores and Achievement Scores

Space Relations	Achievement			
	High	Average	Low	Total
High	23 (20.14)	71 (68.99)	19 (23.87)	113
Average	9 (11.41)	39 (39.08)	16 (13.52)	64
Low	22 (22.46)	75 (76.93)	29 (26.61)	126
Total	54	185	64	303

(Expected frequencies are shown in the brackets in each cell).

$$\chi^2 = \Sigma \frac{(f_o - f_e)^2}{f_e}$$

Where f_o = observed frequency in each cell.

f_e = expected frequency in each cell.

On calculating, $\chi^2 = \underline{2.6947}$

$$df = (r-1)(c-1)$$
$$= (3-1)(3-1)$$
$$= 2 \times 2$$
$$= 4$$

Referring to Table E (Garrett, 1981), the obtained value of Chi-Square is not significant. Therefore, the null hypothesis is accepted.

Thus, there is no significant association between Space Relations and Achievement in Mathematics.

4.2.7. Hypothesis - 7

The Hypothesis states, "There is no significant association between each of the 14 Personality Characteristics, namely, Factors - A, B, C, D, E, F, G, H, I, J, O, Q_2, Q_3 and Q_4 (as given in the Cattell's HSPQ) and Achievement in Mathematics".

The calculations are presented for the scores obtained on each of the 14 Personality Characteristics (Factors A, B, C, D, E, F, G, H, I, J, O, Q_2, Q_3 and Q_4) separately as shown further.

4.2.7.1. Factor - A (Reserved, Detached, Critical, Aloof, Stiff – Warmhearted, Outgoing, Easygoing, Participating).

The Hypothesis with reference to Factor A is stated as: "There is no significant association between Factor A (as given in the Cattell's HSPQ) and Achievement in Mathematics".

Since the Achievement scores happen to be the same as were for testing Hypothesis - 1, the same groupings of High, Average, and Low (Refer Caption 4.2.1.) are maintained for this Hypothesis also.

In a similar way, the students were grouped as High, Average, and Low on the Factor A scores. The details of the score values for the formation of groups are shown below.

$$M + 1\ SD = 10.17 + 3.12$$
$$= 13.29 \approx 13$$
$$M - 1\ SD = 10.17 - 3.12$$
$$= 7.05 \approx 7$$

Therefore, on the Factor A scores:

Students who scored 13 and above formed the High group.

Students who scored between 12 and 8 formed the Average group.

Students who scored 7 and below formed the Low group.

Based on the above groupings, a 3 x 3 Contingency Table was formed between Factor A scores and Achievement scores as shown in Table - 12.

Table - 12

A 3 x 3 Contingency Table Between Factor A Scores and Achievement Scores

Factor A	Achievement			
	High	Average	Low	Total
High	14 (13.37)	44 (45.79)	17 (15.84)	75
Average	32 (29.94)	98 (102.57)	38 (35.49)	168
Low	8 (10.69)	43 (36.63)	9 (12.67)	60
Total	54	185	64	303

(Expected frequencies are presented in the brackets in each cell).

$$\chi^2 = \Sigma \frac{(f_o - f_e)^2}{f_e}$$

Where f_o = observed frequency in each cell.

f_e = expected frequency in each cell.

On calculating, $\chi^2 = \underline{3.5551}$

$$df = (r-1)(c-1)$$
$$= (3-1)(3-1)$$
$$= 2 \times 2$$
$$= 4$$

Referring to Table E (Garrett, 1981), the obtained value of Chi-Square is not significant. Therefore, the null hypothesis is accepted.

Hence, there is no significant association between *Factor A and Achievement in Mathematics.*

4.2.7.2. Factor - B: (Less-Intelligent, Concrete-Thinking, of Lower Scholastic Mental Capacity – More-Intelligent, Abstract-Thinking, Bright, of Higher Scholastic Mental Capacity).

The Hypothesis with reference to Factor B is stated as: "There is no significant association between Factor B (as given in the Cattell's HSPQ) and Achievement in Mathematics".

Since the Achievement scores happen to be the same as were for testing Hypothesis - 1, the same groupings of High, Average, and Low (Refer Capttion 4.2.1.) are maintained for this Hypothesis also.

In a similar way, the students were grouped as High, Average, and Low on the Factor B scores. The details of the score values for the formation of groups are shown below.

$$M + 1\ SD = 6.43 + 2.33$$
$$= 8.76 \approx 9$$
$$M - 1\ SD = 6.43 - 2.33$$
$$= 4.10 \approx 4$$

Therefore, on the Factor B scores:

Students who scored 9 and above formed the High group.

Students who scored between 8 and 5 formed the Average group.

Students who scored 4 and below formed the Low group.

Based on the above groupings, a 3 x 3 Contingency Table was formed between Factor B scores and Achievement scores as presented in Table 13.

Table - 13

A 3 x 3 Contingency Table Between Factor B Scores and Achievement Scores

Factor B	Achievement			
	High	Average	Low	Total
High	17 (12.12)	43 (41.52)	8 (14.36)	68
Average	31 (30.83)	106 (105.63)	36 (36.54)	173
Low	6 (11.05)	36 (37.85)	20 (13.09)	62
Total	54	185	64	303

(Expected frequencies are provided in the brackets in each cell).

$$\chi^2 = \Sigma \frac{(f_o - f_e)^2}{f_e}$$

Where f_o = observed frequency in each cell.

f_e = expected frequency in each cell.

On calculating, $\chi^2 = \underline{10.8906}$

$$df = (r-1)(c-1)$$
$$= (3-1)(3-1)$$
$$= 2 \times 2$$
$$= 4$$

Referring to Table E (Garrett, 1981), the obtained value of Chi-Square is significant at 0.05 level. Therefore, the null hypothesis is rejected.

Thus, there is an association between Factor B and Achievement in Mathematics at 0.05 level.

This calls for further analysis and for this purpose Congingency Coefficient was computed as follows:

$$C = \sqrt{\frac{\chi^2}{N + \chi^2}}$$

$$= \sqrt{\frac{10.8906}{303 + 10.8906}}$$

$$= \sqrt{\frac{10.8906}{313.8906}}$$

$$= \sqrt{0.0346955}$$

$$= \underline{0.19}$$

From the above value of C, it is concluded that there exists a close association between Factor B and Achievement in Mathematics.

4.2.7.3. Factor - C: (Affected By Feelings, Emotionally Less Stable, Easily Upset, Changeable, of Lower Ego Strength – Emotionally Stable, Mature, Faces Reality, Calm, of Higher Ego Strength (not the same as 'egotistical').

The Hypothesis with reference to Factor C is stated as: "There is no significant association between Factor

C (as given in the Cattell's HSPQ) and Achievement in Mathematics".

Since the Achievement scores happen to be the same as were for testing Hypothesis - 1, the same groupings of High, Average, and Low (Refer Caption 4.2.1.) are maintained for this Hypothesis also.

In a similar way, the students were grouped as High, Average, and Low on the Factor C scores. The details of the score values for the formation of groups are shown below:

$$M + 1\ SD = 10.88 + 2.68$$
$$= 13.56 \approx 14$$
$$M - 1\ SD = 10.88 - 2.68$$
$$= 8.20 \approx 8$$

Therefore, on the Factor C Scores:

Students who scored 14 and above formed the High group.

Students who scored between 13 and 9 formed the Average group.

Students who scored 8 and below formed the Low group.

Based on the above groupings, a 3 x 3 Contingency Table was formed between Factor C scores and Achievement scores as shown in Table - 14.

Table - 14
A 3 x 3 Contingency Table Between Factor C Scores and Achievement Scores

	Achievement			
Factor C	High	Average	Low	Total
High	10 (10.87)	38 (37.24)	13 (12.88)	61
Average	34 (32.26)	109 (110.51)	38 (38.23)	181
Low	10 (10.87)	38 (37.24)	13 (12.88)	61
Total	54	185	64	303

(Expected frequencies are given in the brackets in each cell).

$$\chi^2 = \Sigma \frac{(f_o - f_e)^2}{f_e}$$

Where f_o = observed frequency in each cell.

f_e = expected frequency in each cell.

On calculating, $\chi^2 = \underline{0.2882}$

$$df = (r-1)(c-1)$$
$$= (3-1)(3-1)$$
$$= 2 \times 2$$
$$= 4$$

Referring to Table E (Garrett, 1981), the obtained value of Chi-Square is not significant. Therefore, the null hypothesis is accepted.

Thus, there is no significant association between Factor C and Achievement in Mathematics.

4.2.7.4. Factor - D: (Undemonstrative, Deliberate, Inactive, Stodgy, Phlegmatic – Excitable, Impatient, Demanding, Over-active, Unrestrained).

The Hypothesis with reference to Factor D is stated as: "There is no significant association between Factor D (as given in the Cattell's HSPQ) and Achievement in Mathematics".

Since the Achievement scores happen to be the same as were for testing Hypothesis - 1, the same groupings of High, Average, and Low (Refer Caption 4.2.1.) are maintained for this Hypothesis also.

In a similar way, the students were grouped as High, Average, and Low on the Factor D scores. The details of the score values for the formation of groups are shown below:

$$M + 1\ SD = 11.28 + 3.20$$
$$= 14.48 \approx 14$$
$$M - 1\ SD = 11.28 - 3.20$$
$$= 8.08 \approx 8$$

Therefore, on the Factor D scores:

Students who scored 14 and above formed the High group.

Students who scored between 13 and 9 formed the Average group.

Students who scored 8 and below formed the Low group.

Based on the above groupings, a 3 x 3 Contingency Table was formed between Factor D scores and Achievement scores as given in Table - 15.

Table - 15
A 3 x 3 Contingency Table Between Factor D Scores and Achievement Scores

	Achievement			
Factor D	High	Average	Low	Total
High	11 (13.37)	48 (45.79)	16 (15.84)	75
Average	32 (30.12)	101 (103.18)	36 (35.69)	169
Low	11 (10.51)	36 (36.02)	12 (12.46)	59
Total	54	185	64	303

(Expected frequencies are indicated in the brackets in each cell).

$$\chi^2 = \Sigma \frac{(f_o - f_e)^2}{f_e}$$

Where f_o = observed frequency in each cell.

f_e = expected frequency in each cell.

On calculating, χ^2 = 0.7343

$$df = (r-1)(c-1)$$
$$= (3-1)(3-1)$$
$$= 2 \times 2$$
$$= 4$$

Referring to Table E (Garrett, 1981), the obtained value of Chi-Square is not significant. Therefore, the null hypothesis is accepted.

Hence, there is no significant association between Factor D and Achievement in Mathematics.

4.2.7.5. Factor - E: (Obedient, Mild, Easily Led, Accommodating, Submissive — Assertive, Competitive, Aggressive, Stubborn, Dominant).

The Hypothesis with reference to Factor E is stated as: "There is no significant association between Factor E (as given in the Cattell's HSPQ) and Achievement in Mathematics".

Since the Achievement scores happen to be the same as were for testing Hypothesis - 1, the same groupings of High, Average, and Low (Refer Caption 4.2.1.) are maintained for this Hypothesis also.

In a similar way, the students were grouped as High, Average, and Low on the Factor E scores. The details of the score values for the formation of groups are shown below:

$$M + 1\ SD = 8.35 + 2.67$$
$$= 11.02 \approx 11$$
$$M - 1\ SD = 8.35 - 2.67$$
$$= 5.68 \approx 6$$

Therefore, on the Factor E Scores:

Students who scored 11 and above formed the High group.

Students who scored between 10 and 7 formed the Average group.

Students who scored 6 and below formed the Low group.

Based on the above groupings, a 3 x 3 Contingency Table was formed between Factor E scores and Achievement scores as presented in Table - 16.

Table - 16

A 3 x 3 Contingency Table Between Factor E Scores and Achievement Scores

Factor E	Achievement			
	High	Average	Low	Total
High	13 (12.12)	42 (41.52)	13 (14.36)	68
Average	23 (27.09)	92 (92.81)	37 (32.11)	152
Low	18 (14.79)	51 (50.68)	14 (17.53)	83
Total	54	185	64	303

(Expected frequencies are shown in the brackets in each cell).

$$\chi^2 = \Sigma \frac{(f_o - f_e)^2}{f_e}$$

Where f_o = observed frequency in each cell.

f_e = expected frequency in each cell.

On calculating, χ^2 = 2.977

$$df = (r-1)(c-1)$$
$$= (3-1)(3-1)$$
$$= 2 \times 2$$
$$= 4$$

Referring to Table E (Garrett, 1981), the obtained value of Chi-Square is not significant. Therefore, the null hypothesis is accepted.

Thus, there is no significant association between Factor E and Achievement in Mathematics.

4.2.7.6. Factor - F: (Sober, Taciturn, Serious – Enthusiastic, Heedless, Happy-Go-Lucky).

The Hypothesis with reference to Factor F is stated as: "There is no significant association between Factor F (as given in the Cattell's HSPQ) and Achievement in Mathematics".

Since the Achievement scores happen to be the same as were for testing Hypothesis - 1, the same groupings of High, Average, and Low (Refer Caption 4.2.1.) are maintained for this Hypothesis also.

In a similar way, the students were grouped as High, Average, and Low on the Factor F scores. The details of the score values for the formation of groups are shown below:

$$M + 1\ SD = 9.50 + 2.76$$
$$= 12.26 \approx 12$$
$$M - 1\ SD = 9.50 - 2.76$$
$$= 6.74 \approx 7$$

Therefore, on the Factor F scores:

Students who scored 12 and above formed the High group.

Students who scored between 11 and 8 formed the Average group.

Students who scored 7 and below formed the Low group.

Based on the above groupings, a 3 x 3 Contingency Table was formed between Factor F scores and Achievement scores as shown in Table - 17.

Table - 17

A 3 x 3 Contingency Table Between Factor F Scores and Achievement Scores

	Achievement			
Factor F	High	Average	Low	Total
High	16 (12.48)	37 (42.74)	17 (14.79)	70
Average	29 (30.30)	104 (103.80)	37 (35.91)	170
Low	9 (11.23)	44 (38.47)	10 (13.31)	63
Total	54	185	64	303

(Expected frequencies are presented in the brackets in each cell).

$$\chi^2 = \Sigma \frac{(f_o - f_e)^2}{f_e}$$

Where f_o = observed frequency in each cell.

f_e = expected frequency in each cell.

On calculating, $\chi^2 = \underline{4.2439}$

$$df = (r-1)(c-1)$$
$$= (3-1)(3-1)$$
$$= 2 \times 2$$
$$= 4$$

Referring to Table E (Garrett, 1981), the obtained value of Chi-Square is not significant. Therefore, the null hypothesis is accepted.

Hence, there is no significant association between Factor F and Achievement in Mathematics.

4.2.7.7. **Factor - G:** (Disregards Rules, Expedient, Has weaker Super Ego Strengh – Conscientious, Persistent, Moralistic, Staid, Has Stronger Super Ego Strength).

The Hypothesis with reference to Factor G is stated as: "There is no signicant association between Factor G (as given in the Cattell's HSPQ) and Achievement in Mathematics".

Since the Achievement scores happen to be the same as were for testing Hypothesis - 1, the same groupings of High, Average, and Low (Refer Caption 4.2.1.) are maintained for this Hypothesis also.

In a similar way, the students were grouped as High, Average and Low on the Factor G scores. The details of the score values for the formation of groups are shown below:

$$M + 1\ SD = 12.28 + 2.66$$
$$= 14.94 \approx 15$$
$$M - 1\ SD = 12.28 - 2.66$$
$$= 9.62 \approx 10$$

Therefore, on the Factor G Scores:

Students who scored 15 and above formed the High group.

Students who scored between 14 and 11 formed the Average group.

Students who scored 10 and below formed the Low group.

Based on the above groupings, a 3 x 3 Contingency Table was formed between Factor G scores and Achievement scores as given in Table - 18.

Table - 18
A 3 x 3 Contingency Table Between Factor G Scores and Achievement Scores

	Achievement			
Factor G	High	Average	Low	Total
High	11 (11.76)	47 (40.30)	8 (13.94)	66
Average	31 (27.27)	93 (93.42)	29 (32.32)	153
Low	12 (14.97)	45 (51.29)	27 (17.74)	84
Total	54	185	64	303

(Expected frequencies are provided in the brackets in each cell).

$$\chi^2 = \Sigma \frac{(f_o - f_e)^2}{f_e}$$

Where f_o = observed frequency in each cell.

f_e = expected frequency in each cell.

On calculating, $\chi^2 = \underline{10.7413}$

$$df = (r-1)(c-1)$$
$$= (3-1)(3-1)$$
$$= 2 \times 2$$
$$= 4$$

Referring to Table E (Garrett, 1981), the obtained value of Chi-Square is significant at 0.05 level. Therefore, the null hypothesis is rejected at 0.05 level.

This calls for further analysis and for this purpose, Contingency Coefficient was carried out as follows:

$$C = \sqrt{\frac{\chi^2}{N + \chi^2}}$$
$$= \sqrt{\frac{10.7413}{303 + 10.7413}}$$
$$= \sqrt{\frac{10.7413}{313.7413}}$$
$$= \sqrt{0.0342361}$$
$$= \underline{0.19}$$

From the above value of C, it can be said that there is a close association between Factor G and Achievement in Mathematics.

4.2.7.8. Factor - H: (Shy, Timid, Threat-Sensitive – Adventurous, "Thick-Skinned", Socially Bold).

The Hypothesis with reference to Factor H is stated as: "There is no significant association between Factor H (as given in the Cattell's HSPQ) and Achievement in Mathematics".

Since the Achievement scores happen to be the same as were for testing Hypothesis - 1, the same groupings of High, Average, and Low (Refer Caption 4.2.1.) are maintained for this Hypothesis also.

In a similar way, the students were grouped as High, Average, and Low on the Factor H scores. The details of the score values for the formation of groups are shown below:

$$M + 1\ SD = 10.56 + 2.95$$
$$= 13.51 \approx 14$$
$$M - 1\ SD = 10.56 - 2.95$$
$$= 7.61 \approx 8$$

Therefore, on the Factor H Scores:

Students who scored 14 and above formed the High group.

Students who scored between 13 and 9 formed the Average group.

Students who scored 8 and below formed the Low group.

Based on the above groupings, a 3 x 3 Contingency Table was formed between Factor H scores and Achievement scores as presented in Table - 19.

Table - 19
A 3 x 3 Contingency Table Between Factor H Scores and Achievement Scores

	Achievement			
Factor H	High	Average	Low	Total
High	8 (8.55)	30 (29.31)	10 (10.14)	48
Average	35 (32.08)	108 (109.90)	37 (38.02)	180
Low	11 (13.37)	47 (45.79)	17 (15.84)	75
Total	54	185	64	303

(Expected frequencies are given in the brackets in each cell).

$$\chi^2 = \Sigma \frac{(f_o - f_e)^2}{f_e}$$

Where f_o = observed frequency in each cell.

f_e = expected frequency in each cell.

On calculating, $\chi^2 = \underline{0.9165}$

$$df = (r-1)(c-1)$$
$$= (3-1)(3-1)$$
$$= 2 \times 2$$
$$= 4$$

Referring to Table E (Garrett, 1981), the obtained value of Chi-Square is not significant. Therefore, the null hypothesis is accepted.

Thus, it is concluded that there is no significant association between Factor H and Achievement in Mathematics.

4.2.7.9. Factor - I: (Tough-Minded, Rejects Illusions - Tender-Minded, Sensitive, Clinging, Over-Protected).

The Hypothesis with reference to Factor I is stated as: "There is no significant association between Factor I (as given in the Cattell's HSPQ) and Achievement in Mathematics".

Since the Achievement scores happen to be the same as were for testing Hypothesis - 1, the same groupings of High, Average, and Low (Refer Caption 4.2.1.) are maintained for this Hypothesis also.

In a similar way, the students were grouped as High, Average, and Low on the Factor I scores. The details of the score values for the formation of groups are shown below:

$$M + 1\ SD = 11.50 + 3.63$$
$$= 15.13 \approx 15$$
$$M - 1\ SD = 11.50 - 3.63$$
$$= 7.87 \approx 8$$

Therefore, on the Factor I Scores:

Students who scored 15 and above formed the High group.

Students who scored between 14 and 9 formed the Average group.

Students who scored 8 and below formed the Low group.

Based on the above groupings, a 3 x 3 Contingency Table was formed between Factor I scores and Achievement scores as shown in Table - 20.

Table - 20
A 3 x 3 Contingency Table Between Factor I Scores and Achievement Scores

	Achievement			
Factor I	High	Average	Low	Total
High	10 (12.12)	41 (41.52)	17 (14.36)	68
Average	32 (30.12)	101 (103.18)	36 (35.70)	169
Low	12 (11.76)	43 (40.30)	11 (13.94)	66
Total	54	185	64	303

(Expected frequencies are indicated in the brackets in each cell).

$$\chi^2 = \Sigma \frac{(f_o - f_e)^2}{f_e}$$

Where f_o = observed frequency in each cell.

f_e = expected frequency in each cell.

On calculating, $\chi^2 = \underline{1.8343}$

$$df = (r-1)(c-1)$$
$$= (3-1)(3-1)$$
$$= 2 \times 2$$
$$= 4$$

Referring to Table E (Garrett, 1981), the obtained value of Chi-Square is not significant. Therefore, the null hypothesis is accepted.

Hence, it can be said that there is no significant association between Factor I and Achievement in Mathematics.

4.2.7.10. Factor - J: (Zestful, Likes Group Action – Circumspect Individualism, Reflective, Internally Restrained).

The Hypothesis with reference to Factor J is stated as: "There is no significant association between Factor J (as given in the Cattell's HSPQ) and Achievement in Mathematics".

Since the Achievement scores happen to be the same as were for testing Hypothesis - 1, the same groupings of High, Average, and Low (Refer Caption 4.2.1.) are maintained for this Hypothesis also.

In a similar way, the students were grouped as High,

Average, and Low on the Factor J scores. The details of the score values for the formation of groups are shown below:

$$M + 1\ SD = 9.66 + 2.67$$
$$= 12.33 \approx 12$$
$$M - 1\ SD = 9.66 - 2.67$$
$$= 6.99 \approx 7$$

Therefore, on the Factor J Scores:

Students who scored 12 and above formed the High group.

Students who scored between 11 and 8 formed the Average group.

Students who scored 7 and below formed the Low group.

Based on the above groupings, a 3 x 3 Contingency Table was formed between Factor J scores and Achievement scores as given in Table - 21.

Table - 21
A 3 x 3 Contingency Table Between Factor J Scores and Achievement Scores

Factor J	Achievement			
	High	Average	Low	Total
High	10 (13.37)	42 (45.79)	23 (15.84)	75
Average	34 (30.30)	102 (103.80)	34 (35.91)	170
Low	10 (10.34)	41 (35.41)	7 (12.25)	58
Total	54	185	64	303

(Expected frequencies are presented in the brackets in each cell).

$$\chi^2 = \Sigma \frac{(f_o - f_e)^2}{f_e}$$

Where f_o = observed frequency in each cell.

f_e = expected frequency in each cell.

On calculating, $\chi^2 = \underline{8.1279}$

$$df = (r-1)(c-1)$$
$$= (3-1)(3-1)$$
$$= 2 \times 2$$
$$= 4$$

Referring to Table E (Garrett, 1981), the obtained value of Chi-Square is not significant. Therefore, the null hypothesis is accepted.

Thus, it is concluded that there is no significant association between Factor J and Achievement in Mathematics.

4.2.7.11. Factor - O: (Self-Assured, Placid, Secure, Complacent, Untroubled – Apprehensive, Self-Reproaching, Insecure, Worrying, Guilt Prone).

The Hypothesis with reference to Factor O is stated as: "There is no significant association between Factor O (as given in the Cattell's HSPQ) and Achievement in Mathematics".

Since the Achievement scores happen to be the same as were for testing Hypothesis - 1, the same groupings of High, Average, and Low (Refer Caption 4.2.1.) are maintained for this Hypothesis also.

In a similar way, the students were grouped as High, Average, and Low on the Factor O scores. The details of the score values for the formation of groups are shown below:

$$M + 1\ SD = 9.78 + 2.80$$
$$= 12.58 \approx 13$$
$$M - 1\ SD = 9.78 - 2.80$$
$$= 6.98 \approx 7$$

Therefore, on the Factor O Scores:

Students who scored 13 and above formed the High group.

Students who scored between 12 and 8 formed the Average group.

Students who scored 7 and below formed the Low group.

Based on the above groupings, a 3 x 3 Contingency Table was formed between Factor O scores and Achievement scores as presented in Table - 22.

Table - 22

A 3 x 3 Contingency Table Between Factor O Scores and Achievement Scores

	Achievement			
Factor O	High	Average	Low	Total
High	8 (9.09)	37 (31.14)	6 (10.77)	51
Average	38 (34.93)	113 (119.67)	45 (41.40)	196
Low	8 (9.98)	35 (34.19)	13 (11.83)	56
Total	54	185	64	303

(Expected frequencies are provided in the brackets in each cell).

$$\chi^2 = \Sigma \frac{(f_o - f_e)^2}{f_e}$$

Where f_o = observed frequency in each cell.

f_e = expected frequency in each cell.

On calculating, $\chi^2 = \underline{4.8283}$

$$df = (r-1)(c-1)$$
$$= (3-1)(3-1)$$
$$= 2 \times 2$$
$$= 4$$

Referring to Table E (Garrett, 1981), the obtained value of Chi-Square is not significant. Therefore, the null hypothesis is accepted.

Hence, it can be said that there is no significant association between Factor O and Achievement in Mathematics.

4.2.7.12. **Factor - Q_2** (Sociably Group-Dependent, A "Joiner" and Sound Follower - Self-Sufficient, Prefers Own Decisions, Resourceful).

The Hypothesis with reference to Factor Q_2 is stated as: "There is no significant association between Factor Q_2 (as given in the Cattell's HSPQ) and Achievement in Mathematics".

Since the Achievement scores happen to be the same as were for testing Hypothesis - 1, the same groupings of High, Average, and Low (Refer Caption 4.2.1.) are maintained for this Hypothesis also.

In a similar way, the students were group as High, Average, and Low on the Factor Q_2 scores. The details of the score values for the formation of groups areshown below:

$$M + 1\ SD = 10.48 + 2.61$$
$$= 13.09 \approx 13$$
$$M - 1\ SD = 10.48 - 2.61$$
$$= 7.87 \approx 8$$

Therefore, on the Factor Q_2 Scores:

Students who scored 13 and above formed the High group.

Students who scored between 12 and 9 formed the Average group.

Students who scored 8 and below formed the Low group.

Based on the above groupings, a 3 x 3 Contingency Table was formed between Factor Q_2 scores and Achievement scores as given in Table - 23.

Table - 23
A 3 x 3 Contingency Table Between Factor Q_2 Scores and Achievement Scores

Factor Q_2	Achievement			
	High	Average	Low	Total
High	12 (11.58)	42 (39.69)	11 (13.73)	65
Average	30 (29.76)	101 (101.96)	36 (35.27)	167
Low	12 (12.65)	42 (43.35)	17 (14.99)	71
Total	54	185	64	303

(Expected frequencies are indicated in the brackets in each cell).

$$\chi^2 = \Sigma \frac{(f_o - f_e)^2}{f_e}$$

Where f_o = observed frequency in each cell.

f_c = expected frequency in each cell.

On calculating, $\chi^2 = \underline{1.0633}$

$$df = (r-1)(c-1)$$
$$= (3-1)(3-1)$$
$$= 2 \times 2$$
$$= 4$$

Referring to Table E (Garrett, 1981), the obtained value of Chi-Square is not significant. Therefore, the null hypothesis is accepted.

Thus, it was found that there is no significant association between Factor Q_2 and Achievement in Mathematics.

4.2.7.13. Factor - Q_3: (Uncontrolled, Lax, Follows Own Urges, Careless of Social Rules, Has Low Integration – Controlled, Socially-Precise, Self-Disciplined, Compulsive, Has High Self-Concept Control).

The Hypothesis with reference to Factor Q_3 is stated as: "There is no significant association between Factor Q_3 (as given in the Cattell's HSPQ) and Achievement in Mathematics".

Since the Achievement scores happen to be the same as were for testing Hypothesis - 1, the same groupings of High, Average, and Low (Refer Caption 4.2.1.) are maintained for this Hypothesis also.

In a similar way, the students were grouped as High, Average, and Low on the Factor Q_3 scores. The details of the score values for the formation of groups are shown below:

$$M + 1\ SD = 11.36 + 2.89$$
$$= 14.25 \approx 14$$
$$M - 1\ SD = 11.36 - 2.89$$
$$= 8.47 \approx 8$$

Therefore, on the Factor Q_3 Scores:

Students who scored 14 and above formed the High group.

Students who socred between 13 and 9 formed the Average group.

Students who scored 8 and below formed the Low group.

Based on the above groupings, a 3 x 3 Contingency Table was formed between Factor Q_3 scores and Achievement scores as shown in Table - 24.

Table - 24

A 3 x 3 Contingency Table Between Factor Q_3 Scores and Achievement Scores

Factor Q_3	Achievement			
	High	Average	Low	Total
High	15 (11.94)	35 (40.91)	17 (14.15)	67
Average	31 (33.86)	123 (116.00)	36 (40.13)	190
Low	8 (8.20)	27 (28.09)	11 (9.72)	46
Total	54	185	64	303

(Expected frequencies are presented in the brackets in each cell).

$$\chi^2 = \Sigma \frac{(f_o - f_e)^2}{f_e}$$

Where f_o = observed frequency in each cell.

f_e = expected frequency in each cell.

On calculating, $\chi^2 = \underline{3.5167}$

$$df = (r-1)(c-1)$$
$$= (3-1)(3-1)$$
$$= 2 \times 2$$
$$= 4$$

Referring to Table E (Garrett, 1981), the obtained value of Chi-Square is not significant. Therefore, the null hypothesis is accepted.

Hence, it can be said that there is no significant association between Factor Q_3 and Achievement in Mathematics.

4.2.7.14. Factor - Q_4: (Relaxed, Tranquil, Torpid, Unfrustrated, Composed – Tense, Driven, Over-Wrought, Frustrated, Fretful).

The Hypothesis with reference to Factor Q_4 is stated as: "There is no significant association between Factor Q_4 (as given in the Cattell's HSPQ) and Achievement in Mathematics".

Since the Achievement scores happen to be the same as were for testing Hypothesis - 1, the same groupings of High, Average, and Low (Refer Caption 4.2.1.) are maintained for this Hypothesis also.

In a similar way, the students were grouped as High, Average, and Low on the Factor Q_4 scores. The details of the score values for the formation of groups are shown below:

$$M + 1\ SD = 10.96 + 3.35$$
$$= 14.31 \approx 14$$
$$M - 1\ SD = 10.96 - 3.35$$
$$= 7.61 \approx 8$$

Therefore, on the Factor Q_4 Scores:

Students who scored 14 and above formed the High group.

Students who scored between 13 and 9 formed the Average group.

Students who scored 8 and below formed the Low group.

Based on the above groupings, a 3 x 3 Contingency Table was formed between Factor Q_4 scores and Achievement scores as presented in Table - 25.

Table - 25

A 3 x 3 Contingency Table Between Factor Q_4 Scores and Achievement Scores

Factor Q_4	Achievement			
	High	Average	Low	Total
High	12 (12.83)	44 (43.96)	16 (15.21)	72
Average	28 (27.80)	92 (95.25)	36 (32.95)	156
Low	14 (13.37)	49 (45.79)	12 (15.84)	75
Total	54	185	64	303

(Expected frequencies are given in the brackets in each cell).

$$\chi^2 = \Sigma \frac{(f_o - f_e)^2}{f_e}$$

Where f_o = observed frequency in each cell.

f_e = expected frequency in each cell.

On calculating, $\chi^2 = \underline{1.6749}$

$$df = (r-1)(c-1)$$
$$= (3-1)(3-1)$$
$$= 2 \times 2$$
$$= 4$$

Referring to Table E (Garrett, 1981), the obtained value of Chi-Square is not significant. Therefore, the null hypothesis is accepted.

Thus, it is concluded that there is no significant association between Factor Q_4 and Achievement in Mathematics.

4.3.0. Summary of Results

Before summing up the results to provide a comprehensive picture, the results as obtained when each of the Hypotheses of the study were tested are given. They are as follows:

1. There is a significant association between Attitude towards Mathematics and Achievement in Mathematics. This association can be considered as close as the value of C was found to be equal to 0.24

2. There is a significant association between Educational Aspiration and Achievement in Mathematics. This association can be considered as close as the value of C was found to be equal to 0.22.

3. There is no significant association between Occupational Aspiration and Achievement in Mathematics.

4. There is a significant association between Numerical Ability and Achievement in Mathematics. This association can be considered as close as the value of C was found to be equal to 0.20.

5. There is a significant association between Abstract Reasoning and Achievement in Mathematics. This association can be considered as very good as the value of C was found to be equal to 0.32.

6. There is no significant association between Space Relations and Achievement in Mathematics.

7.(i) There is no significant association between the Personality Characteristic Factor A (Reserved – Warmhearted) and Achievement in Mathematics.

(i) There is a significant association between Personality Characteristic Factor B (Less-Intelligent – More-Intelligent) and Achievement in Mathematics. This association can be considered as close as the value of C was found to be equal to 0.19.

(iii) There is no significant association between Personality Characteristic Factor C (Affected by Feelings – Emotionally Stable) and Achievement in Mathematics.

(iv) There is no significant association between Personality Characteristic Factor D (Undemonstrative – Excitable) and Achievement in Mathematics.

(v) There is no significant association between Persona-

lity Characteristic Factor E (Obedient – Assertive) and Achievement in Mathematics.

(vi) There is no significant association between Personality Characteristic Factor F (Sober – Enthusiastic) and Achievement in Mathematics.

(vii) There is a significant association between Personality Characteristic Factor G (Disregards Rules – Conscientious) and Achievement in Mathematics. This association can be considered as close as the value of C was found to be equal to 0.19.

(viii) There is no significant association between Personality Characteristic Factor H (Shy – Adventurous) and Achievement in Mathematics.

(ix) There is no significant association between Personality Characteristic Factor I (Tough-Minded – Tender-Minded) and Achievement in Mathematics.

(x) There is no significant association between Personality Characteristic Factor J (Zestful – Circumspect-Individualism) and Achievement in Mathematics.

(xi) There is no significant association between Personality Characteristic Factor O (Self-Assured – Apprehensive) and Achievement in Mathematics.

(xii) There is no significant association between Personality Characteristic Factor Q_2 (Sociably Group-Dependent – Self-Sufficient) and Achievement in Mathematics.

(xiii) There is no significant association between Personality Characteristics Factor Q_3 (Uncontrolled – Controlled) and Achievement in Mathematics.

(xiv) There is no significant association between Pesonality Characteristic Factor Q_4 (Relaxed – Tense) and Achievement in Mathematics.

To sum up, the study has showed that achievement in Mathematics is significantly associated with the variables Attitude towards Mathematics, Educational Aspiration, Numerical Ability, Abstract Reasoning, and the Personality Characteristics Less-Intelligent – More-Intelligent, and Disregards Rules – Conscientious.

On the other hand, the Achievement in Mathematics is not significantly associated with the variables Occupational Aspiration, Space Relations, and the Personality Characteristics Reserved – Warmhearted, Affected by Feelings – Emotionally Stable, Undemonstrative – Excitable, Obedient – Assertive, Sober-Enthusiastic, Shy – Adventurous, Tough-

Minded – Tender-Minded, Zestful – Circumspect-Individualism, Sociably Group-Dependent – Self-Sufficient, Uncontrolled – Controlled, and Relaxed – Tense.

4.4.0. Discussion of Results

The present study has shown that there is a significant association between Attitude towards Mathematics and Achievement in Mathematics. The results of the studies by Samant (1944), Peskin (1965), Neale (1969), Kulkarni, Naidu & Arya (1970), Ohuche (1980), and Cheung (1988) have also suggested relationship to different extents between the two variables under consideration. The positive association found does not indicate whether positive attitude towards Mathematics is developed because of some achievement or vice versa. Whatever might be the starting point, it is of importance to note that since the two variables are associated, efforts by all concerned should be to promote a positive attitude towards Mathematics which may initiate some achievement in the subject.

The present investigation has tried to find out whether any association exists between Achievement in Mathematics and each of the variables, Educational Aspiration and Occupational Aspiration, separately. Though no specific study reviewed has dealt with the Achievement in Mathematics

in particular, there are some studies which have taken achievement in general as the variable. Pierce (1952), Menon (1973) and Das (1986) have found a significant relationship between Educational Aspirations of students and their academic achievement. Austin (1964), Nichols & Davis (1964), Prenter & Steward (1972), and Deka (1985) have found a significant relationship between Occupational Aspiration and academic achievement. In the present study which has considered Achievement in Mathematics in particular, it has been found that the variable has a significant association with Educational Aspiration while not so with Occupational Aspiration. The result has to be looked into considering the subject of study under consideration, that is, Mathematics and the region in which the study has been conducted. The sample for the study is drawn from three of the States of North-East India where majority of the population are tribals. Till recently the educational opportunities provided to them were very meagre and even today they are at a very low order when compared to the rest of the country. As the people of the region are getting exposed more and more to the progress and development through a gradual improvement in the transport and communication system, there is an increase in their desire to get better educated. Thus, their educational aspiration would have become higher and conse-

quently because of their serious efforts would have achieved higher also, thus resulting in an association between these two variables. But, it must be noted that the region can be said as poor as far as industrialisation is considered. Hardly any major industry can be found in all the three States considered in the study, namely, Nagaland, Meghalaya, and Manipur. This environment may be thought of as not inducing students to aspire for jobs which are considered high on any Occupational Scale, though they might have quenched their thirst for knowledge by studying well and achieving high on the school subjects including Mathematics.

Numerical Ability, Abstract Reasoning, and Space Relations were the three Specific Abilities which were hypothesized to have association with Achievement in Mathematics. Results of the study have indicated that while Numerical Ability and Abstract Reasoning have significant associations, Space Relations was found to have no association with Achievement in Mathematics. Except for the studies by Chhikara (1985) and Tiwari (1986) which reported a positive relationship between reasoning abilities and achievement of concepts, no study in particular to the association of each of the concepts of Numerical Ability, Abstract Reasoning, and Space Relations taken separately, with Achievement in Mathematics was found. Mathematics which a high school student studies

may be more loaded with the requirement of Numerical Ability and Abstract Reasoning, and less with Space Relations. Hence or otherwise, the teachers may give more attention to promote the abilities of Numerical Ability and Abstract Reasoning and thus it is possible for the lesser development of the ability of Space Relations in students. This may be a plausible reason for the result of the study, that is, a significant association between each of Numerical Ability and Abstract Reasoning with Achievement in Mathematics and no association between Space Relations and Achievement in Mathematics.

The present study attempted to find out whether each of the Personality Characteristics as measured on 14 HSPQ have an association with Achievement in Mathematics. Studies on similar lines by Ainsworth (1967), Srivastava (1974), Seetha (1975), and Gopalacharyulu (1984) have given varied results. But they cannot be compared with the present study as these studies differ in their criterion of achievement from that used in the present study. The present study concluded that only two Personality Characteristics, namely, Factor B and Factor G, have an association with Achievement in Mathematics. Factor B indicates the continuum Less-Intelligent, Concrete-Thinking, of Lower Scholastic Mental Capacity – More-Intelligent, Abstract-Thinking, Bright, of Higher

Scholastic Mental Capacity. This means that a student who has higher intelligence and has higher abstract thinking power may be expected to have a higher Achievement in Mathematics. This finding also adds support to the result, which is already discussed, that Abstract Reasoning ability has an association with Achievement in Mathematics. The Factor G indicates the continuum Disregards Rules, Expedient, Has Weaker Super-ego Strength – Conscientious, Persistent, Moralistic, Staid, Has Stronger Super-ego Strength. This means that a student who is conscientious and persistent in nature may be expected to achieve higher in Mathematics. This seems to be plausible as Mathematics is a subject which requires a conscientious and persistent effort on the part of the student to obtain mastery. All the other 12 Personality Characteristics, namely, Factors A (Reserved - Warmhearted), C (Affected by Feelings - Emotionally Stable), D (Undemonstrative - Excitable), E (Obedient - Assertive), F (Sober – Enthusiastic), H (Shy – Adventurous), I (Tough-Minded – Tender-Minded), J (Zestful-Circumspect-Individualism), O (Self-Assured – Apprehensive), Q_2 (Sociably Group-Dependent – Self-Sufficient), Q_3 (Uncontrolled – Controlled), and Q_4 (Relaxed – Tense), seem to be involved more with the affective aspects of an individual's personality. Mathematics is claimed as a subject which is more practical in nature.

A mathematician is considered more as a square person. Hence, the result obtained in the study that none of the above Personality Characteristics has an association with Achievement in Mathematics seems plausible.

Looking to the results of the study in their entirety, it may be said that a student, who is having positive Attitude towards Mathematics, who is having higher Educational Aspiration, who is having greater Numerical and Abstract Reasoning Abilities, who is more Intelligent and who is Conscientious, may be expected to have higher Achievement in Mathematics. Some of these variables can be attributed to nature. Others are to be nurtured by parents, teachers and other persons concerned, if the students are to be helped to improve their Achievement in Mathematics.

CHAPTER v

SUMMARY

SUMMARY

5.1.0. Introduction

With the advancement in the field of science and technology, the world has become very complex and as a result life has become more complicated than ever before. In fact, noted civilizations of the world flourished on the strong foundation of Mathematics laid by its thinkers. It has been rightly said that Mathematics is the 'mother of all progress'. It is not only essential in all sciences but also in carrying out day-to-day activities of ordinary purposes. Modern citizen requires one to know sufficient quantum of Mathematics. In order to achieve greater development in our daily life, the country needs those who are strong in Mathematics. Thus, Mathematics has added a new dimension to education and to its role in the life of a nation.

Mathematics is for the most part a sequential subject. One cannot usually learn the content of Mathematics in a random manner. Many students approach it with considerable anxiety and view mathematical problems as insurmountable obstacles. As a result, references are made to low pass percentage in the subject. Consequently, there is a great

controversy over whether to make it optional or compulsory at the secondary school stage. It is believed that Mathematics is an exceptionally difficult subject and its study requires special ability and intelligence. Therefore, it is argued by some that everybody should not be burdened with the study of this tough subject. On the other hand, it is felt that man's knowledge is incomplete without Mathematics. A continuously higher level of Mathematics is required to reach the frontiers of knowledge and to have a clear appreciation of its implications in practical life. Realising the need, educationists in our country have made it as a compulsory subject for the first ten years of a student's formal schooling.

Hence, it may be said that Mathematics deserves special attention and a systematic study of the students' achievement in this subject is worthwhile.

The academic achievement of a student is a complex phenomenon which is influenced by a number of variables or factors acting singly or coupled with certain other variables. Many researches have been conducted to identify the various factors which influence the academic achievement of students. But it is found that very few are carried out with regard to the students' achievement in Mathematics

in particular. A perusal of the studies conducted highlights the need for a deeper research to understand the variables that are associated with achievement in Mathematics. It is in this thinking that the present study is envisaged.

5.2.0. Statement of the Problem

The title of the problem under study is, "A Study of Selected Variables Associated with Achievement in Mathematics."

The study considers under its purview the following variables which may be associated with the Achievement in Mathematics.

(i) Attitude towards Mathematics.

(ii) Aspirations (Educational and Occupational).

(iii) Specific Abilities for Mathematics – These abilities are selected from those drafted for the Differential Aptitude Tests, on the consideration that they would be associated with Achievement in Mathematics. These are:

(a) Numerical Ability.

(b) Abstract Reasoning, and

(c) Space Relations.

Hence, they are nomenclatured as Specific Abilities for Mathematics instead of Aptitude in Mathematics.

(iv) Personality Characteristics.

5.2.1. Conceptual Definitions of the Terms Used

Conceptual definitions of the variables considered in the study are as follows:

A. Achievement

It is the extent to which proficiency is obtained in Mathematics as a school subject.

B.(i) Attitude

It is the degree of positive or negative affect associated with some psychological object.

(ii) Aspiration

It is the goal the individual sets for himself/herself in a task which has intense personal significance for him/her or in which he/she is ego-involved.

(iii) Specific Abilities for Mathematics

They refer to some Specific Abilities which are expected to promote Achievement in Mathematics.

(iv) Personality Characteristics

They may be stated as those which permit a prediction of what a person will do in a given situation.

5.2.2. Operational Definitions of the Terms Used

Operational definitions of the variables considered in the study are as follows:

A. Achievement

It is the Achievement in Mathematics as indicated by the score obtained on the Achievement Test in Mathematics developed by the investigator for the purpose of the study.

B.(i) Attitude

It refers to the score obtained on the Attitude Scale developed by the investigator (Caroline Ngailiankim, 1988) to measure the Attitude of students towards Mathematics.

(ii) Aspirations

(a) Educational Aspiration – It is represented by the scores obtained on the Educational Aspiration Scale (E.A.S.) Form - V, developed by Sharma and Gupta (1980).

(b) Occupational Aspiration – It is represented by the scores obtained on the Occupational Aspiration Scale (O.A.S.), developed by Grewal (1975).

(iii) Specific Abilities for Mathematics

(a) Numerical Ability – It refers to the score obtained on the Numerical Ability Test of Differential Aptitude

Tests (DAT) Form A, adapted to the Indian conditions by J.M. Ojha.

(b) Abstract Reasoning – It refers to the score obtained on the Abstract Reasoning Test of Differential Aptitude Tests (DAT) Form A, adapted to the Indian conditions by J.M. Ojha.

(c) Space Relations – It refers to the score obtained on the Space Relations Test of Differential Aptitude Tests (DAT) Form - A, adapted to the Indian conditions by J.M. Ojha.

(iv) Personality Characteristics

They refer to the scores obtained on the Jr-Sr 14 High School Personality Questionnaire (14 HSPQ), developed by Cattell and Cattell (1968).

5.3.0. Objectives

The following were the Objectives of the study:

(i) To find out whether any significant association exists between Attitude towards Mathematics and Achievement in Mathematics.

(ii) To find out whether any significant association exists between Educational Aspiration and Achievement in Mathematics.

(iii) To find out whether any significant association exists between Occupational Aspiration and Achievement in Mathematics.

(iv) To find out whether any significant association exists between Numerical Ability and Achievement in Mathematics.

(v) To find out whether any significant association exists between Abstract Reasoning and Achievement in Mathematics.

(vi) To find out whether any significant association exists between Space Relations and Achievement in Mathematics.

(vii) To find out whether any significant association exists between each of the 14 Personality Characteristics, namely, Factors A, B, C, D, E, F, G, H, I, J, O, Q_2, Q_3 and Q_4 (as given in the Cattell's HSPQ) and Achievement in Mathematics.

5.4.0. Hypotheses

The following were the Hypotheses of the study:

(i) There is no significant association between Attitude towards Mathematics and Achievement in Mathematics.

(ii) There is no significant association between Educational Aspiration and Achievement in Mathematics.

(iii) There is no significant association between Occupational Aspiration and Achievement in Mathematics.

(iv) There is no significant association between Numerical Ability and Achievement in Mathematics.

(v) There is no significant association between Abstract Reasoning and Achievement in Mathematics.

(vi) There is no significant association between Space Relations and Achievement in Mathemnatics.

(vii) There is no significant association between each of the 14 Personality Characteristics, namely, Factors A, B, C, D, E, F, G, H, I, J, O, Q_2, Q_3 and Q_4 (as given in the Cattell's HSPQ) and Achievement in Mathematics.

5.5.0. Delimitation of the Study

The study was confined to only the students of Class IX (following the CBSE pattern) in the three States of the North-Eastern Region of India, namely, Nagaland, Meghalaya, and Manipur.

5.6.0. Methodology

The study is a piece of descriptive research. Details are as follows:

5.6.1. Population and Sample

The population comprised all Class IX students study-

ing in the high schools affiliated to the Central Board of Secondary Education (CBSE) in the three States of the North-Eastern Region of India, namely, Nagaland, Meghalaya, and Manipur. The total number of such schools happened to be eight. Since the number of schools were only eight, all the Class IX students who answered all the tools used for data collection in all these schools formed the sample. The total number of such students happened to be 303.

5.6.2. Tools Used

The following Tools were used to collect the data:

1. Achievement Test in Mathematics (developed for the purpose of the study).
2. Attitude Scale – to measure the Attitude of students towards Mathematics (developed by Caroline Ngailiankim, 1988).
3. Educational Aspiration Scale (by Sharma and Gupta, 1980).
4. Occupational Aspiration Scale (by Grewal, 1975).
5. Numerical Ability Test (of Differential Aptitude Tests).
6. Abstract Reasoning Test (of Differential Aptitude Tests).
7. Space Relations Test (of Differential Aptitude Tests).

8. Cattell's 14 High School Personality Questionnaire (14 HSPQ).

The first Tool in the list above was developed for the purpose of the study. The details regarding the development of the Tool is presented in Caption 5.6.2.1.

5.6.2.1. Development of Achievement Test in Mathematics

Achievement Test in Mathematics for Class IX (following the CBSE pattern) in Tamil Nadu and Kerala, which was constructed and standardized by Sharada (1984), formed the basis for the items to be included in the Achievement Test that was developed for the purpose of the present study. Since there were little differences in the syllabi of Mathematics for Class IX in 1988 (at the time of the present study) since 1984, the test items were presented to six teachers, two each (one teaching Class IX and the other Class X) from the three high schools of Shillong, namely, B.K. Bajoria High School, Kendriya Vidyalaya, Happy Valley, and Kendriya Vidyalaya, Upper Shillong. These teachers were requested to indicate the items which fell within the purview of the present Class IX syllabus and their responses were collected. The teachers also informed that the items covered the syllabus completely. On the basis of their responses, items were selected so as to be included in the Achievement

Test in Mathematics. The Test was accepted to have Content Validity by the method through which the items got selected and included.

The test was administered to 147 students of Class X (that is, who had covered the Class IX syllabus) drawn from the three sample high schools of Shillong. The Odd-Even reliability Coefficient for the Test was found to be 0.75, which is significant at 0.01 level.

5.6.2.2. Attitude Scale

The Attitude Scale to measure the Attitude of students towards Mathematics was developed by the investigator (Caroline Ngailiankim, 1988) during her M.Phil work. It consists of 24 Statements (12 positive and 12 negative). The subject is required to indicate his/her choice of response to each of the Statements on a five point scale, namely, 'Strongly Agree', 'Agree', 'Undecided', 'Disagree', and 'Strongly Disagree'. The Scoring Scheme for the positive Statements is 4, 3, 2, 1, 0, corresponding to the five points as given above. For the negative Statements the corresponding scores are 0, 1, 2, 3, 4. The reliability of the Attitude Scale by the Odd-Even Method is 0.86.

5.6.2.3. Educational Aspiration Scale (EAS)

The Educational Aspiration Scale was developed by

Sharma and Gupta (1980). The Scale which was in Hindi was translated into English and the translation was checked by three experts for their correctness. This translated version was tried out on ten Class IX students to check any difficulties in understanding and answering the items. The Scale consists of eight lists of different Educational Qualifications that are offered in India. Each list consists of ten items and their prestige values range from 1 to 10. The maximum score on the Scale happens to be 80 and the minimum 8.

5.6.2.4. Occupational Aspiration Scale (OAS)

The Occupational Aspiration Scale was developed by Grewal (1975). It consists of eight items and each item is a list of ten different kinds of jobs. The testee has to choose one out of the ten choices. The score for each item ranges from zero (lowest) to nine (highest). Thus an individual's total score ranges from 0 to 72.

5.6.2.5. Numerical Ability Test

This Test is one of the subtests of the Differential Aptitude Tests adapted to the Indian conditions by J.M. Ojha. There are 40 items in the Test and scoring requires giving one mark for each of the correct response.

5.6.2.6. Abstract Reasoning Test

This Test is one of the subtests of the Differential Aptitude Tests adapted to the Indian conditions by J.M. Ojha. There are 50 items in the Test and scoring requires giving one mark for each of the correct response.

5.6.2.7. Space Relations Test

This Test is one of the subtests of the Differential Aptitude Tests adapted to the Indian conditions by J.M. Ojha. There are 40 items in the Test. Multiple marks are permitted for each item. The maximum possible score on the Test is 100.

5.6.2.8. Cattell's 14 High School Personality Questionnaire (14 HSPQ)

The 14 HSPQ was developed by Cattell and Cattell in 1968. It measures fourteen distinct dimensions of Personality which have been found by Psychologists to come near to covering the total Personality. These are designated as Factors A, B, C, D, E, F, G, H, I, J, O, Q_2, Q_3, and Q_4. There are 142 items to be answered in the 14 High School Personality Questionnaire. The Scoring Keys provide the raw scores for each of the above 14 personality factors separately.

5.6.3. Data Collection

After obtaining necessary permission in each school covered by the sample (Refer Caption 5.6.1.), the investigator met the classes to which the tools were to be administered. Rapport was established with the students. The tools (Refer Caption 5.6.2.) were administered to the students after taking care of all the requirements of a testing situation and also of the necessary instructions which each of the tools demanded. The answer scripts were scored in accordance with the corresponding Scoring Keys. Thus, the data required to test the Hypotheses of the study were collected.

5.6.4. Analysis of Data

For the scores on each of the sets of scores obtained on the different tools, Mean and Standard Deviation were found out. On each of them the scores were grouped as High, Average, and Low. Scores which fell on M + 1 SD and above formed the High group; Scores which fell on M - 1 SD and below formed the Low group; and Scores which fell in between these two groups formed the Average group.

Chi-Square test was used for testing each of the Hypotheses. Contingency Coefficient was calculated further in such cases where the Chi-Square value was found to be significant.

5.7.0. Summary of Results

Before summing up the results to provide a comprehensive picture, the results as obtained when each of the Hypotheses of the study were tested are given. They are as follows:

1. There is a significant association between Attitude towards Mathematics and Achievement in Mathematics. This association can be considered as close as the value of C was found to be equal to 0.24.
2. There is a significant association between Educational Aspiration and Achievement in Mathematics. This association can be considered as close as the value of C was found to be equal to 0.22.
3. There is no significant association between Occupational Aspiration and Achievement in Mathematics.
4. There is a significant association between Numerical Ability and Achievement in Mathematics. This association can be considered as close as the value of C was found to be equal to 0.20.
5. There is a significant association between Abstract Reasoning and Achievement in Mathematics. This association can be considered as very good as the value of C was found to be equal to 0.32.
6. There is no significant association between Space Relations and Achievement in Mathematics.

7.(i) There is no significant association between the Personality Characteristic Factor A (Reserved – Warmhearted) and Achievement in Mathematics.

(ii) There is a significant association between Personality Characteristic Factor B (Less-Intelligent – More-Intelligent) and Achievement in Mathematics. This association can be considered as close as the value of C was found to be equal to 0.19.

(iii) There is no significant association between Personality Characteristic Factor C (Affected by Feelings – Emotionally Stable) and Achievement in Mathematics.

(iv) There is no significant association between Personality Characteristic Factor D (Undemonstrative – Excitable) and Achievement in Mathematics.

(v) There is no significant association between Personality Characteristic Factor E (Obedient – Assertive) and Achievement in Mathematics.

(vi) There is no significant association between Personality Characteristic Factor F (Sober – Enthusiastic) and Achievement in Mathematics.

(vii) There is a significant association between Personality Characteristic Factor G (Disregards Rules – Conscientious) and Achievement in Mathematics. This association can be considered as close as the value of C was found to be equal to 0.19.

(viii) There is no significant association between Personality Characteristic Factor H (Shy – Adventurous) and Achievement in Mathematics.

(ix) There is no significant association between Personality Characteristic Factor I (Tough-Minded – Tender-Minded) and Achievement in Mathematics.

(x) There is no significant association between Personality Characteristic Factor J (Zestful – Circumspect – Individualism) and Achievement in Mathematics.

(xi) There is no significant association between Personality Characteristic Factor O (Self-Assured – Apprehensive) and Achievement in Mathematics.

(xii) There is no significant association between Personality Characteristic Factor Q_2 (Sociably Group-Dependent – Self-Sufficient) and Achievement in Mathematics.

(xiii) There is no significant association between Personality Characteristic Factor Q_3 (Uncontrolled – Controlled) and Achievement in Mathematics.

(xiv) There is no significant association between Personality Characteristic Factor Q_4 (Relaxed – Tense) and Achievement in Mathematics.

To sum up, the study has showed that Achievement in Mathematics is significantly associated with the variables

Attitude towards Mathematics, Educational Aspiration, Numerical Ability, Abstract Reasoning, and the Personality Characteristics Less-Intelligent – More-Intelligent, and Disregards Rules – Conscientious.

On the other hand, the Achievement in Mathematics is not significantly associated with the variables Occupational Aspiration, Space Relations and the Personality Characteristics Reserved – Warmhearted, Affected by Feelings – Emotionally Stable, Undemonstrative – Excitable, Obedient – Assertive, Sober – Enthusiastic, Shy – Adventurous, Tough-Minded – Tender-Minded, Zestful – Circumspect Individualism, Self-Assured – Apprehensive, Sociably Group-Dependent – Self-Sufficient, Uncontrolled – Controlled, and Relaxed-Tense.

5.8.0. Suggestions For Further Research

Some of the research work which could be undertaken as a furtherance to the present study are suggested below:

1. Investigations may be undertaken to find out other variables which have got an association with Achievement in Mathematics.
2. Investigations of the same type may be conducted at different regions of our country to make a comparative study.

3. Similar studies may be envisaged with respect to other school subjects.
4. Studies of such nature may be undertaken at different levels of education.

APPENDICES

APPENDIX I

ACHIEVEMENT TEST IN MATHEMATICS

1. Name: _____
2. School: _____
3. Class: _____ Section _____
4. Date: _____

INSTRUCTIONS

1. Choose the Correct Answer out of the given four CHOICES for each Question below.
2. Write the ITEM NUMBER of the CORRECT CHOICE in the Blank Provided at the Right.
3. If any Question is Difficult, go to the Next one. You can Come Back to the Difficult Question later.
4. Do not Waste your Time.
5. Attempt All the Questions.

1. A is a non-empty set. Which of the following is equal to $A \cup \emptyset$?

   (1) $\emptyset$
   (2) A
   (3) $A \mu \emptyset$
   (4) None of these. Ans: _____

2. R and S are subsets of a universal set *U*. If R is a subset of S which of the following is true?

   (1) R'CS
   (2) R'CS'
   (3) S'CR'
   (4) S'CR Ans: _____

3. A = (1,2,5), B = (2,3,6), C = (3,4,7), which of the following is equal to $A \cup (B \mu C)$?

   (1) AUBUC
   (2) $A \mu B \mu C$
   (3) $(A \mu B) \cup (A \mu C)$
   (4) $(A \cup B) \mu (A \cup C)$ Ans: _____

4. $\{(1,2), (-1,2), (3,\frac{1}{2}), (-1,\frac{3}{4})\}$ is not a function. Which of the following is the correct reason for that?

   (1) The domain is not a set of positive integers.
   (2) The range is not a set of positive integers.
   (3) One element is repeated in the first entry.
   (4) None of these.

   Ans: _____

5. In solving the system of equations $5x + 8y + 3 = 0$ and $3x - 11y = 14$, to eliminate y which of the following steps is correct?

   (1) Multiply the first equation by 3 and second equation by 5 and add the new equation.

   (2) Multiply the first equation by 3 and the second equation by 11 and add the new equation.

   (3) Multiply the first equation by 11 and the second equation by 8 and add the new equations.

   (4) Multiply the first equation by 8 and the second equation by 11 and substract one new equation from the other.

   Ans: _____

6. To solve the system of equations $\frac{1}{4}x + \frac{2}{7}y + 1 = 0$ and $\frac{1}{7}x - \frac{1}{4}y = \frac{65}{28}$, which of the following would you do first?

   (1) Clear of fractions by multiplying the first equation by 4.

   (2) Clear of fractions by multiplying the first equation by 7.

   (3) Clear of fractions by multiplying the first equation by 11.

   (4) Clear of fractions by multiplying the first equation by 28.

   Ans: _____

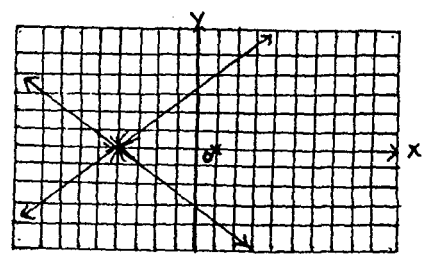
7. Which of the following is the solution set of the equations whose graph is shown in the figure?

   (1) (2, 1)

   (2) (2,-1)

   (3) (-2, -1)

   (4) None of these.



   Ans: _____

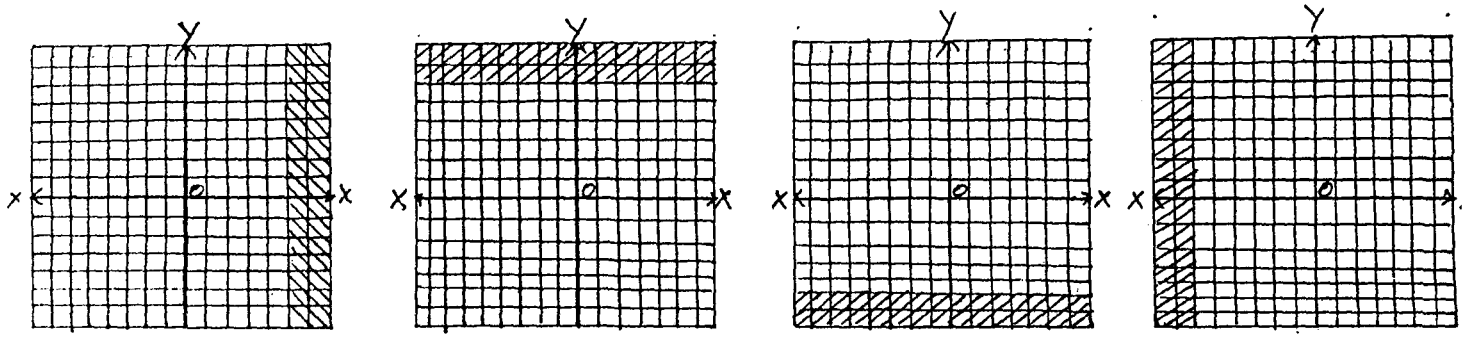
8. The length of a rectangle is five metres more than its breadth. The perimeter is 38 M. Which of the following is a true statement if x is one side of the rectangle?

(1) $2x + 5 = 38$

(2) $x(x + 5) = 38$

(3) $2(2x + 10) = 38$

(4) $2(2x + 5) = 38$ Ans:_____



Which of the following in equations is not shown in any of the above graphs as shaded region?

(1) $y + 2 < 0$

(2) $y - 2 > 0$

(3) $x - 2 > 0$

(4) $x + 2 > 0$ Ans:_____

10. x is greater than y by 12%. Then which of the following is equal to x?

(1) $12y$

(2) $112y$

(3) $\frac{12y}{100}$

(4) $\frac{112y}{100}$ Ans:_____

11. 10% of y is added to y. How many times of y is equal to the resulting quantity?

(1) $\frac{10}{11}$

(2) $\frac{10y}{11}$

(3) $\frac{11}{10}$

(4) $\frac{11y}{10}$

Ans: _____

12. The number of students appearing for an examination is x. The number of passing students is y. Which of the following gives percentage of passes?

(1) $\frac{100x}{y}$

(2) $\frac{100y}{x}$

(3) $\frac{100y}{x - y}$

(4) $\frac{100x}{x - y}$

Ans: _____

13. The price of a commodity increases by 15%. By what percent should the consumption be reduced if expenses are all the same?

(1) 15

(2) $13\frac{1}{23}$

(3) $17\frac{1}{4}$

(4) None of these.

Ans: _____

14. A wholesaler sells 40 pens to a retailer for the price of 35 pens. The retailer sells the pens at the market price. Which of the following is the gain percent for the retailer?

(1) $14\frac{2}{7}$

(2) $87\frac{1}{2}$

(3) $12\frac{1}{2}$

(4) None of these. Ans: _____

15. A coat was sold fetching a profit of 8%. If it were sold for Rs. 54 more, it would have fetched a profit of 17%. Which of the following is the cost price?

(1) Rs. 620

(2) Rs. 600

(3) Rs. 900

(4) Rs. 540 Ans: _____

16. Which of the following gives a single discount equivalent to two successive discounts of 20% and 5%?

(1) 25%

(2) 24%

(3) 15%

(4) None of these. Ans: _____

17. A sum of Rs. 10,000 is lent for 2 years at 8% per annum compounded quarterly. In using the formula $A = P(1 + \frac{r}{100})^n$ which of the following substitutions is the correct one?

(1) r is 8 and n is 2.

(2) r is 2 and n is 2.

(3) r is 2 and n is 8.

(4) r is 8 and n is 8. Ans: _____

18. A sum of Rs. 2,000 is lent for 2 years at 5% per annum compounded semi-annually. Which of the following gives the compound interest (Paise being neglected).

(1) Rs. 207

(2) Rs. 205

(3) Rs. 200

(4) None of these. Ans: _____

19. In approximately how many years will an amount treble itself if interest is 6% per annum compounded annually? To solve this problem, we use the formula and write after substitution $3P = P(1.06)^n$

$\Longrightarrow 3 = (1.06)^n$. By which of the following steps is n determined?

(1) $\log n = \log 3 - \log 1.06$

(2) $\log n = 3 \div 1.06$

(3) $n = \log^3 - \log 1.06$

(4) $n = \log^3 \div \log 1.06$ Ans: _____

20. The simple interest and compound interest on a certain sum of 2 years at the same rate compounded annually are Rs. 25 and Rs. 26. Which of the following is the correct statement?

(1) The difference of Re. 1 between the two interests is the interest on the principal for 2 years.

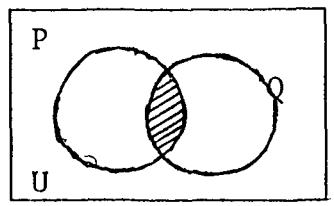
(2) The difference of Re. 1 between the two interests is the interest on Rs. 25 for one year.

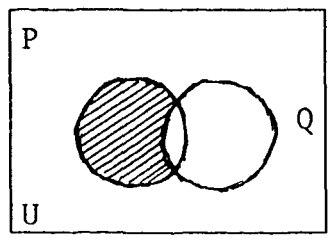
(3) The difference of Re. 1 between the two interests is the interest on Rs. 25 for two years.

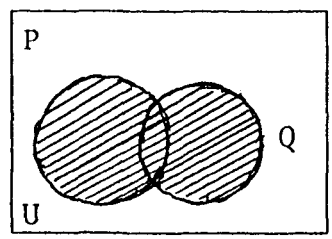
(4) None of these. Ans: _____

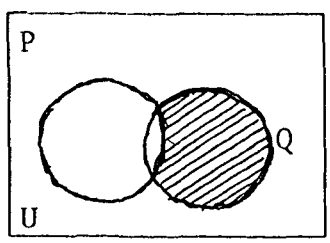
21. A: Match the items of the List A with the items of List B. Write the matching item number of List B in the blank provided before the item of List A.

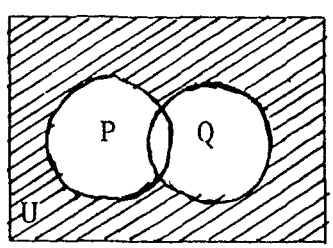
List A

(1) ———— 

(2) ———— 

(3) ———— 

(4) ———— 

(5) ———— 

List B

(a) P - Q

(b) (PUQ)

(c) PμQ

(d) PUQ

(e) None of the above.

21. B:

List A	List B
(1) _____ $x - 5 = 0$	(a) Inconsistent
(2) _____ $y + 8 = 0$	(b) Coincident
(3) _____ $x + 4y = 0$	(c) Parallel to the y - axis
(4) _____ $2x - y = 8$ and $6x - 24 = 3y$	(d) Intersecting
	(e) Passing through the origin
(5) _____ $3x + 4y = 10$ and $15x + 20y = 20$	(f) None of these.

21. C:

List A	List B
(1) _____ A man buys a fan for Rs. 450. After two months he sells it at a profit of a%. What is the selling price?	(a) $\frac{2a \times 450}{100}$
(2) _____ A lady buys a transistor for Rs.450 After two months she sells it at a loss of a%. What is the selling price?	(b) $(\frac{100 + a}{100})^2 \times 450$
(3) _____ A person holds Rs. 450 stock in a company which declares a dividend of a% semi-annually. Find the annual dividend income.	(c) $(\frac{100 - a}{100})^2 \times 450$
	(d) $(\frac{100 - a}{100}) \times 450$
(4) _____ A man borrows Rs.450 for 2 years at the rate of a% per annum compounded annually. Find the amount he has to pay.	(e) $(\frac{100 + a}{100}) \times 450$

22. Some of the following statements given below are True and some False. Write the word True or False in the blank provided before the statement.

(1) ____ If $M \mu N = \emptyset$, M and N are called disjoint sets.

(2) ____ Given A {1, {2}}, {2} is a subset of A.

(3) ____ If X is not in complement of A in U, but X is in U, then X will be in A.

(4) ____ $(AUB)' = A' \mu B'$

(5) ____ A and B are any two sets. Then A x B is equal to B x A.

(6) ____ The domain of the relation {(1, -1), (1, 3), (2, -1), (3, 3)} is a subset of set of Positive integers.

(7) ____ $f(x) = x^2 - 1$, $-3 < x < 3$, $x \in 1$. Then f(x) is a one - to - one function.

(8) ____ The equation $5x + 6y = 22$, $x, y \in R$ has a single set of solution.

23. Complete the following statements with correct word(s) or figure(s) and write the Answer in the blank provided after the statement.

(1) The intersection of the set of integers and the set of Positive integers less than 4 is _____.

(2) Given P = (2, 5, 3), number of ordered pairs is P x P is _____.

(3) (3, 1) and (2, 5) are members of A x B. Both A and B have two elements in each. How many other members are there in A x B? _____.

(4) If $f(x) = \dfrac{x - \frac{1}{x}}{x + \frac{1}{x}}$ then $\dfrac{f(1)}{f(2)}$ = _____

(5) $f:1 \longrightarrow 1$, $f(x) = 8 - x$ and $g:R \longrightarrow R$, $g(x) = 8 - x$. The difference between graphs of f(x) and g(x) is that g(x) is _____ Whereas f(x) is not.

(6) If $14x - 6(-4) = 4$, then $x =$ _____.

(7) Given $3x - \frac{1}{2} + \frac{5x}{2} + 3 = 4x + 7 - \frac{1}{2}x + \frac{1}{2}$, the solution (S) will be _____.

(8) $|x| < 6$ means $x >$ —— and $x <$ —— respectively.

(9) If the equation $2x - 5y = 8$ is solved for y, then $y =$ _____.

(10) The Linear equations in two unknowns are inconsistent if the two lines of the graph are _____.

(11) In a triangle with angles 30°, 60° and 90°, the side opposite to 30° is 1 cm. The hypotenuse is _____cm.

24. Answer the following questions in ONE WORD or ONE EXPRESSION or ONE NUMBER. Write the Correct answer in the blank provided after the statement or the short question.

(1) Given M as a subset of universal set U, is M' a subset of U?

Ans: _____

(2) U = (1,2,3,4,5,6), A = (2,5,3), B = (1,2,5,6) What is (AUB)?

Ans: _____

(3) A man invests a part of Rs. 650 at 4% interest and the remaining at 5% interest. His total income is Rs. 30. What is the amount invested in 4% interest?

Ans: _____

(4) Distance between airports A and B is 900 Km. An aeroplane flies from A to B in 3 hours. While flying from B to A, only due to the wind blowing in the opposite direction it takes 3 hours 45 minutes. If x Km/hr. is the speed of the wind, complete the two equations $x + y =$ _____ and $x - y =$ _____

Ans: (i) $x + y =$ _____

(ii) $x - y =$ _____

(5) A certain mortality table showed the following fact. Although 9,60,201 babies lived upto 16 years old, 2,103 died during that year. What percentage lived upto 17 years old?

Ans:_____

(6) The population of a country increases at the rate of 20 per thousand per annum. In order to calculate the population after 10 years a person writes as follows:

Population in 1976 - 10,00,00,000

Population in 1977 - 10,20,00,000

Population in 1978 - 10,40,40,000

Write the expression used by the quicker method to find the population after 10 years.

Ans:_____

THANK YOU

APPENDIX II

SCORING KEY FOR THE ACHIEVEMENT TEST IN MATHEMATICS

Item No.	Correct Response	Item No.	Correct Response
1.	2	20.	2
2.	2	21. A: (1)	c
3.	4	(2)	a
4.	3	(3)	d
5.	3	(4)	e
6.	4	(5)	b
7.	4	21. B: (1)	c
8.	4	(2)	f
9.	4	(3)	e
10.	4	(4)	b
11.	3	(5)	a
12.	2	21. C: (1)	e
13.	2	(2)	d
14.	1	(3)	a
15.	2	(4)	b
16.	2	22: (1)	True
17.	3	(2)	False
18.	1	(3)	True
19.	4	(4)	True

Item No.	Correct Response	Item No.	Correct Response
(5)	False	(4)	(i) $\frac{900}{3}$
(6)	True		(ii) $\frac{900}{3}$
(7)	False		
(8)	False	(5)	99.78 or 99.8
23: (1)	1, 2, 3	(6)	$100000000\frac{(1 + 20)^{10}}{1000}$ or Equivalent answer.
(2)	9		
(3)	2		
(4)	0		
(5)	Continuous		
(6)	$-\frac{10}{7}$		
(7)	$\frac{5}{2}$		
(8)	- 6 and + 6		
(9)	$\frac{2x - 8}{5}$		
(10)	Parallel		
(11)	2		
24: (1)	Yes		
(2)	(4)		
(3)	Rs. 250		

APPENDIX III

ATTITUDE SCALE

1. Name: _____

2. Schoo: _____

3. Class: _____ Section: _____

4. Date: _____

Given below are some Statements expressing Opinions about the subject Mathematics.

Please read each Statement Carefully and Indicate your Agreement or Disagreement with it by Indicating with a check "(√)" in the appropriate Column. A check "(√)" placed under the column of 'SA' indicates, 'Strong Agreement' while if placed under the column 'A' would indicate 'Agreement'. Similarly, checks in the other columns 'U', 'D' and 'SD', would indicate an Opinion of 'Undecided', 'Disagreement' or 'Strong Disagreement', respectively. Please Indicate your Responses Frankly.

Kindly Respond to All Items

Sl. No.	Statement	SA	A	U	D	SD
1.	Learning of Mathematics enables a person to get a well paid job.					
2.	Mathematics is a subject which is really frightening.					
3.	Mathematics develops reasoning ability.					
4.	Mathematics does not help in developing any constructive ideas in students.					
5.	Basic knowledge of Mathematics is essential for everyone.					
6.	I do not like Mathematics as it is a confusing subject.					
7.	Mathematics develop self-confidence among students.					
8.	What a joy it would have been if there were no subject like Mathematics.					
9.	Mathematics helps to seek and cultivate new knowledge.					
10.	Mathematics is not an interesting subject.					
11.	If Mathematics was made an optional subject no pupil would choose it for study.					
12.	It is good that Mathematics is a compulsory subject in every school.					

Sl. No.	Statement	SA	A	U	D	SD
13.	I do not like even to see any paper related to Mathematics.					
14.	The knowledge of Mathematics is a must in our day-to-day life.					
15.	Mathematics should not be given much importance in school courses.					
16.	To attempt solving Mathematical problems on various concepts is a pleasant experience.					
17.	Solving of Mathematical problems is a waste of time.					
18.	Mathematics should be learnt by everybody because it is a useful subject.					
19.	Mathematics takes away the joy of students' life.					
20.	Mathematics is a must in todays' technological world.					
21.	Mathematics is the most tiresome among all subjects that we have to study.					
22.	It is a good pastime to read Mathematics puzzle books.					
23.	The progress of humanity does not in any way depend on the advancement in Mathematics.					
24.	Mathematics is useful in every walk of life.					

THANK YOU

APPENDIX IV

EDUCATIONAL ASPIRATION SCALE (E.A.S.)

Dr. V. P. Sharma
Km. Anuradha Gupta

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1. Name: _____

2. School: _____

3. Class: _____ Section: _____

4. Date: _____

DIRECTION

Altogether, Eight lists of Educational degrees are given in this Question paper. Each list Contains 10 degrees. After Carefully going through all, Tick (√) the One which you are Sure to Achieve in your Academic Career or Wish to do so OR can Achieve after 20 years. This Question paper is designed/planned to Measure your Educational desire. Do cooperate fully with us. Do you find it tough? Do not Turn over Unless you are Sure.

List - I

Given below is a list of examinations. Society cares for all those who pass the following examinations but not equally. The factors influencing on examination e.g. one's own ability to work hard, social, cultural and economical backgrounds, qualifications, memory etc. Keeping all these factors in mind tick/mark (√) the highest examination one which you are sure to pass.

1.1. Cambridge High School Examination.

1.2. B. Lib.

1.3. M. Tech.

1.4. P.M.T.

1.5. Middle School Board Examination.

1.6. B.Sc.

1.7. Dip. in Journalism.

1.8. Indian Navy Examination.

1.9. B.Sc. (Textile).

1.10. B.E. (Mining).

List - II

Given below is a list of examinations. Society cares for all those who pass the following examination but not equally. Tick/mark (√) against the one you will name, when asked about the examination you like most.

2.1. Indian Military Academy Exam.

2.2. B.V.Sc.

2.3. B.S. (Hons.)

2.4. A.C.F. (Asst. Conservator of Forest).

2.5. M.Ed.

2.6. Board Primary Examination.

2.7. M.D.

2.8. M.Sc. (Agr.)

2.9. H.Sc.

2.10. Ph.D. in Journalism.

List - III

Given below is a list of Examinations. Society cares for all those who pass the following examination but not equally. Keeping in mind all the factors influencing an examinations e.g. on ability to work, social, cultural and economical backgrounds, qualifications, memory, etc., tick/mark (√) against the most suitable which you are sure to pass after 20 years.

3.1. Poly Tech. Exam.

3.2. B.E. (Elect.).

3.3. M.Sc.

3.4. I.T.I.

3.5. H.Sc.

3.6. B.H.Sc.

3.7. F.A.A.Sc. (Fellow of the Australian Academy of Science).

3.8. F.L.A. (Fellow of the Library Association).

3.9. M. Phil in Social Sc.

3.10. Ph.D. in Lib.

List - IV

Given below is a list of examinations. Society cares for all those who pass the following examinations but not equally. If someone ask you to name the one you will like most to pass after 20 years, which one will you choose? Tick/mark (√) that exam.

4.1. M.S.C.

4.2. M.B.B.S.

4.3. F.C.S. (Fellow of Chemical Society).

4.4. B. Ed.

4.5. M. Phil in Science.

4.6. Chartered Accountancy Examination.

4.7. B. Sc.

4.8. LL.B.

4.9. M.S.

4.10. D. Litt.

List - V

Given below is a list of examinations. Society cares for all those who pass the following examinations but not equally. If someone ask you to name the best one a man should aim to pass, which one will you choose? Tick/mark (√) that exam.

5.1. M. Lit.

5.2. B.I.D. (Bach. of Industrial Design).

5.3. F.E.R. (Red Cross First-Aid Exam.)

5.4. L.L.D.

5.5. M. Com.

5.6. H.Sc. (Agri. Group).

5.7. F.I.E. (Fellow of the Institute of Engineers).

5.8. Science (Talent Search Exam.)

5.9. Ph.D. in Com.

5.10. I.P.S.

List - VI

Given below is a list of examinations. Society cares for all those who pass the following examinations but not equally. The factors influencing on examination e.g. one's own ability to work hard, social, cultural and economical backgrounds, qualifications, memory etc. Keeping all these factors in mind tick/mark (√) the highest examination one which you are sure to pass.

6.1. M.J.

6.2. B.Sc. (Tech.)

6.3. A.C.F. (Asst. Conservator of Forest)

6.4. B.B.A.

6.5. B.C.E.

6.6. LL.M.

6.7. B.J.

6.8. I.A.S.

6.9. B.M.

6.10. B.A.M.

List - VII

Given below is a list of examinations. Society cares for all those who pass the following examinations but not equally. Keeping in mind all the factors influencing on examination e.g. one's own ability to work, social, cultural and economical backgrounds, qualifications, memory etc., tick/mark (√) against the most suitable which you are sure to pass after 20 years.

7.1. H.Sc. (Science Group)

7.2. B.Com.

7.3. D.Sc.

7.4. D.C.L. (Doctor of Civil Law).

7.5. B.E. (Mech.)

7.6. Ph.D. in Agri.

7.7. M.Phil in Humanities.

7.8. M.A.

7.9. Dip. in Lit.

7.10. M.Sc. (Tech.)

List - VIII

Given below is a list of examinations. Society cares for all those who pass the following examinations but not equally. If someone ask you to name the one you will like most to pass after 20 years which one you choose? Tick/mark (√) that examination.

8.1. LL.B.

8.2. B.Ed.

8.3. M.B.B.S.

8.4. B.E. (Elect.)

8.5. B.E. (Mech.)

8.6. B.E. (Tech.)

8.7. B.A.M.

8.8. B. Lib.

8.9. B.J.

8.10. B.P. Ed.

APPENDIX V

SCORING KEY FOR EDUCATIONAL ASPIRATION SCALE (E.A.S.)

Alternatives	List No.							
	1	2	3	4	5	6	7	8
1	10	2	8	7	5	4	10	5
2	8	7	2	1	6	7	8	6
3	1	8	6	8	2	5	2	1
4	3	6	1	9	4	6	3	2
5	9	5	10	5	7	8	4	3
6	6	10	9	3	10	2	1	4
7	7	1	3	10	8	10	5	7
8	5	4	7	6	9	1	7	8
9	4	9	5	2	3	3	9	9
10	2	3	4	4	1	9	6	10

APPENDIX VI

OCCUPATIONAL ASPIRATION SCALE (O.A.S.)

Dr. J. S. Grewal
Professor of Education
Regional College of Education
Bhopal - 13

1. Name: _____

2. School: _____

3. Class: _____ Section: _____

4. Date: _____

DIRECTION

This set of Questions concerns your Interest in different Questions. Each One Asks You to CHOOSE One job out of Ten presorted. Read each Question Carefully. They are All different. Answer each One the Best You Can by placing a Cross mark (X) against the Occupation of your Preference. Please Do Not Omit Any Item.

Question 1: Of the jobs listed in this question, which one is the BEST ONE you are REALLY SURE YOU CAN GET when your SCHOOLING IS OVER?

1.1. Laywer.

1.2. Agriculture Inspector.

1.3. Doctor.

1.4. Primary School Teacher.

1.5. Diplomat in the Indian Foreign Service.

1.6. Barbar.

1.7. Psychologist.

1.8. Motor Mechanic.

1.9. Travelling salesman for a wholesale firm.

1.10. Postman.

Question 2: Of the jobs listed in this question, which one would you choose if you were FREE TO CHOOSE ANY of them you wished when your SCHOOLING IS OVER?

2.1. Govt. Contractor.

2.2. Insurance Agent.

2.3. Member of Parliament.

2.4. Clerk in an Office.

2.5. State Governor.

2.6. Maid Servant.

2.7. Owner-Operator of a Printing Press.

2.8. Electrician.

2.9. Priest (Pujari).

2.10. Truck Driver.

Question 3: Of the jobs listed in this question, which one you choose if you were FREE TO CHOOSE ANY OF them you wished when your SCHOOLING IS OVER?

3.1. Airline hostess.

3.2. Trained Merchant.

3.3. Captain in the Army.

3.4. Midwife (Dai).

3.5. Supreme Court Justice.

3.6. Restaurant waiter.

3.7. Instrumental Musician.

3.8. Machine Operator Musician.

3.9. Librarian.

3.10. Plumber.

Question 4: Of the jobs listed in this question, which ONE would you choose if you were FREE TO CHOOSE ANY OF THEM you wished when your SCHOOLING IS OVER?

4.1. Novelist.

4.2. Soldier in the Army.

4.3. Bank Manager.

4.4. Taxi Driver.

4.5. Cabinet Minister in the Central Government.

4.6. Petrol Pump Attendant.

4.7. Artist who paints pictures.

4.8. Lady Village Level Worker (Gram Sevika).

4.9. Photographer.

4.10. Coal Miner.

Question 5: Of the jobs listed in this question, which one is the BEST ONE you are REALLY SURE YOU CAN HAVE BY the time you are 30 years old?

5.1. Dentist.

5.2. Physical Educational Instructor.

5.3. Scientist.

5.4. Carpenter.

5.5. Chairman of a large municipality.

5.6. Wood Cutter.

5.7. Newspaper Correspondent.

5.8. Bus Driver.

5.9. Steno-Typist to an Officer.

5.10. Farm Worker.

Question 6: Of the jobs listed in this question, which one would you choose to have when you are 30 YEARS OLD, if you were FREE TO HAVE ANY of them you wished?

6.1. Accountant for a large Govt. Office.

6.2. Revenue record keeper (Patwari).

6.3. College Lecturer.

6.4. Fisherman.

6.5. Director of a Department in State Govt.

6.6. Night Watchman (Chowkidar).

6.7. Radio Announcer.

6.8. Police Constable.

6.9. Receptionist.

6.10. Railway Signalman.

Question 7: Of the jobs listed in this question, which is the BEST ONE you are REALLY SURE YOU CAN HAVE by the time you are 30 years OLD?

7.1. Chemist.

7.2. Nurse.

7.3. Owner of a farm or factory which employs 100 people.

7.4. Shop Attendant.

7.5. District Magistrate.

7.6. Shoe-Shiner.

7.7. Commercial Artist.

7.8. Typist.

7.9. Social Welfare Worker.

7.10. Cloth Pressure in a Laundry.

Question 8: Of the jobs listed in this question which ONE would you choose to have when you are 30 YEARS OLD, if you were FREE TO HAVE ANY of them you wished?

8.1. Farm Owner and Operator.

8.2. Railway Guard.

8.3. Engineer.

8.4. Door-to-door salesman of home products.

8.5. Airline Pilot.

8.6. Sweeper.

8.7. Owner of a small hotel.

8.8. Tailor.

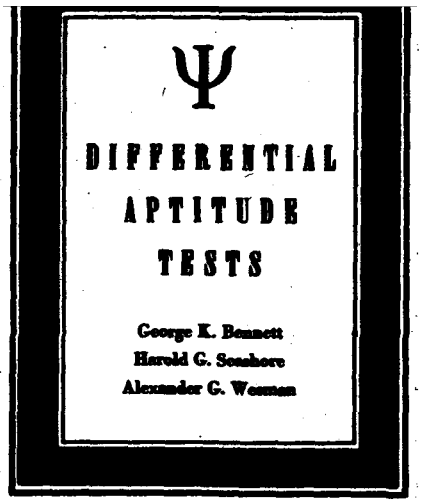
8.9. Cashier in a firm.

8.10. Restaurant Cook.

APPENDIX VII

SCORING KEY FOR OCCUPATIONAL ASPIRATION SCALE (O.A.S.)

Alternative	Score
1	7
2	4
3	8
4	2
5	9
6	0
7	6
8	3
9	5
10	1



Do not open this booklet until you are told to do so.

On your SEPARATE ANSWER SHEET write your name, address and other required information in CAPITAL LETTERS.

In the space after Form, write a Capital A.

Then wait for further instructions.

DO NOT MAKE ANY MARK IN THIS BOOKLET

NUMERICAL ABILITY

FORM A

DIRECTIONS

This test consists of forty arithmetical problems. Next to each problem there are five answers. These are marked A, B, C, D and E. Only one of these suggested answers is right. You are to pick out the one correct answer for each problem. Then mark X in the circle under its letter, on the separate Answer Sheet as shown in the Examples below :

EXAMPLE X

Add 13 / 12

A 14
B 25
C 16
D 59
E none of these

In Example X, 25 is the correct answer, so the circle under the letter B—the letter for the correct answer 25—has been crossed.

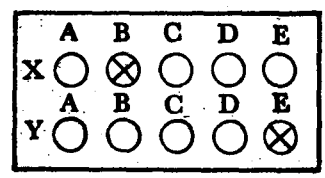
EXAMPLE Y

Subtract 30 / 29

A 15
B 26
C 16
D 8
E none of these

In Example Y, the correct answer (10) has not been given, so an X has been put in the circle under the letter E — the letter for 'none of these.'

SAMPLE OF ANSWER SHEET



Each answer must be reduced to its simplest terms. For example, if two choices are $1\frac{1}{2}$ and 1-2/4, only $1\frac{1}{2}$ is correct.

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Do not make any marks in this booklet

Mark your answers on the separate Answer Sheet

DO ALL YOUR ROUGH WORK IN THE SPACE PROVIDED ON THE ANSWER SHEET

	ANSWER
1. Add 293 4688 3790 67	A 7908 B 8608 C 8898 D 8908 E none of these
2. Subtract 5473 2987	A 2485 B 2486 C 2496 D 3486 E none of these
3. Multiply 484 25	A 10900 B 11100 C 11900 D 11700 E none of these
4. Multiply 2.04 .75	A 1.5300 B 153 00 C 1530 D 15300 E none of these
5. Multiply 4.50 22	A .99 B 98.40 C 99.00 D 9900 E none of these
6. Multiply .025 .025	A .001375 B .00625 C .625 D 1.375 E none of these

	ANSWER
7. Multiply .016 .016	A 256 B 25.6 C .00256 D .000256 E none of these
8. Divide $46\overline{)69}$	A $1.\frac{13}{46}$ B $1.\frac{23}{46}$ C 1.5 D 15 E none of these
9. Divide $.75\overline{)2.25}$	A .0003 B .03 C .3 D 3 E none of these
10. Divide $3.6\overline{)\ .72}$	A .02 B .2 C 2 D 20 E none of these
11. Divide $64.7\overline{)304.09}$	A .47 B 4.07 C 4.7 D 47 E none of these
12. Divide $.04\overline{)4.036}$	A 1.009 B 10.9 C 10.09 D 100.9 E none of these

	ANSWER
13. $\frac{1}{4} \div \frac{1}{8} =$	A $\frac{1}{32}$ B $\frac{1}{8}$ C $\frac{1}{2}$ D 2 E none of these
14. $\frac{2}{7} \times \frac{3}{7} =$	A $\frac{6}{49}$ B $\frac{3}{7}$ C $\frac{2}{3}$ D $\frac{6}{7}$ E none of these
15. $\frac{3 \times 10}{5 \times 9} =$	A $\frac{27}{50}$ B $1\frac{1}{2}$ C $\frac{30}{45}$ D $\frac{2}{3}$ E none of these
16. Add $4\ \frac{3}{4}$ $9\ \frac{1}{2}$ $13\ \frac{7}{8}$	A $26\ \frac{11}{14}$ B $27\ \frac{1}{8}$ C $28\ \frac{1}{2}$ D $28\ \frac{11}{14}$ E none of these
17. Add 2 ft. 3 in. 28 ft. 11 1/2 in. 17 ft. 5 in. 4 1/2 in.	A 49 ft. B 48 ft. 2 in. C 47 ft. 24 in. D 48 ft. E none of these
18. Add 3 lbs. 3 oz. 6 lbs. 7 oz. 7 lbs. 5 oz. 11 lbs. 1 oz.	A 28 lbs. 6 oz. B 28 lbs. C 27 lbs. 16 oz. D 18 lbs. E none of these

ANSWER

19. Square root

$\sqrt{169}$

A 13
B 43
C $84\frac{1}{2}$
D 169
E none of these

20. Square root

$\sqrt{.09}$

A .03
B .3
C $3\frac{1}{2}$
D 9
E none of these

21. Square root

$\sqrt{\frac{4}{9} \times \frac{25}{36}}$

A $\frac{25}{81}$
B $\frac{25}{36}$
C $\frac{5}{9}$
D $2\frac{7}{9}$
E none of these

22.

? = 33⅓% of 963

A 32.19
B 231
C 321
D 32100
E none of these

23.

? = 12½% of 816

A .12
B 12
C 102
D 101
E none of these

24.

? = 4/9 of 648

A 14.58
B 72
C 218
D 1458
E none of these

25.

15 = 75% of ?

A .20
B 10.25
C 20
D 22.5
E none of these

ANSWER

26.

25 = ? % of 125

A $\frac{1}{5}$
B 5
C 20
D 31.25
E none of these

27.

2.5 = ?% of 2

A 5
B 8
C 80
D 125
E none of these

28.

$\frac{?}{8} = \frac{3}{24}$

A $\frac{1}{8}$
B 1
C 3
D 4
E nonc of these

29.

$\frac{5}{9} = \frac{55}{?}$

A $\frac{55}{99}$
B 11
C 45
D 99
E none of these

30.

$\frac{11}{4} = \frac{77}{?}$

A $\frac{77}{28}$
B 28
C 44
D 308
E none of these

31. What one number can replace both question marks ?

$\frac{2}{?} = \frac{?}{50}$

A 1
B 10
C 25
D 100
E none of these

32. What one number can replace both question marks ?

$\frac{1}{?} = \frac{?}{36}$

A 6
B .12
C 35
D 36
E none of these

33. What one number can replace both question marks ?

$\frac{4}{?} = \frac{?}{100}$

A 1
B 20
C 25
D 200
E none of these

34. What one number can replace both question marks ?

$\frac{8}{?} = \frac{?}{12\frac{1}{2}}$

A $1\frac{1}{2}$
B 4
C 64
D 100
E none of these

35. What one number can replace both question marks ?

$\frac{6.25}{?} = \frac{?}{16}$

A 4
B 10
C 16
D 50
E none of these

36.

$\frac{9+1\times6-3}{4+2\times7-6} =$

A $\frac{57}{50}$
B $1\frac{7}{12}$
C 1
D $\frac{57}{36}$
E none of these

37.

List Price = Rs. 75.00
First Discount 33⅓ %
Further Discount 2%
Net Price = Rs ?

A 25
B 48.50
C 49.50
D 50
E none of these

38. Cube root

$\sqrt[3]{32\times2}$

A 4
B 8
C $21\frac{1}{3}$
D 192
E none of these

39. Cube root

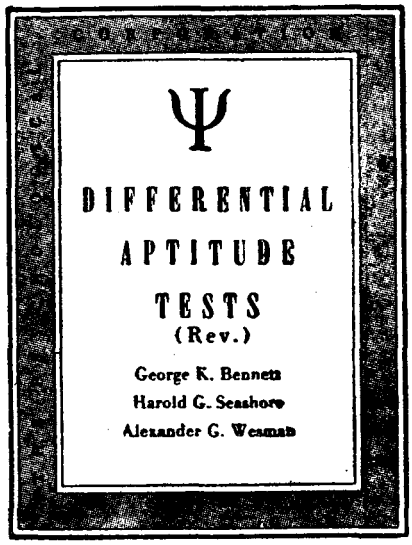
$\sqrt[3]{.000729}$

A .000243
B .009
C .027
D .09
E none of these

40. Cube root

$\sqrt[3]{\frac{1}{8} \times \frac{125}{64}}$

A $\frac{5}{8}$
B $\frac{375}{512}$
C $2\frac{1}{2}$
D $15\frac{5}{8}$
E none of these



APPENDIX IX

ABSTRACT REASONING

FORM A

Do not open this booklet until you are told to do so.

On your SEPARATE ANSWER SHEET, write your name, address, and other requested information in the proper spaces.

In the space after Form, write an A.

Then wait for further instructions.

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ABSTRACT REASONING

Mark your answers on the separate Answer Sheet

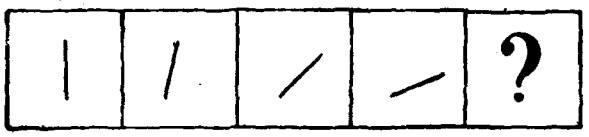
DIRECTIONS

In this test you will see rows of designs or figures. Each row is a problem. You are to mark your answers on Separate Answer Sheet.

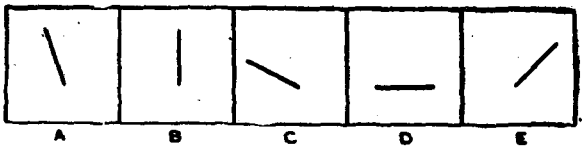
Each row has four designs called Problem Figures. These are followed by five designs called Answer Figures. The four problem Figures make a series. That means, they follow each other in a special order. The fifth figure is missing. It is shown in first example by a question mark (?). What should this fifth picture be? You will find the right picture among the five Answer Figures. Then, you will mark it on your Answer Sheet, as shown in the examples below.

EXAMPLE W

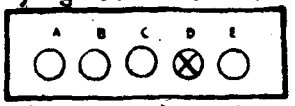
PROBLEM FIGURES



ANSWER FIGURES



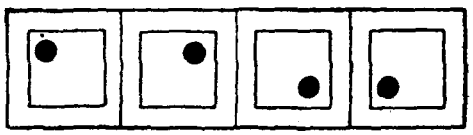
Note what is happening to the lines in the Problem Figures, as you move from one picture to the next. They are falling down. In the first square, the line stands straight up. As you go from square to square, the line falls more and more to the right. In the fifth square—the one with the question mark in it—the line would be lying flat. So the answer is D, which is the picture of a line lying flat. You would show this on your Answer Sheet by writing an X in the circle under D, like this



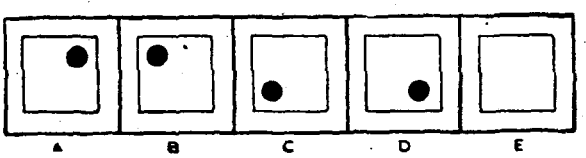
Each row of Problem Figures has the last figure missing. The question marks, however, have been left out. But the figure is missing from the same place, the end of each row.

EXAMPLE X

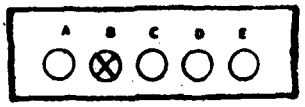
PROBLEM FIGURES



ANSWER FIGURES

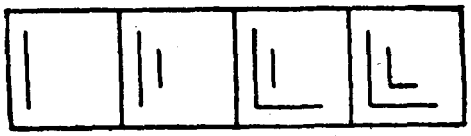


Study the position of the dot. Note that it keeps moving around the square. It always moves in the same direction. First it is in the upper left corner; then in the upper right corner; then in the lower right corner; then in the lower left corner. What picture belongs to the next, the fifth, square? The dot would come back to the upper left corner. Therefore, B is the answer. You would mark it on your Answer Sheet like this: ⟶

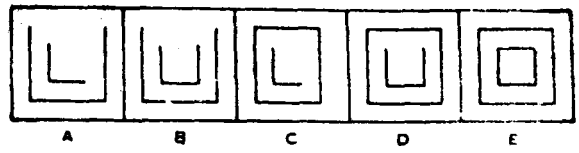


EXAMPLE Y

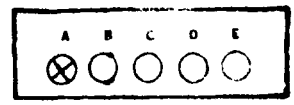
PROBLEM FIGURES



ANSWER FIGURES



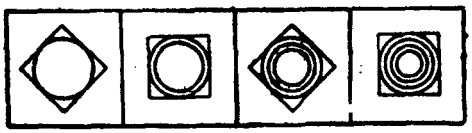
What is happening in the above Problem Figures? Two squares are being made, a small one and a large one. First there is one long line for the outer square. Then a short line is added for the inner square. Then another long line is added. Then another short line is added. What should happen next? Another long line should be added. So A is the correct answer. You would mark your Answer Sheet with a cross in the circle under A, like this: ⟶



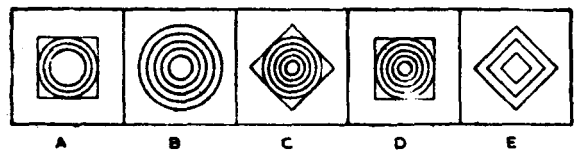
Now look at the next problem. You will see two different things happening at once.

EXAMPLE Z

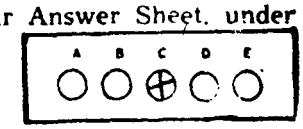
PROBLEM FIGURES



ANSWER FIGURES



The number of circles is increasing: 1, 2, 3, 4; so the last missing figure would have 5 circles. But note that the square is also turning. First the point is up, then the flat side, then again the point is up, and then again the flat side. In the missing place, therefore, the point should be up. Only figure C has *both*: the point is up and 5 circles. So you would place inside the circle on your Answer Sheet, under C like this ⟶



Remember—You are to choose the one figure, from among the Answer Figures, which belongs next in the series.

DO NOT TURN OVER THE PAGE UNTIL YOU ARE TOLD TO DO SO.

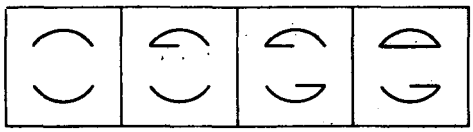
Do Not Begin Until You Are Told To Do So
Mark All Your Answers On Answer Sheet
Be Sure To Mark Your Answers In The Right Places

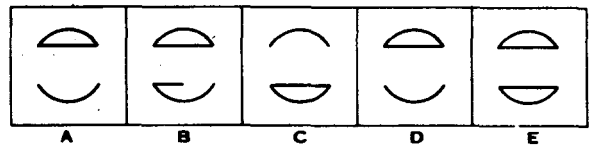
START HERE

PROBLEM FIGURES

ANSWER FIGURES

1.





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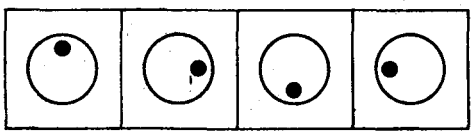

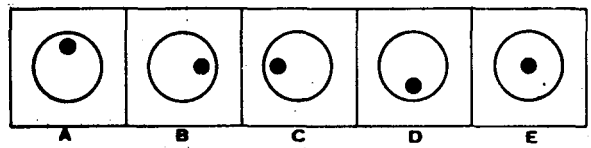

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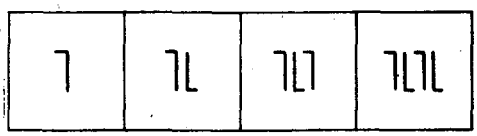
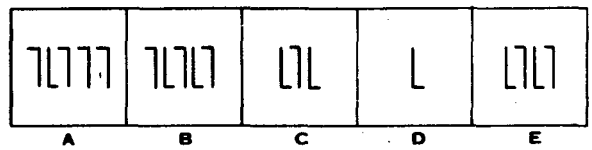
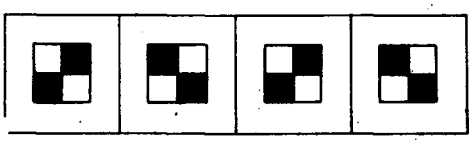
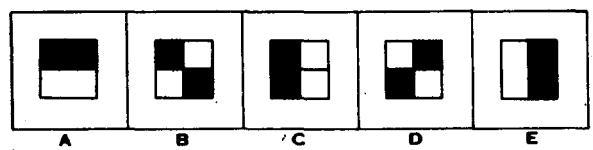




4.





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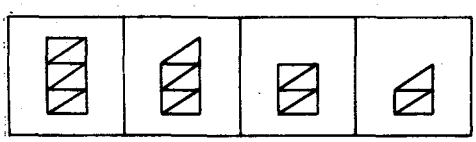
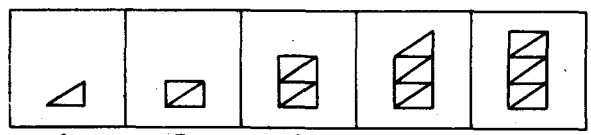
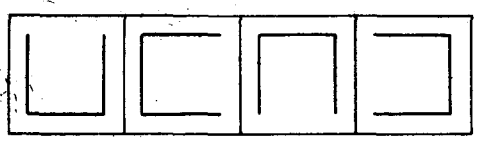
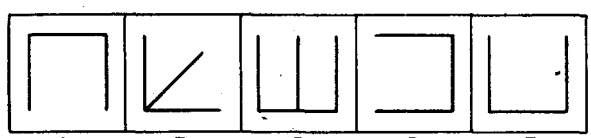




6.





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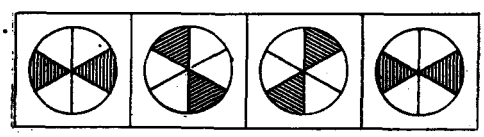

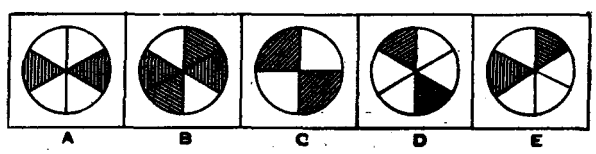

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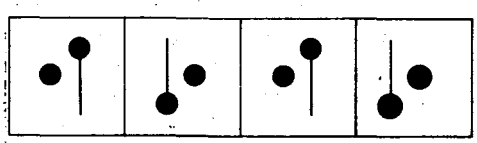

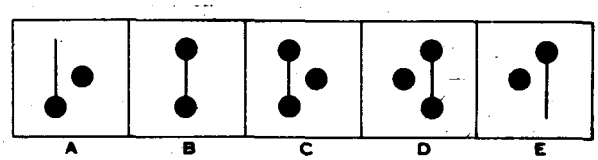

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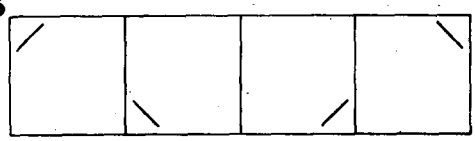

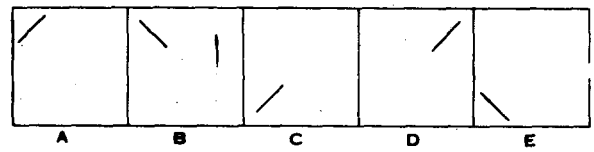

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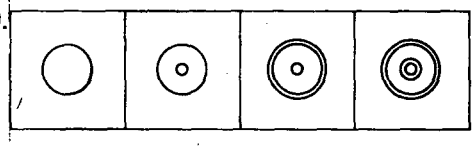

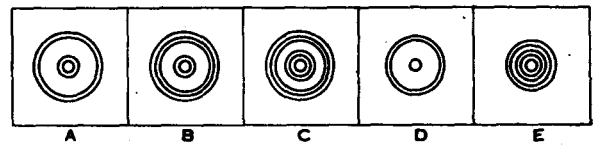

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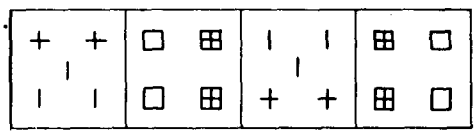

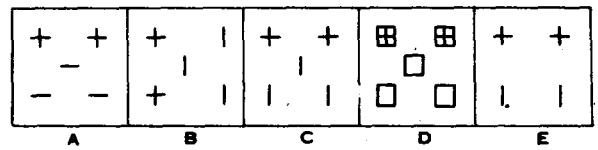

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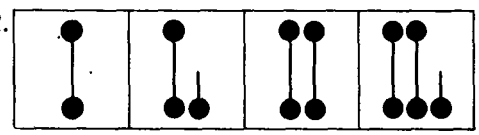

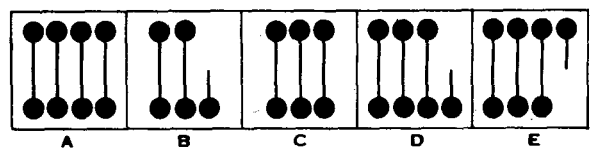

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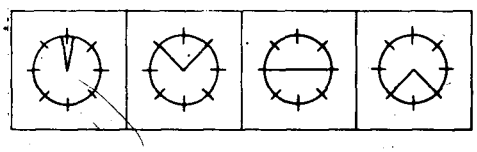

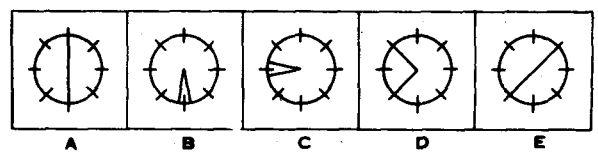

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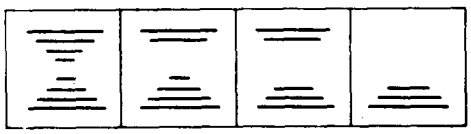

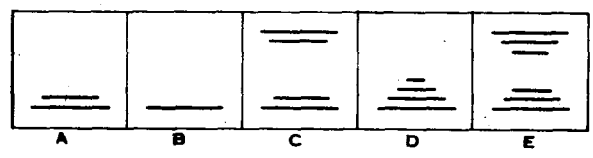

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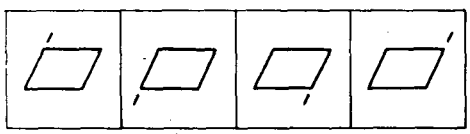

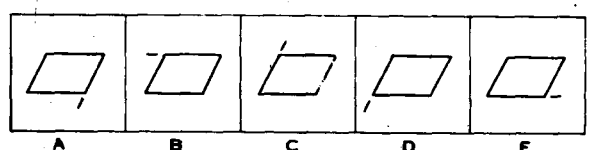

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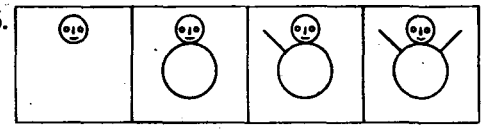

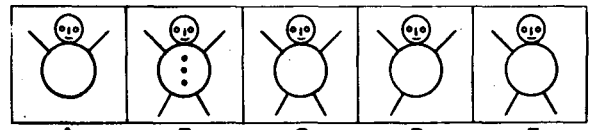

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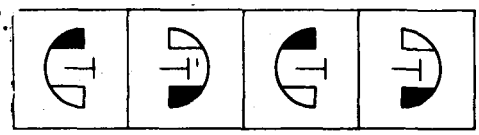

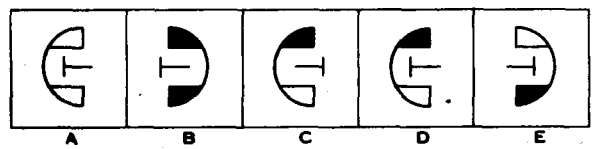

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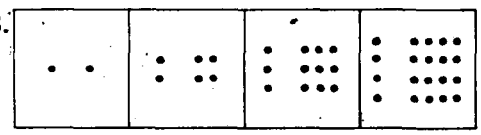

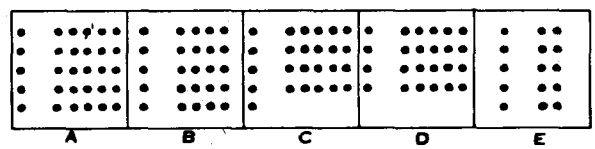

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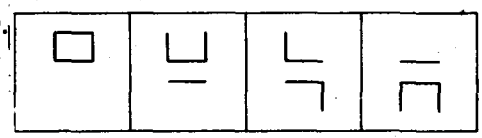

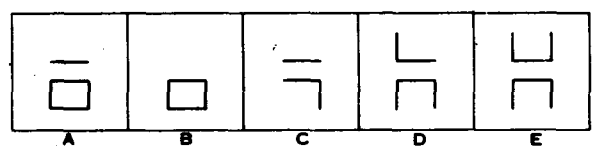

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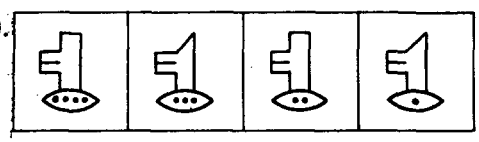

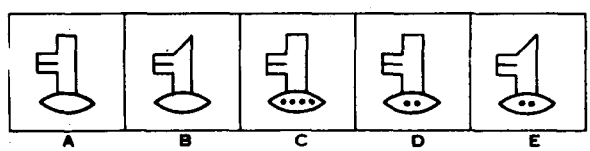

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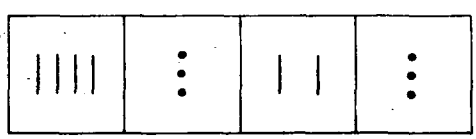

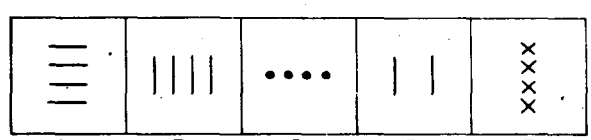

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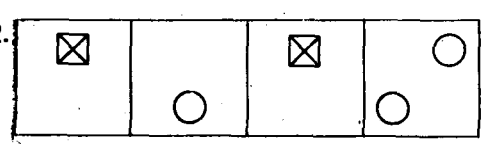

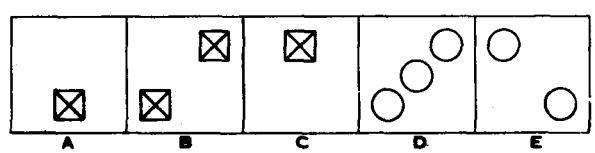

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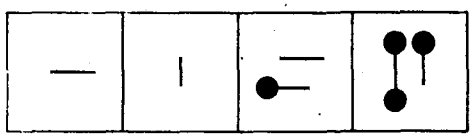

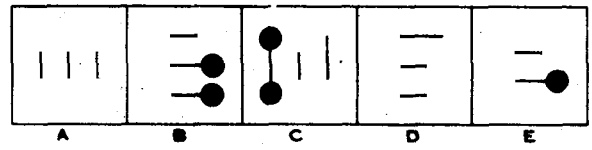

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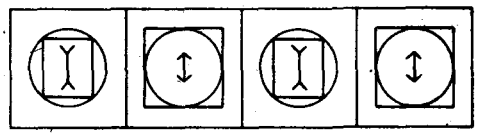

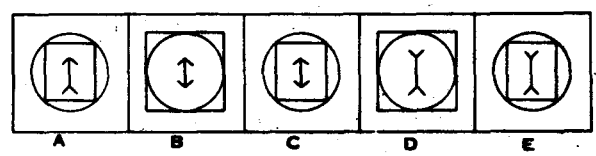

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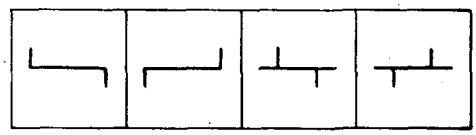

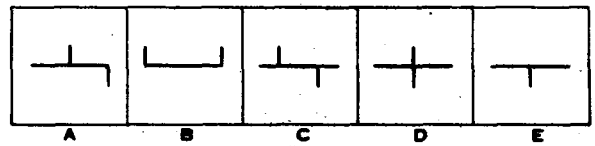

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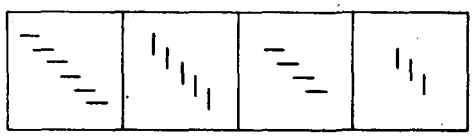

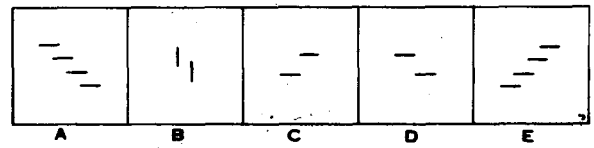

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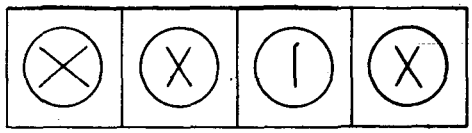

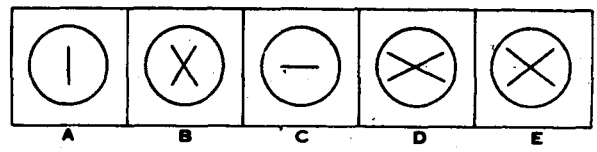

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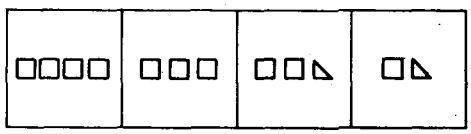

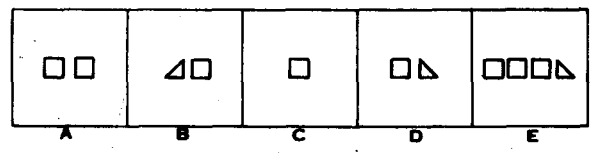

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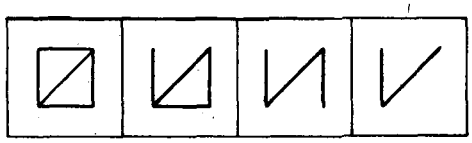

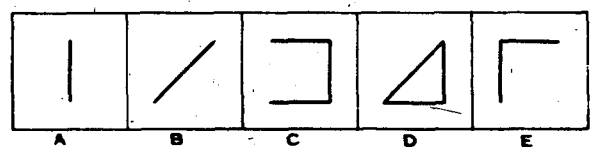

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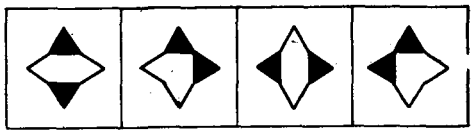

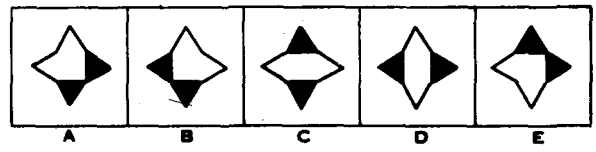

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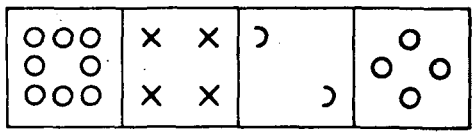

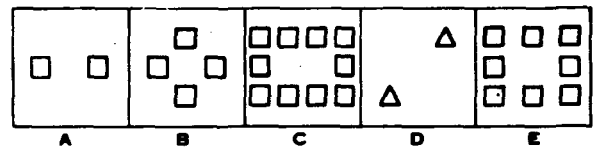

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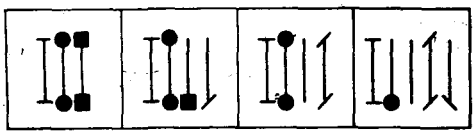

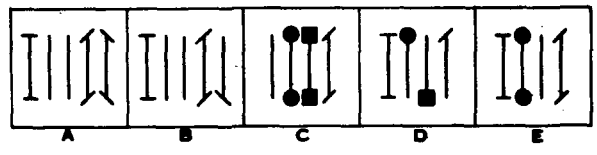

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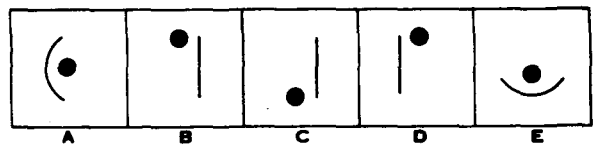

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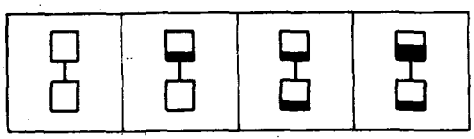

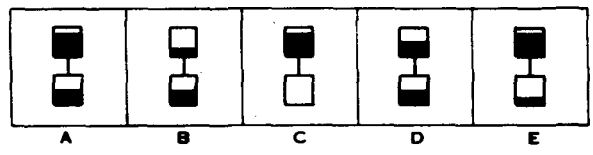

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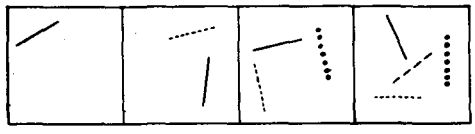

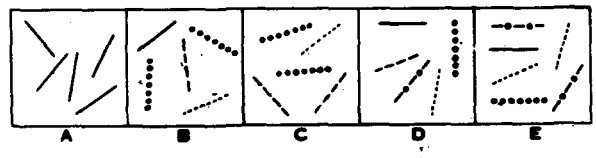

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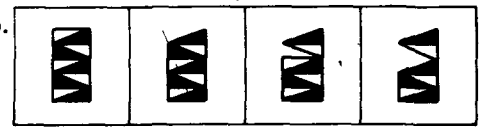

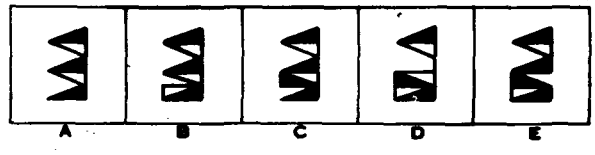

227

PROBLEM FIGURES

ANSWER FIGURES

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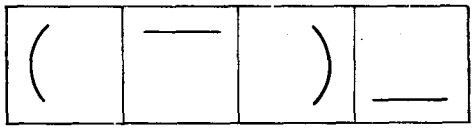

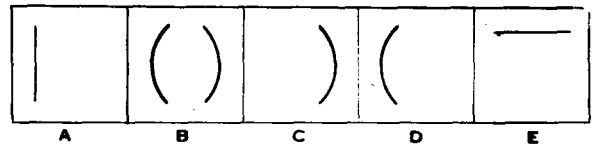

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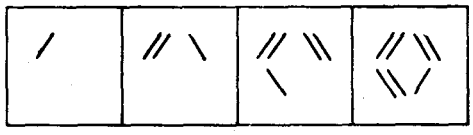

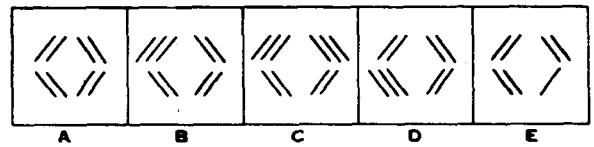

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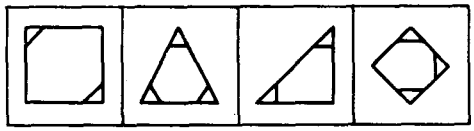

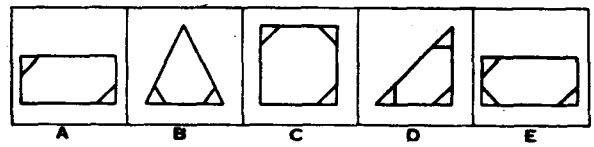

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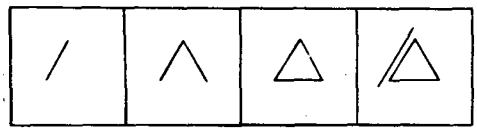

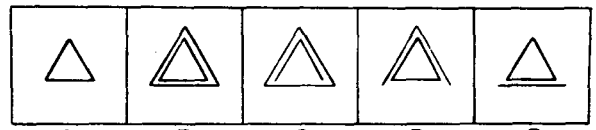

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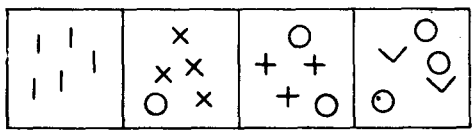

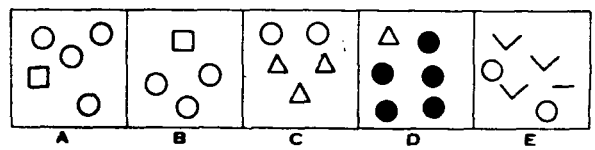

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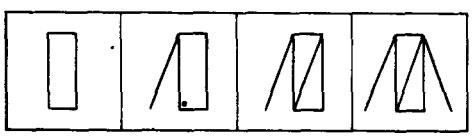

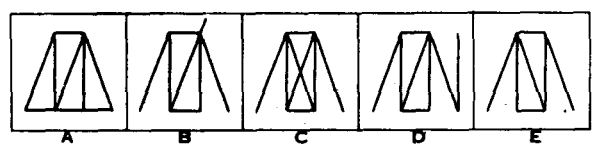

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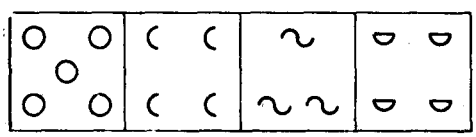

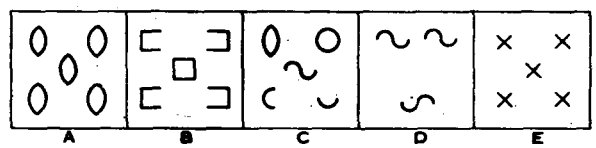

PROBLEM FIGURES

ANSWER FIGURES

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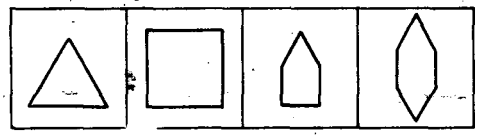

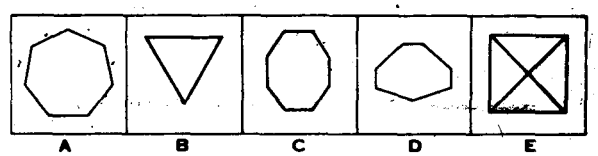

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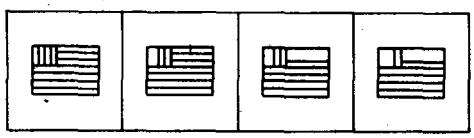

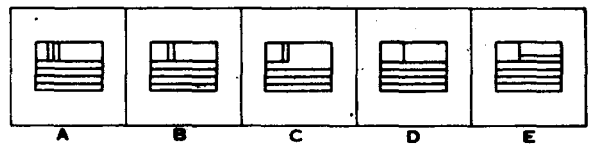

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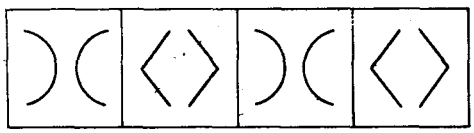

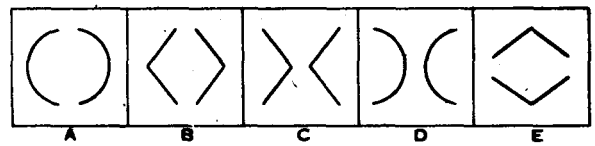

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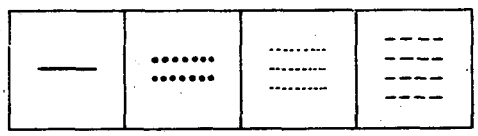

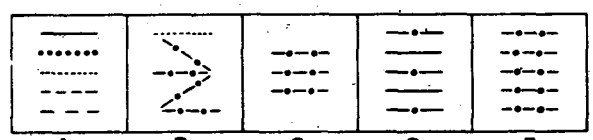

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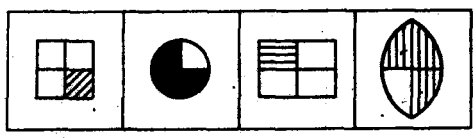

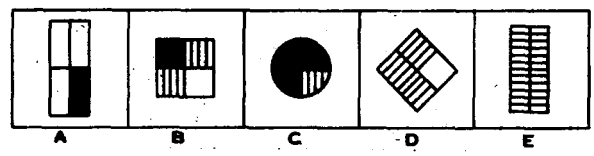

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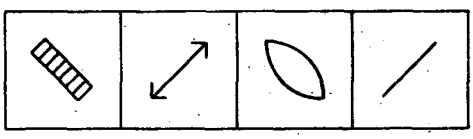

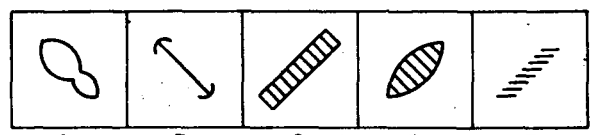

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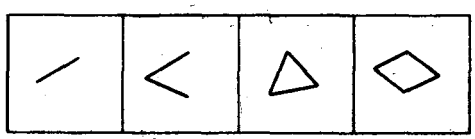
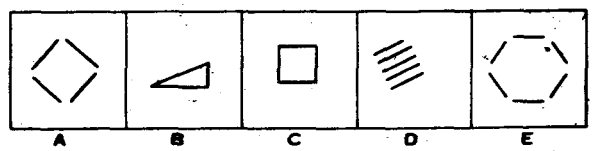
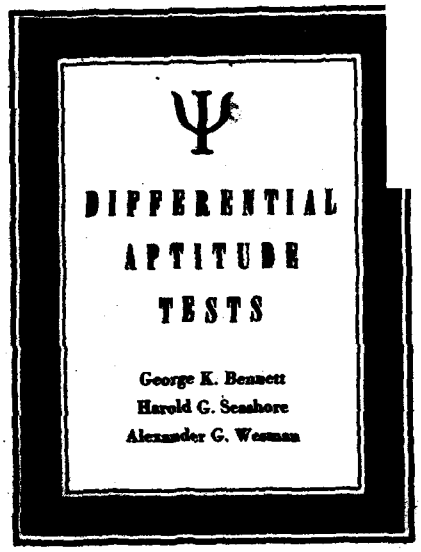






APPENDIX X

SPACE RELATIONS

FORM A

Do not open this booklet until you are told to do so.

On your SEPARATE ANSWER SHEET, write your name, address, and other requested information in the proper spaces.

In the space after **Form**, write an **A**.

Then wait for further instructions.

DO NOT MAKE ANY MARKS IN THIS BOOKLET

MANASAYAN
32 Faiz Bazar
Delhi-7.

Do not make any narks in this booklet

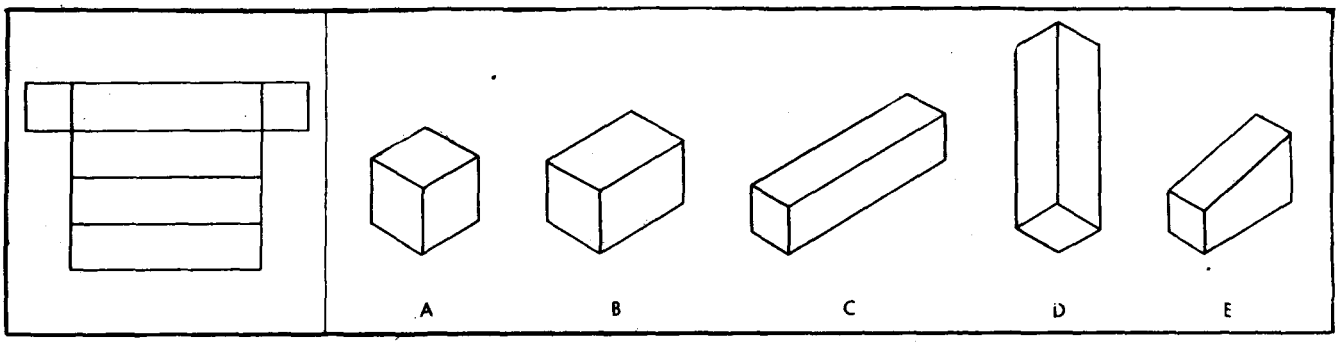
Mark your answers on the separate Answer Sheet

SPACE RELATIONS

DIRECTIONS

This test consists of forty patterns which can be folded into figures. For each pattern, five figures are shown. You are to decide which of these figures can be made from the pattern shown. The pattern always shows the outside of the figure. Here is an example:

EXAMPLE X



Which of these five figures — A, B, C, D, E — can be made from the pattern in Example X? A and B certainly cannot be made; they are not the right shape. C and D are correct both in shape and size. You cannot make E from this pattern.

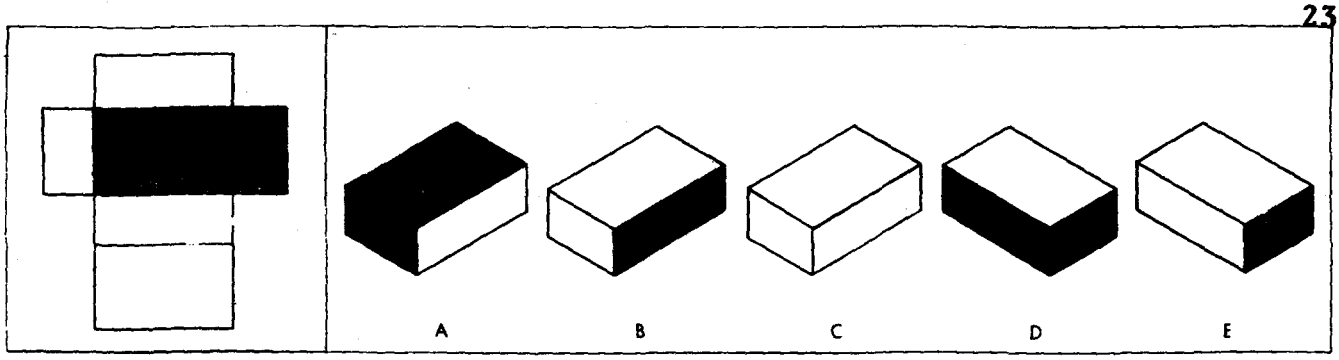
— In the test there will always be a row of five figures for each pattern.

— In every row there is at least one correct figure.

— Usually more than one is correct. In fact, in some cases, all five may be correct.

Now look at the pattern for Example Y and the five choices for it. Note that when the pattern is folded, the figure must have two gray surfaces. One of these is a large surface which could be either the top or bottom of a box. The other is a small surface which would be one end of the box.

EXAMPLE Y



Notice — all the "boxes" made from this pattern are correct in **shape,** but the sides which you see are different. Some of these figures can be made from this pattern while others cannot. Let us look at them.

— Figure A is correct. If the large gray surface is shown as the top, then the end surface of gray can be shown facing towards you.

— Figure B is wrong. The **long, narrow** side is not gray in the pattern.

— Figure C is correct. The two gray surfaces can both be hidden by placing the large gray surface at the bottom and the gray end to the back.

— Figure D is wrong. The gray end is all right, but there is no long gray side in the pattern.

— Figure E is correct. One can show the box so that the large gray surface is at the bottom (as it was in C), but with the gray end showing at the front.

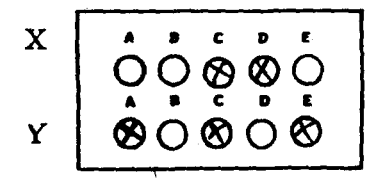
So, you see, there are three figures (A, C and E) which can be made from the pattern in Example Y, and two figures (B and D) which cannot be made from this pattern.

Remember that the surface you see in the pattern must always be the OUTSIDE surface of the completed figure.

Now let's see how we mark our answers on the separate Answer Sheet. A sample is shown here.

For Example X we found that only figures C and D could be made, so the circles under C and D opposite X are marked X. For Example Y, A is a correct figure, C is correct, and E is correct; so opposite Y we have marked X's in the circles under A, C and E.

SAMPLE OF ANSWER SHEET



In taking the test:

— Study each pattern.

— Decide which of the figures can be made from the pattern.

— Show your choices on the Answer Sheet by blackening in the little space under the letter which is the same as that of the figure you have chosen in the booklet.

— If you decide a certain figure cannot be made from the Pattern, make no mark on the Answer Sheet.

Do Not Write Anything in This Booklet

Use Separate Answer Sheet

DO NOT TURN THE PAGE UNTIL YOU ARE TOLD TO DO SO.

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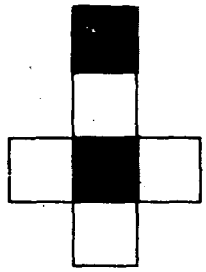
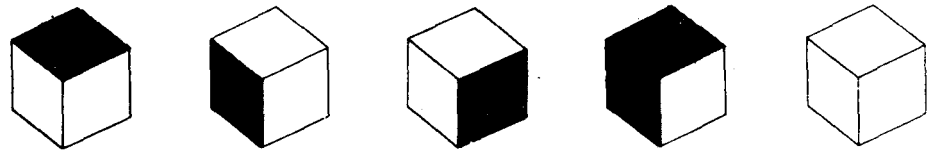
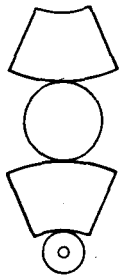
1

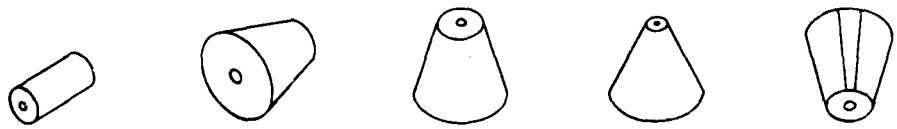




A B C D E

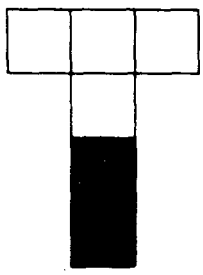
2

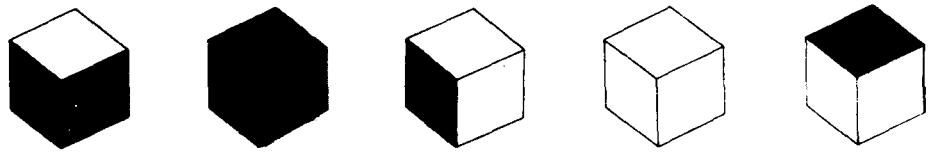




A B C D E

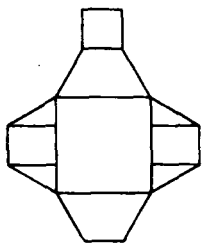
3

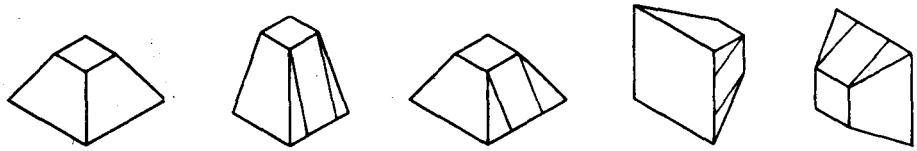




A B C D E

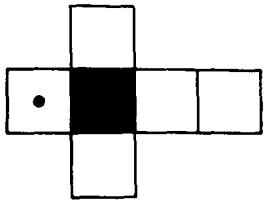
4

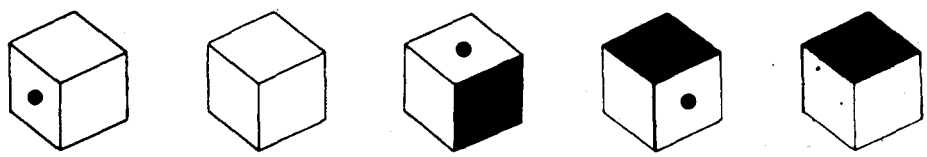




A B C D E

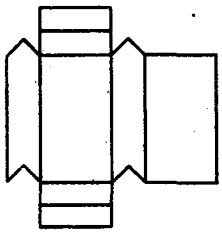
5

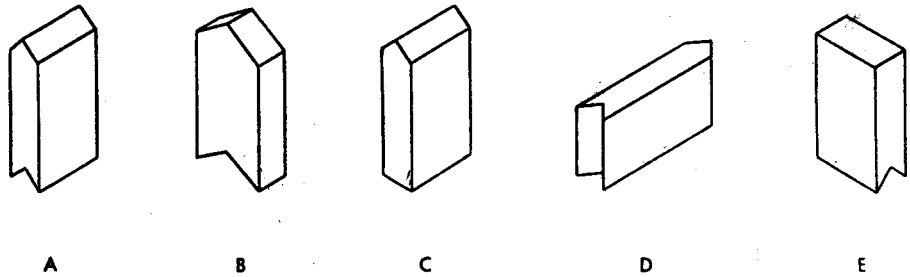




A B C D E

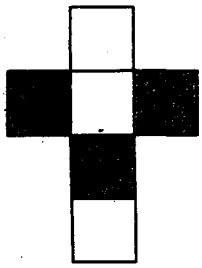
6

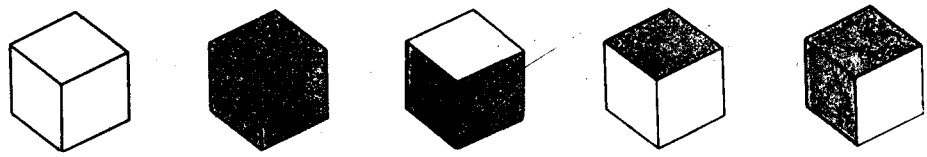




A B C D E

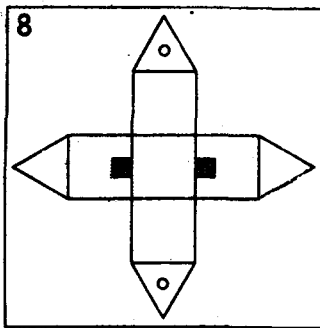
7

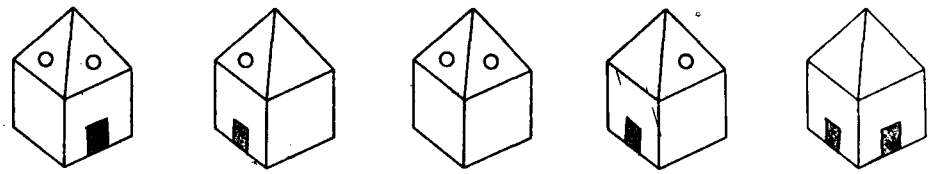




A B C D E

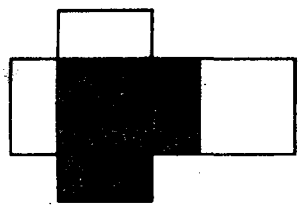
8

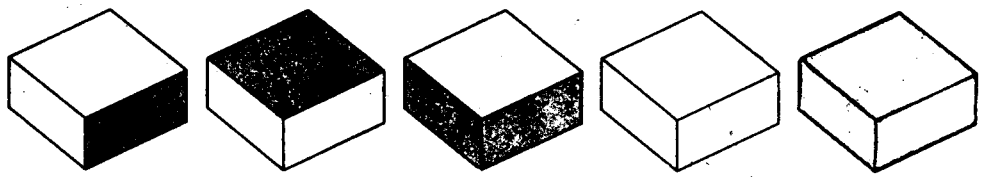




A B C D E

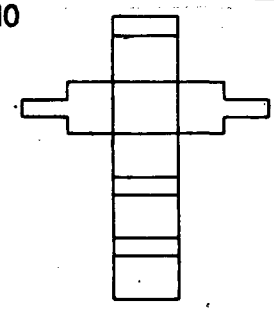
9

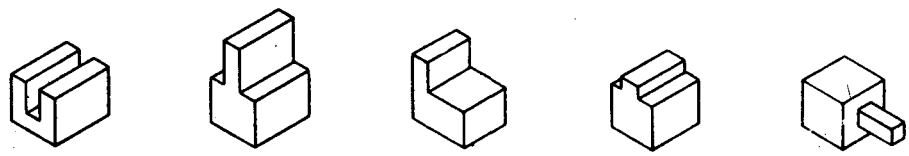




A B C D E

10





A B C D E

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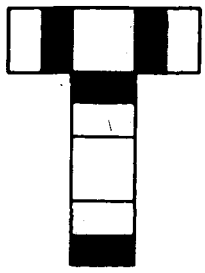

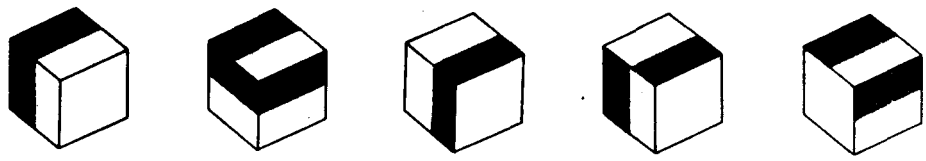

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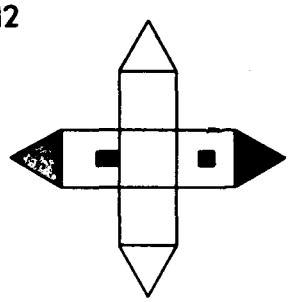

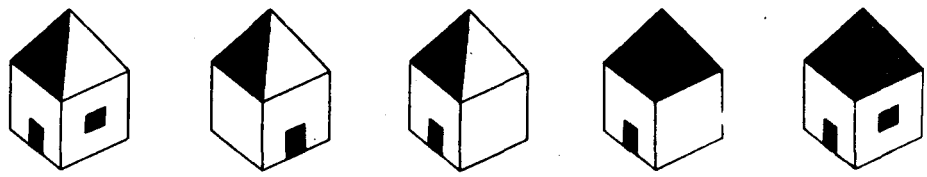

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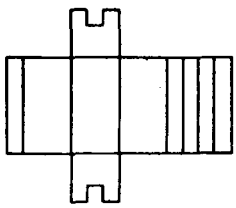

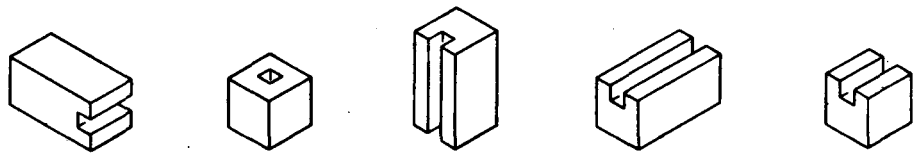

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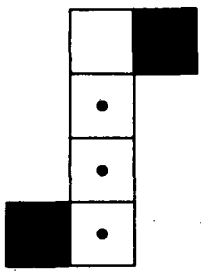

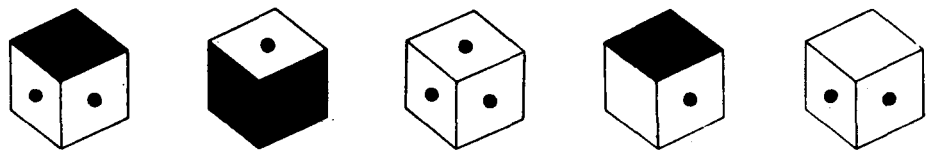

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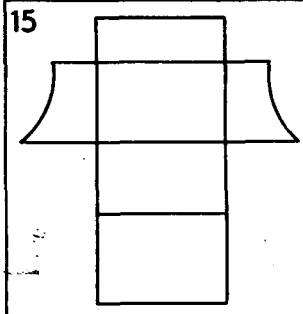

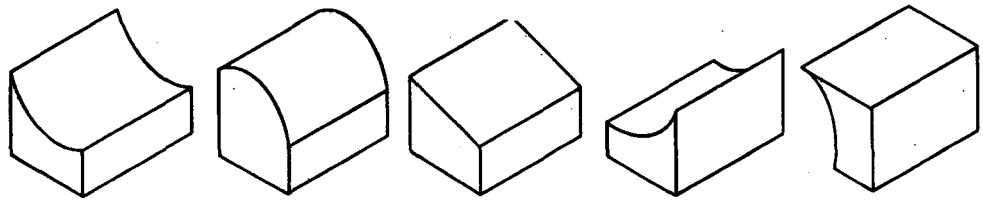

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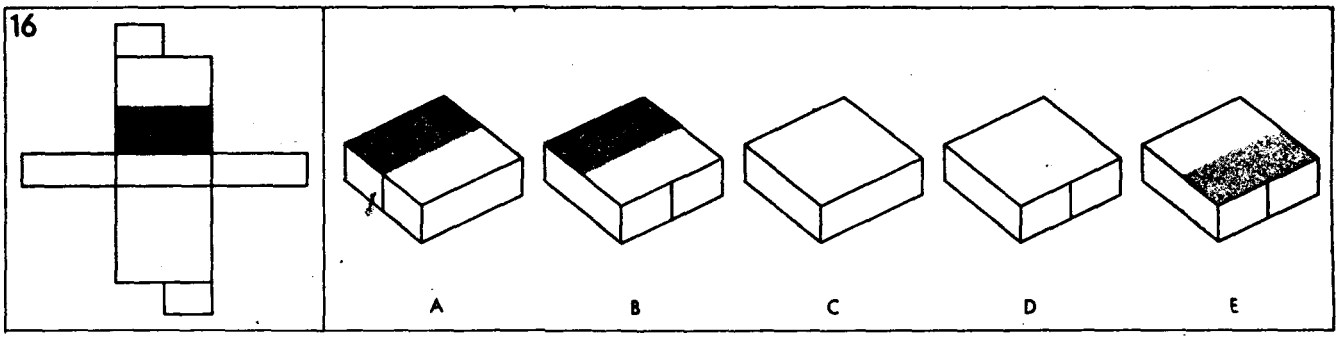

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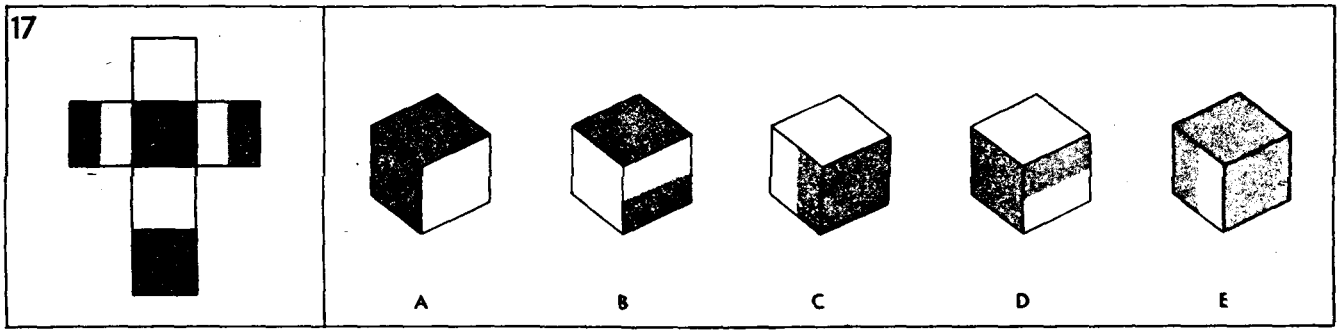

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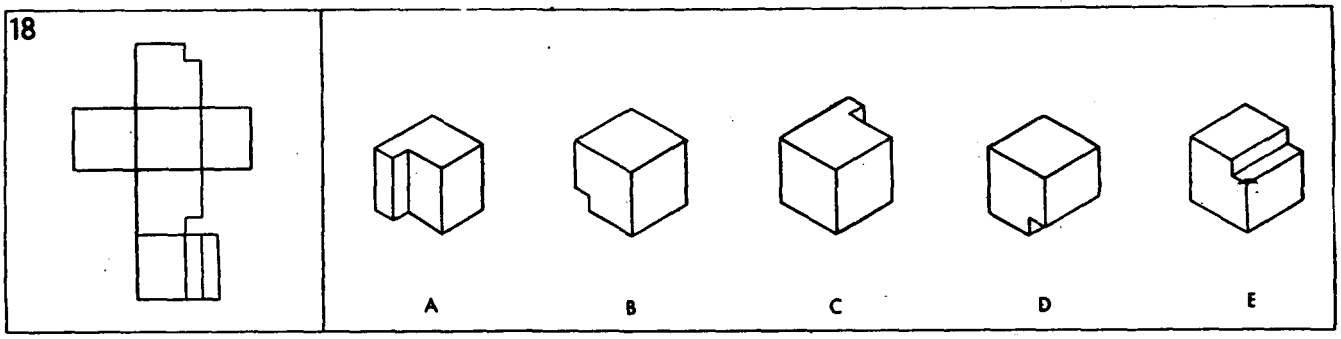

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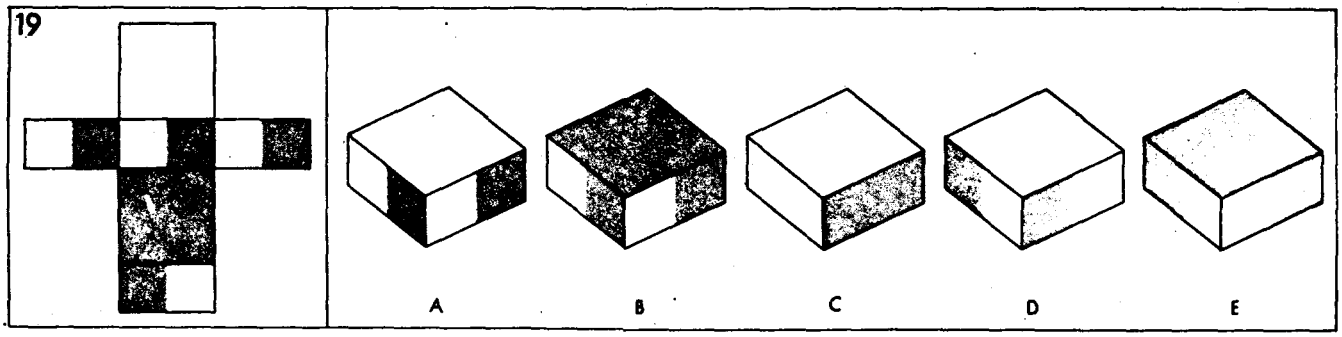

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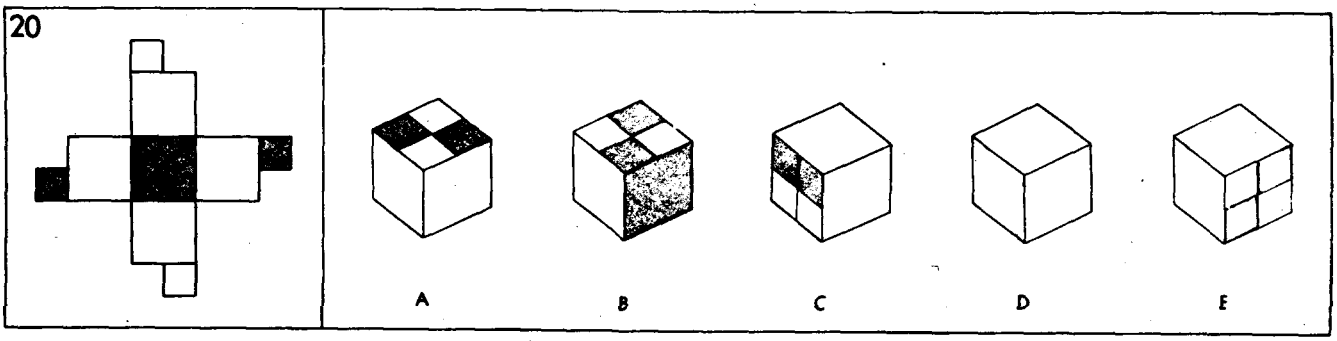

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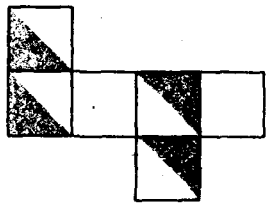

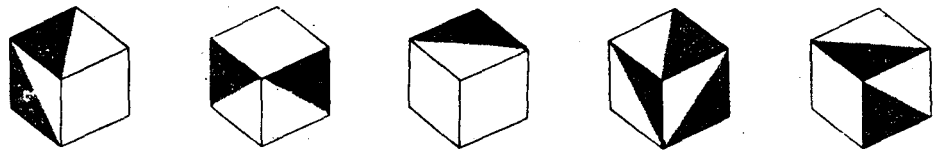

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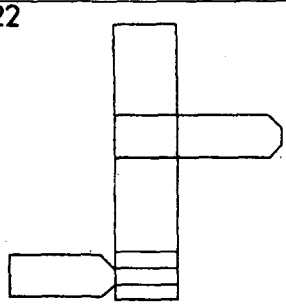

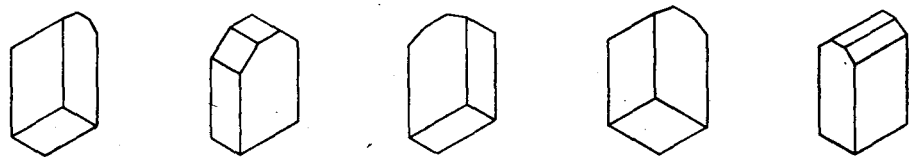

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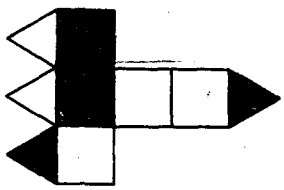

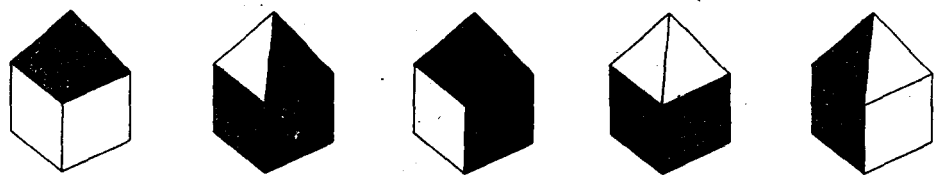

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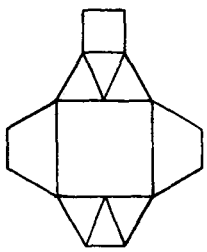

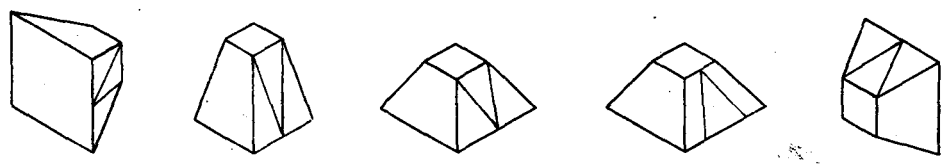

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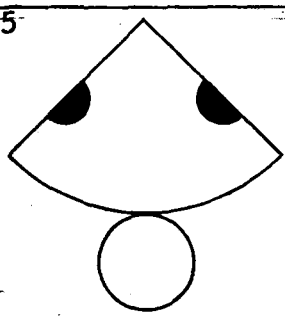

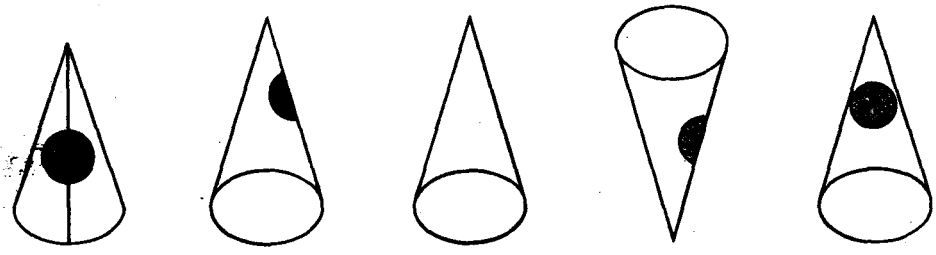

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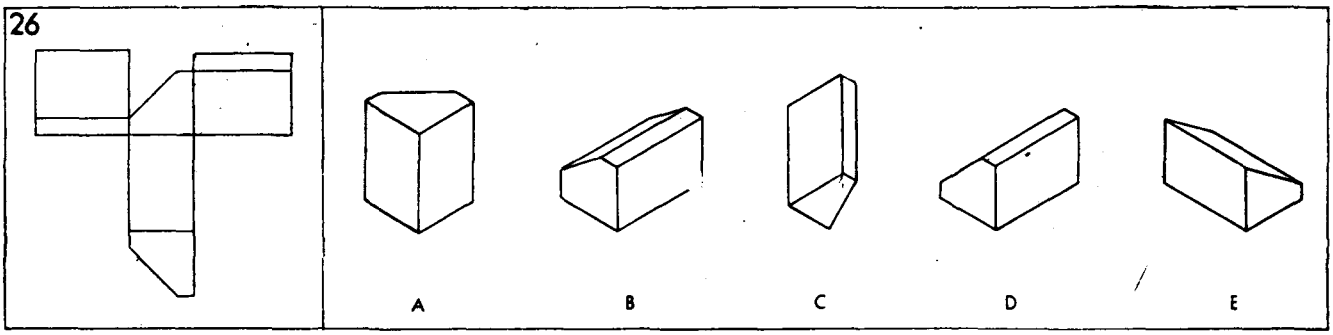

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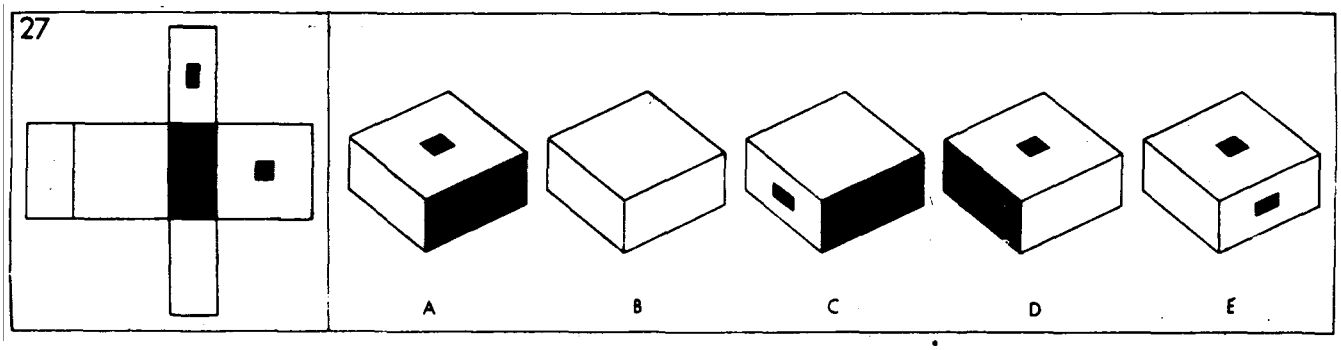

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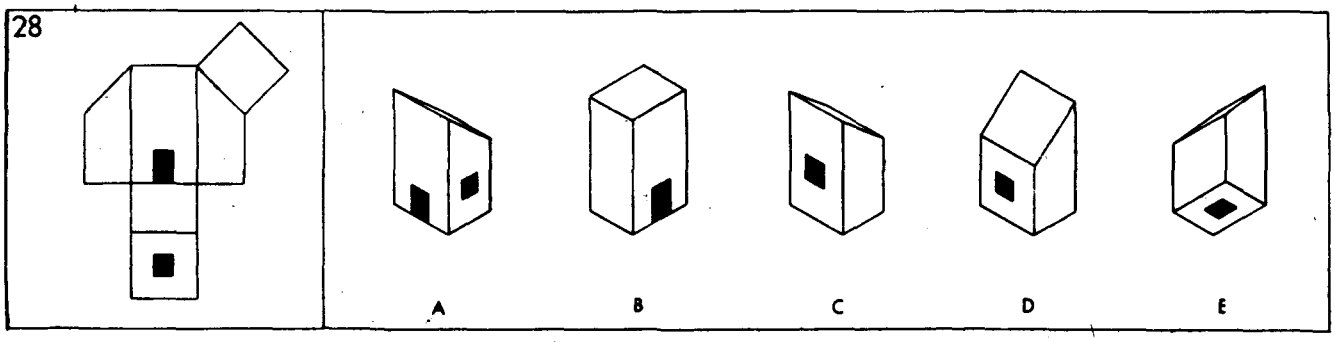

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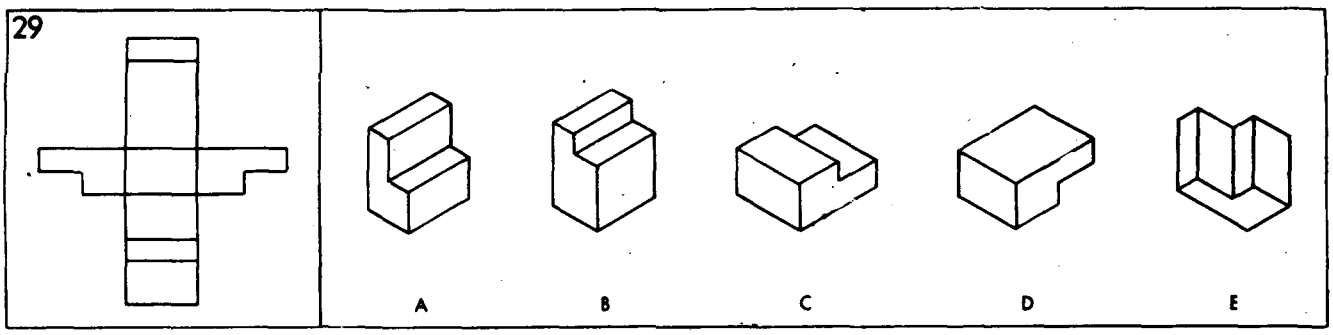

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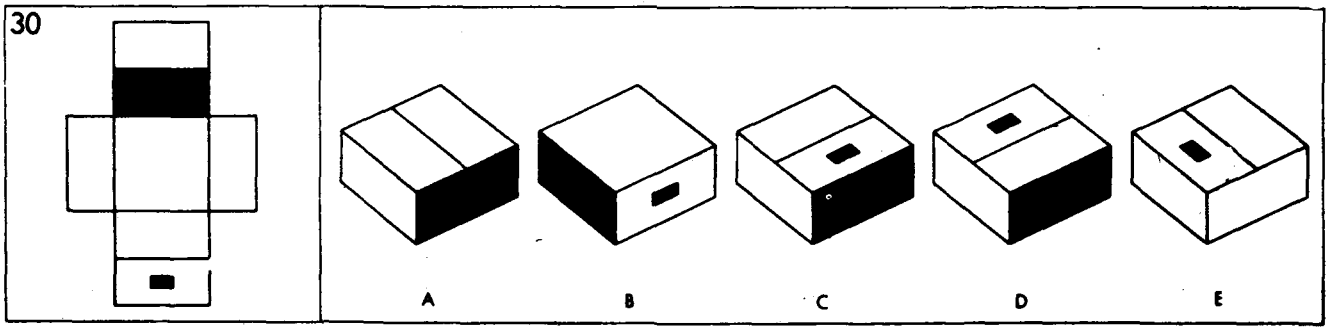

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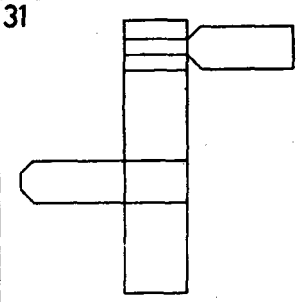

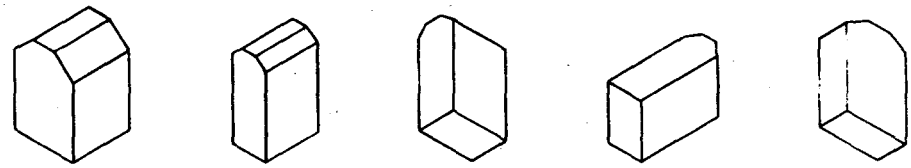

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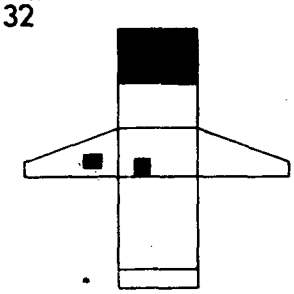

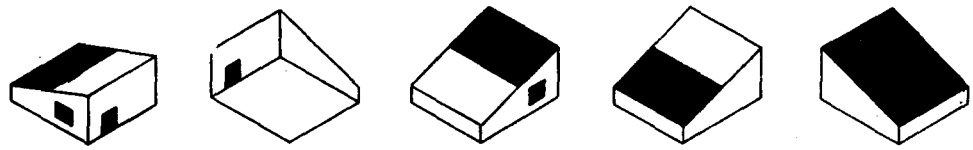

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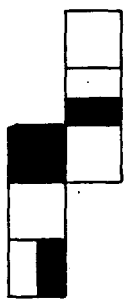

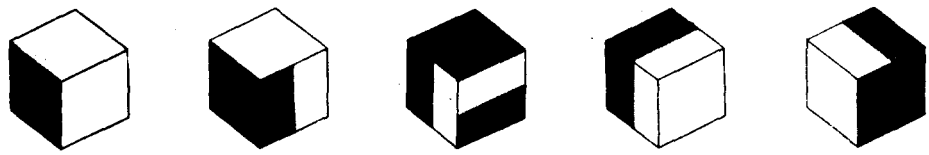

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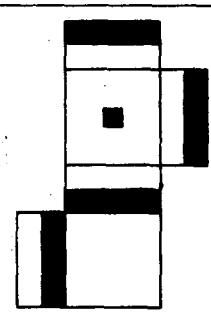

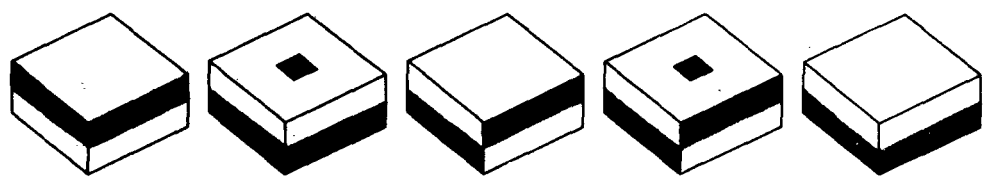

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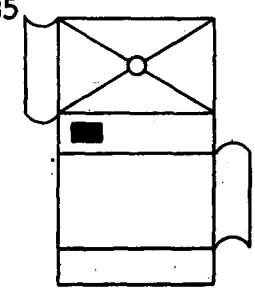

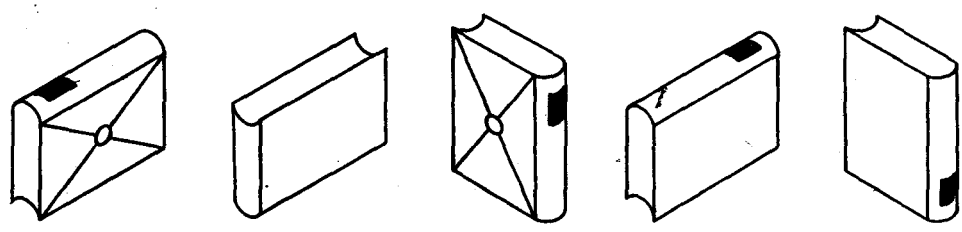

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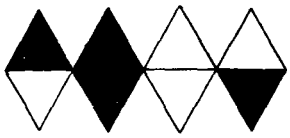

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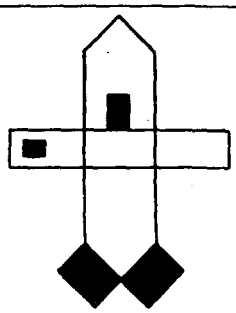

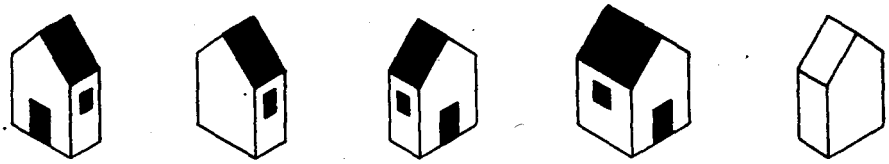

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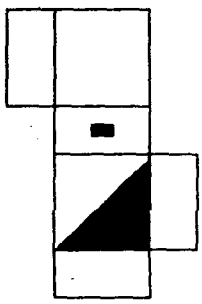

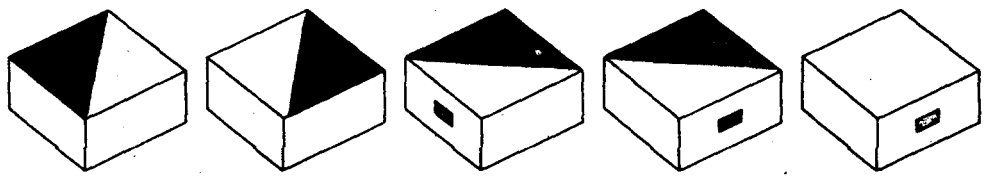

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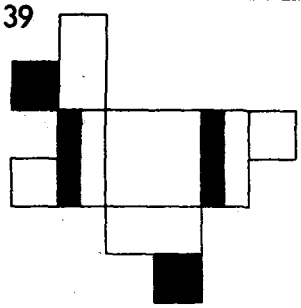

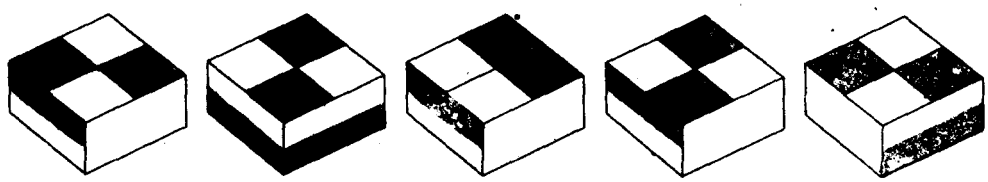

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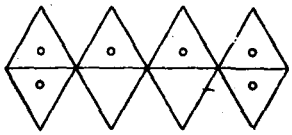

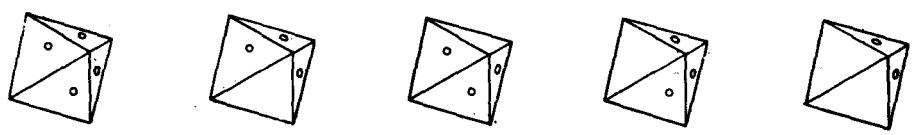

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Jr.-Sr.

HSPQ

FORM A

1968 Edition

APPENDIX XI

WHAT TO DO: You have a Booklet and an Answer Sheet. Write your name, age, etc., on the Answer Sheet where it tells you to.

The Booklet before you has in it questions about your interests and your likes and dislikes. Although you are to read the questions in *this* Booklet, *you must put your answers on the Answer Sheet,* making sure that the number of your answer *matches* the number of the question in the Booklet.

First, we shall give you two examples so that you will know exactly what to do. After each of the questions there are three answers. Read the following examples and fill in the right boxes where it says Example 1 and Example 2, on the Answer Sheet, below your name. Fill in the left-hand box if your answer choice is the "a" answer, the middle box if your choice is the "b" answer, and the right-hand box if you choose the "c" answer.

EXAMPLES:

1. Which would you rather do:
   a. visit a zoo,
   b. uncertain,
   c. go up in an airplane?

2. If you have a quarrel, do you make friends again quickly?
   a. yes, b. in between, c. no.

As you see from these examples, there are *usually* no right or wrong answers, although sometimes a correct answer is expected. Each person is different and you should say only what is true for *you*. You can always find one answer that suits you a *little* better than the others, so never leave a question without marking one of the answers.

Inside you will find more questions like the ones above. When you are told to turn the page, begin with number 1 and go on until you finish all the questions. In answering them, please keep these four points in mind:

1. Answer the questions frankly and truthfully. There is no advantage in giving an untrue answer about yourself because you think it is the "right thing to say."

2. Answer the questions as quickly as you can. Don't spend too much time thinking about them. Give the first, natural answer that comes to you. Some questions may seem much like others, but no two are exactly alike so your answers will often be different too.

3. Use the middle answer *only* when it is *absolutely impossible* to decide on one of the other choices. In other words, the "a" or the "c" answer should be used *most* of the time.

4. Don't skip any questions. Sometimes a statement may not seem to apply to you, but answer every question, somehow.

If there is anything you don't understand, please ask your questions now. If you have no question now, but later on come across a word you don't know, ask the examiner then.

DO NOT TURN PAGE UNTIL TOLD TO DO SO

1. Have you understood the instructions?
   a. yes, b. uncertain, c. no.

2. At a picnic would you rather spend some time:
   a. exploring the woods alone,
   b. uncertain,
   c. playing around the campfire with the crowd?

3. In a group discussion, do you like to tell what you think?
   a. yes, b. sometimes, c. no.

4. When you do a foolish thing, do you feel so bad that you wish the earth would just swallow you up?
   a. yes, b. perhaps, c. no.

5. Do you find it easy to keep an exciting secret?
   a. yes, b. sometimes, c. no.

6. When you decide something, do you:
   a. wonder if you may want to change your mind,
   b. in between,
   c. feel sure you're satisfied with it?

7. Can you work hard on something, without being bothered if there's a lot of noise around you?
   a. yes, b. perhaps, c. no.

8. If friends' ideas differ from yours, do you keep from saying yours are better, so as not to hurt their feelings?
   a. yes, b. sometimes, c. no.

9. Do you usually ask someone else to help you when you have a hard problem?
   a. seldom, b. sometimes, c. often.

10. Would you say that *some* rules and regulations are stupid and out of date?
    a. yes, and I don't bother with them if I can help it,
    b. uncertain,
    c. no, most rules are necessary and should be obeyed.

11. Which of these says better what you are like?
    a. a dependable leader,
    b. in between,
    c. charming, good looking.

12. Do you sometimes feel, before a big party or outing, that you are not so interested in going?
    a. yes, b. perhaps, c. no.

13. When you rightly feel angry with people, do you think it's all right for you to shout at them?
    a. yes, b. perhaps, c. no.

14. When classmates play a joke on you, do you usually enjoy it as much as others without feeling at all upset?
    a. yes, b. perhaps, c. no.

15. Are there times when you think, "People are so unreasonable, they can't even be trusted to look after their own good"?
    a. true, b. perhaps, c. false.

16. Can you stay cheerful even when things go wrong?
    a. yes, b. uncertain, c. no.

17. Do you try to keep up with the fads of your classmates?
    a. yes, b. sometimes, c. no.

18. Do most people have more friends than you do?
    a. yes, b. uncertain, c. no.

19. Would you rather be:
    a. a traveling TV actor,
    b. uncertain,
    c. a medical doctor?

20. Do you think that life runs more smoothly and more satisfyingly for you than for many other people?
    a. yes, b. perhaps, c. no.

21. Do you have trouble remembering someone's joke well enough to tell it yourself?
    a. yes, b. sometimes, c. no.

22. Have you enjoyed being in drama, such as school plays?
a. yes, b. uncertain, c. no.

23. "Mend" means the same as:
a. repair, b. heal, c. patch.

24. "Truth" is the opposite of:
a. fancy, b. falsehood, c. denial.

25. Do you completely understand what you read in school?
a. yes, b. usually, c. no.

26. When chalk screeches on the blackboard does it "give you the shivers"?
a. yes, b. perhaps, c. no.

27. When something goes all wrong, do you get very angry with people before you start to think what can be done about it?
a. often, b. sometimes, c. seldom.

28. When you finish school, would you like to:
a. do something that will make people like you, though you are poor,
b. uncertain,
c. make a lot of money?

29. Do you avoid going into narrow caves or climbing to high places?
a. yes, b. sometimes, c. no.

30. Are you always ready to show, in front of everyone, how well you can do things compared with others?
a. yes, b. perhaps, c. no.

31. Do you ask advice from your parents about the best things to do at school?
a. often, b. sometimes, c. seldom.

32. Can you talk to a group of strangers without stammering a little or without finding it hard to say what you want to?
a. yes, b. perhaps, c. no.

33. Do some types of movies upset you?
a. yes, b. perhaps, c. no.

34. Would you enjoy more watching a boxing match than a beautiful dance?
a. yes, b. perhaps, c. no.

35. If someone has been unkind to you, do you soon trust him again and give him another chance?
a. yes, b. perhaps, c. no.

36. Do you sometimes feel you are not much good, and that you never do anything worthwhile?
a. yes, b. perhaps, c. no.

37. When a group of people are doing something, do you:
a. take an active part in what they are doing,
b. in between,
c. usually only watch?

38. Do you tend to be quiet when out with a group of friends?
a. yes, b. sometimes, c. no.

39. Do people say you are a person who can always be counted on to do things exactly and properly?
a. yes, b. perhaps, c. no.

40. When you read an adventure story, do you:
a. just enjoy the story as it goes along,
b. uncertain,
c. get bothered whether it's going to end happily?

41. Does it bother you if you have to sit still and wait for something to begin?
a. yes, b. in between, c. no.

42. Do you feel hurt if people borrow your things without asking you?
a. yes, b. perhaps, c. no.

43. "Firm" is the opposite of:
a. easy, b. kind, c. loose.

44. "Rich" is to "money" as "sad" is to:
a. trouble, b. friends, c. land.

45. Have you always got along really well with your parents, brothers, and sisters?
a. yes, b. in between, c. no.

46. If your classmates leave you out of a game, do you:
a. think it just an accident,
b. in between,
c. feel hurt and angry?

47. Do people say you are sometimes excitable and scatterbrained though they think you are a fine person?
a. yes, b. perhaps, c. no.

48. When you are on a bus or train, do you talk:
a. in your ordinary voice,
b. in between,
c. as quietly as possible?

49. Which would you rather be:
a. the most popular person in school,
b. uncertain,
c. the person with the best grades?

50. In a group of people, are you generally one of those who tells jokes and funny stories?
a. yes, b. perhaps, c. no.

51. Do you like to tell people to follow proper rules and regulations?
a. yes, b. sometimes, c. no.

52. Are your feelings easily hurt?
a. yes, b. perhaps, c. no.

53. In a play, would you rather act the part of a famous teacher of art than that of a tough pirate?
a. yes, b. perhaps, c. no.

54. Which course would you rather take:
a. practical mathematics,
b. uncertain,
c. foreign language or drama?

55. Would you rather spend free time:
a. by yourself, on a book or stamp collection,
b. uncertain,
c. working under others in a group project?

56. Do you feel that you are getting along well, and that you do everything that could be expected of you?
a. yes, b. perhaps, c. no.

57. Do you have trouble acting like or being like other people expect you to be?
a. yes, b. uncertain, c. no.

58. If you found you had nothing to do some evening, would you:
a. call up some friends and do something with them,
b. not sure,
c. read a good book or work on a hobby?

59. Would you like to be extremely good-looking, so that people would notice you wherever you go?
a. yes, b. perhaps, c. no.

60. When something important is coming up, such as a test or a big game, do you:
a. stay very calm and relaxed,
b. in between,
c. get very tense and worried?

61. If someone puts on noisy music while you are trying to work, do you feel you *must* get away?
a. yes, b. perhaps, c. no.

62. In dancing or music, do you pick up a new rhythm easily?
a. yes, b. sometimes, c. no.

63. "Run" is to "pant" as "eat" is to:
a. exercise, b. indigestion, c. sleep.

64. If Joan's mother is my father's sister, what relation is Joan's father to my brother?
a. second cousin, b. grandfather, c. uncle.

65. Do you often make big plans and get excited about them, only to find that they just won't work out?
a. yes, b. occasionally, c. no.

66. When things go wrong and upset you, do you believe in:
a. just smiling,
b. in between,
c. making a fuss?

67. Do you often remember things differently from other people, so that you have to disagree about what really happened?
a. yes, b. perhaps, c. no.

68. Are there times when you feel so pleased with the world that you just have to sing and shout?
a. yes, b. perhaps, c. no.

69. When you are ready for a job, would you like one that:
a. is steady and safe, even if it takes hard work,
b. uncertain,
c. has lots of change and meetings with lively people?

70. Do you like doing really unexpected and startling things to people?
a. yes, b. once in a while, c. no.

71. If everyone were doing something you think is wrong, would you:
a. go along with them,
b. uncertain,
c. do what you think is right?

72. Can you work just as well, without feeling uncomfortable, when people are watching you?
a. yes, b. perhaps, c. no.

73. Would you rather spend a free afternoon:
a. in a place with beautiful pictures and gardens,
b. uncertain,
c. in a duck shooting match?

74. Would you rather spend an afternoon by a lake:
a. watching dangerous speed boat racing,
b. uncertain,
c. walking by the lovely shore with a friend?

75. When you are in a group, do you spend more time:
a. enjoying the friendship,
b. uncertain,
c. watching what happens?

76. Can you always tell what your real feelings are, for example, whether you are tired or just bored?
a. yes, b. perhaps, c. no.

77. When things are going wonderfully, do you:
a. actually almost "jump with joy,"
b. uncertain,
c. feel good inside, while appearing calm?

78. Would you rather be:
a. a builder of bridges,
b. uncertain,
c. a member of a traveling circus?

79. When something is bothering you a lot, do you think it's better to:
a. try to ignore it until you cool off,
b. uncertain,
c. blow off steam?

80. Do you sometimes say silly things, just to see what people will say?
a. yes, b. perhaps, c. no.

81. When you do poorly in an important game, do you:
a. say, "This is just a game,"
b. uncertain,
c. get angry and "kick yourself"?

82. Do you go out of your way to avoid crowded buses and streets?
a. yes, b. perhaps, c. no.

83. "Usually" means the same as:
a. sometimes, b. always, c. generally.

84. The grandmother of the daughter of my brother's sister is my:
a. mother, b. sister-in-law, c. niece.

85. Are you almost always contented?
a. yes, b. in between, c. no.

86. If you keep breaking and accidentally wasting things when you are making something, do you keep calm just the same?
a. yes, b. perhaps, c. no, I get furious.

87. Have you ever felt dissatisfied and said to yourself, "I bet I could run this school better than the teachers do"?
a. yes, b. perhaps, c. no.

88. Would you rather be:
a. someone who plans homes and parks,
b. uncertain,
c. a singer or member of a dance band?

89. If you had a chance to do something really wild and adventurous, but also rather dangerous, would you:
a. probably not do it,
b. not sure,
c. certainly do it?

90. When you have homework to do, do you:
a. very often just not do it,
b. in between,
c. always get it done on time?

91. Do you usually discuss your activities with your parents?
a. yes, b. sometimes, c. no.

92. When the class is discussing something, do you usually have something to say?
a. almost never,
b. once in a while,
c. always.

93. Do you stand up before your class without looking nervous and ill-at-ease?
a. yes, b. perhaps, c. no.

94. Which would you rather watch on a fine evening:
a. car racing,
b. uncertain,
c. an open-air musical play?

95. Have you ever thought what you would do if you were the only person left in the world?
a. yes, b. not sure, c. no.

96. Do you learn games quickly?
a. yes, b. in between, c. no.

97. Do you wish you could learn to be more carefree and lighthearted about your school work?
a. yes, b. perhaps, c. no.

98. Are you, like a lot of people, slightly afraid of lightning?
a. yes, b. perhaps, c. no.

99. Do you ever suggest to the teacher a new subject for the class to discuss?
a. yes, b. perhaps, c. no.

100. Would you rather spend a break between morning and afternoon classes in:
a. a card game,
b. uncertain,
c. catching up on homework?

101. When you are walking in a quiet street in the dark, do you often get the feeling you are being followed?
a. yes, b. perhaps, c. no.

102. In talking with your classmates, do you dislike telling your most private feelings?
a. yes, b. sometimes, c. no.

103. When you go into a new group, do you:
a. quickly feel you know everyone,
b. in between,
c. take a long time to get to know people?

104. Look at these five words: *mostly, gladly, chiefly, mainly, highly.* The word that does not belong with the others is:
a. mostly, b. gladly, c. highly.

105. Do you sometimes feel happy and sometimes feel depressed without real reason?
a. yes, b. uncertain, c. no.

106. When people around you laugh and talk while you are listening to radio or TV:
a. are you happy,
b. in between,
c. does it spoil things and annoy you?

107. If you accidentally say something odd in company, do you stay uncomfortable a long time and find it hard to forget?
a. yes, b. perhaps, c. no.

108. Which would you rather read about:
a. how to win at basketball,
b. uncertain,
c. how to be nice to everyone?

109. Are you best thought of as a person who:
a. thinks, b. in between, c. acts?

110. Do you spend most of your weekly allowance for fun (instead of saving some for future needs)?
a. yes, b. perhaps, c. no.

111. Do other people often get in your way?
a. yes, b. in between, c. no.

112. How would you rate yourself?
a. inclined to be moody,
b. in between,
c. not at all moody.

113. How often do you go places or do things with a group of friends:
a. very often, b. sometimes, c. hardly ever.

114. What kind of movie do you like best?
a. musicals, b. uncertain, c. war stories.

115. Do you get in trouble more often by saying to a group that wants to do something:
a. "Let's go!"
b. uncertain,
c. "I'd rather not join in"?

116. When you were growing up, did you expect the world to be:
a. kinder and more considerate than it is,
b. uncertain,
c. tougher and harder than it is?

117. Do you find it easy to go up and introduce yourself to an important person?
a. yes, b. perhaps, c. no.

118. Do you think that often a committee of your classmates takes more time and makes poorer decisions than one person would?
a. yes, b. perhaps, c. no.

119. Do you feel you are doing pretty much what you should be doing in life?
a. yes, b. uncertain, c. no.

120. Do you sometimes feel so mixed up that you don't know what you are doing?
a. yes, b. perhaps, c. no.

121. When someone is disagreeing with you, do you:
a. let him say all he has to say,
b. uncertain,
c. tend to interrupt before he finishes?

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122. Would you rather live:
a. in a deep forest, with only the song of birds,
b. uncertain,
c. on a busy street corner, where a lot happens?

123. If you were to work on a railroad, would you rather:
a. be a conductor and talk to the passengers,
b. uncertain,
c. be the engineer and run the train?

124. Look at these five words: *below, beside, above, behind, between.* The word that does not belong with the others is:
a. below, b. between, c. beside.

125. If someone asks you to do a new and difficult job, do you:
a. feel glad and show what you can do,
b. in between,
c. feel you will make a mess of it?

126. When you raise your hand to answer a question in class, and many others raise their hands too, do you get excited?
a. sometimes, b. not often, c. never.

127. Would you rather be:
a. a teacher, b. uncertain, c. a scientist?

128. On your birthday, do you prefer:
a. to be asked beforehand to choose the present you want,
b. uncertain,
c. to have the fun of getting a present that's a complete surprise?

129. Are you very careful not to hurt anyone's feelings or startle anyone, even in fun?
a. yes, b. perhaps, c. no.

130. If you were working with groups in class, would you rather:
a. walk around to carry things from one person to another,
b. uncertain,
c. specialize in showing people how to do one difficult part?

131. Do you take trouble to be sure you are right before you say anything in class?
a. always, b. generally, c. not usually.

132. Are you so afraid of what might happen that you avoid making decisions one way or the other?
a. often, b. sometimes, c. never.

133. When things are frightening, can you laugh and not be bothered?
a. yes, b. perhaps, c. no.

134. Do some books and plays almost make you cry?
a. yes, often, b. sometimes, c. no, never.

135. Would you like better, when in the country:
a. running a class picnic,
b. uncertain,
c. learning to know all the different trees in the woods?

136. In group discussions, do you often find yourself:
a. taking a lone stand,
b. uncertain,
c. agreeing with the group?

137. Do your feelings get so bottled up that you feel you could burst?
a. often, b. sometimes, c. seldom.

138. Which kind of friends do you like? Those who like to:
a. "kid around,"
b. uncertain,
c. be more serious?

139. If you were not a human being, would you rather be:
a. an eagle on a far mountain,
b. uncertain,
c. a seal, in a seal colony by the seashore?

140. Are you usually a very careful person?
a. yes, b. in between, c. no.

141. Do small troubles sometimes "get on your nerves" even though you know that they are not very important?
a. yes, b. perhaps, c. no.

142. Are you sure you have answered *every* question?
a. yes, b. perhaps, c. no.

APPENDIX XII

RAW SCORES OBTAINED BY THE SAMPLE ON ALL THE EIGHT TOOLS

Student No.	Achievement Test in Mathematics	Attitude Scale	Educational Aspiration Scale	Occupational Aspiration Scale	Numerical Ability Test	Abstract Reasoning Test	Space Relations Test	14 High School Personality Questionnaire Factors													
								A	B	C	D	E	F	G	H	I	J	O	Q_2	Q_3	Q_4
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1.	16	69	45	57	37	62	52	11	7	10	8	9	8	14	13	8	12	7	8	18	10
2.	13	52	53	65	24	18	45	10	6	7	8	9	9	12	11	12	9	6	11	7	9
3.	22	66	37	31	25	32	30	11	2	8	12	5	12	11	10	13	6	7	12	12	12
4.	19	49	35	56	11	18	47	10	4	8	11	9	9	11	13	14	10	11	9	12	5
5.	18	70	57	56	14	14	35	13	5	11	13	10	7	13	7	16	9	9	14	14	14
6.	23	71	38	64	13	29	52	13	3	9	17	13	5	9	7	17	6	7	8	8	12
7.	20	61	34	48	20	20	22	2	5	12	11	13	8	15	13	10	6	2	11	13	4
8.	14	67	28	55	11	34	54	11	6	11	9	9	11	11	10	13	14	7	13	12	13

Appendix XII (Contd.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
9.	17	70	39	63	14	33	34	16	4	14	9	8	11	18	12	14	6	8	9	16	12
10.	21	62	40	55	21	29	44	3	6	11	9	13	10	16	9	9	10	15	9	9	17
11.	25	69	36	59	26	39	70	11	8	12	14	6	6	12	13	15	10	6	9	16	7
12.	12	49	20	57	17	28	46	19	5	11	17	6	11	15	14	9	12	9	12	15	6
13.	19	37	39	65	23	25	37	18	4	11	9	11	15	10	11	7	4	8	6	13	6
14.	13	66	57	31	26	32	40	9	5	15	16	14	7	10	11	10	11	7	5	16	10
15.	16	45	39	37	29	32	65	7	6	10	9	9	12	13	12	10	12	15	14	9	6
16.	27	46	36	52	15	34	17	8	4	10	12	11	10	11	13	14	9	16	9	12	13
17.	19	65	32	58	33	40	48	10	8	13	15	7	5	11	6	12	8	10	8	10	13
18.	10	46	36	41	19	27	66	8	6	11	12	14	10	11	14	12	8	7	7	6	14
19.	13	58	47	32	25	32	25	14	4	12	9	8	11	12	11	15	13	9	8	11	11
20.	19	80	42	54	29	38	34	8	9	11	14	12	11	11	9	10	13	14	16	9	15
21.	22	52	35	58	10	19	50	14	1	11	6	5	9	12	8	10	9	8	14	7	8
22.	17	63	32	34	17	37	61	13	5	10	13	7	7	11	11	16	6	13	11	9	12
23.	14	61	23	51	20	31	46	10	8	7	14	8	12	10	8	12	7	9	10	14	8
24.	18	53	34	48	24	32	51	14	6	9	11	6	8	14	12	12	7	11	12	11	10

Appendix XII (Contd.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
25.	15	53	48	33	27	33	36	13	5	9	5	4	10	14	11	13	13	7	9	7	8
26.	12	57	38	39	14	14	51	8	4	3	10	10	9	12	8	9	11	9	13	9	11
27.	17	67	36	59	19	31	29	17	2	13	12	13	11	10	5	15	11	12	10	10	15
28.	21	63	31	56	24	36	46	9	6	14	10	11	6	8	13	14	12	10	9	15	11
29.	15	61	27	51	15	29	46	9	4	14	8	8	9	18	11	11	6	9	10	12	9
30.	27	64	33	53	24	35	44	11	6	15	12	11	9	9	12	13	10	11	11	15	11
31.	19	55	45	58	22	34	40	7	4	8	10	13	11	9	6	16	8	9	10	11	8
32.	19	62	47	60	29	38	64	7	7	12	15	14	10	11	9	12	7	8	12	7	10
33.	16	70	35	62	23	39	68	13	7	8	14	7	11	20	6	12	9	8	15	13	11
34.	21	67	43	52	32	37	70	11	7	8	12	5	11	14	12	17	17	13	12	10	15
35.	22	83	38	53	31	35	64	8	7	14	12	4	7	10	8	8	10	4	6	7	8
36.	16	70	25	49	28	31	55	8	6	10	13	10	8	17	6	6	10	11	14	14	13
37.	27	81	30	46	30	43	75	12	5	10	6	4	10	16	18	16	2	9	10	12	2
38.	19	59	34	56	30	38	71	6	7	6	12	8	9	12	10	16	9	12	13	3	15
39.	29	84	41	61	32	40	73	13	9	14	11	4	7	14	13	14	11	9	6	11	16
40.	24	80	24	46	30	44	67	6	3	10	12	5	8	11	7	9	9	8	8	12	14

Appendix XII (Contd.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
41.	15	67	21	66	27	30	68	16	8	8	14	8	6	12	10	12	12	11	10	11	13
42.	11	61	34	47	20	24	47	15	3	10	8	10	10	12	9	9	9	12	11	12	10
43.	16	66	23	61	29	38	70	12	7	11	16	8	7	12	8	16	9	13	11	10	13
44.	21	53	25	62	28	38	68	15	7	10	14	15	9	9	8	18	10	10	15	10	13
45.	23	69	31	50	31	41	70	6	7	9	11	8	4	12	6	15	11	14	10	8	8
46.	18	68	43	63	23	39	68	12	7	14	13	4	12	16	7	16	15	9	12	16	16
47.	22	68	42	50	32	38	70	13	6	7	12	6	11	14	14	17	15	12	11	10	17
48.	18	44	29	62	25	35	67	6	8	11	11	9	8	12	12	15	11	9	13	12	14
49.	14	75	17	33	33	29	39	9	7	8	13	8	6	19	9	6	14	10	14	14	8
50.	15	67	44	55	30	19	51	11	8	15	8	2	9	8	9	8	4	5	4	6	16
51.	21	69	51	59	29	36	59	6	9	10	18	12	9	10	9	9	10	9	15	12	13
52.	17	72	48	62	33	44	73	14	8	11	12	4	13	14	10	12	6	9	9	12	10
53.	25	81	36	63	35	42	56	12	7	12	13	7	14	13	14	11	8	13	11	13	16
54.	19	63	46	44	26	34	37	10	6	7	17	12	9	9	9	3	11	10	10	9	14
55.	18	60	37	40	13	36	63	9	8	10	11	7	13	10	14	19	13	10	13	7	12
56.	27	76	23	44	37	46	36	9	6	8	9	10	11	10	10	6	11	12	9	10	8

Appendix XII (Contd.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
57.	16	68	42	57	28	34	61	11	6	13	11	11	12	10	15	15	9	7	12	12	5
58.	23	61	34	47	28	37	57	10	9	10	10	12	8	17	15	15	8	11	10	13	14
59.	21	49	25	41	26	36	39	12	7	12	14	6	8	11	10	13	10	11	8	11	10
60.	14	58	36	40	27	41	53	15	8	14	12	9	13	10	10	11	12	9	8	8	14
61.	18	60	31	59	29	35	52	9	5	10	11	10	5	17	8	11	6	13	8	13	14
62.	16	69	19	63	29	41	45	15	8	16	14	8	9	14	13	8	11	7	11	14	14
63.	12	46	32	53	20	34	23	16	7	12	12	6	12	19	12	17	10	11	12	13	8
64.	22	52	43	49	23	27	33	10	3	9	12	13	12	16	9	14	9	9	13	12	7
65.	18	67	32	67	17	38	43	8	6	8	17	7	9	14	16	12	13	8	12	14	11
66.	19	70	44	49	26	37	36	8	7	12	13	5	9	15	8	11	12	9	9	12	11
67.	21	68	45	59	26	31	45	11	6	12	9	10	5	14	12	15	11	11	10	11	13
68.	19	68	43	57	25	38	37	7	10	8	14	8	12	14	11	8	11	10	11	14	11
69.	21	75	18	59	29	36	51	11	10	12	14	10	7	16	12	17	11	10	6	15	9
70.	16	56	45	43	14	17	41	13	4	13	12	5	9	12	5	16	11	13	11	11	9
71.	23	52	30	61	19	13	45	13	5	11	11	12	9	13	15	12	12	9	12	15	9
72.	29	61	32	65	28	38	51	7	9	12	12	4	11	13	10	9	9	9	12	14	13

Appendix XII (Contd.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
73.	19	60	34	47	22	40	31	8	10	15	10	9	7	15	13	10	8	9	13	9	14
74.	17	57	35	59	21	32	39	14	7	14	9	12	12	12	13	14	13	6	12	14	6
75.	19	69	34	41	28	43	41	7	10	9	14	6	12	11	9	1	12	13	12	12	8
76.	24	80	44	54	32	40	45	10	10	14	6	6	7	17	12	9	8	10	13	16	12
77.	19	64	24	62	28	33	25	7	8	14	11	8	7	10	10	11	9	6	11	10	11
78.	23	69	28	59	28	38	38	14	9	11	11	4	10	16	7	16	9	5	11	10	12
79.	22	62	21	54	25	34	42	5	6	7	9	7	8	12	7	14	7	9	9	12	14
80.	17	63	26	62	30	39	60	11	10	5	15	6	8	11	7	13	9	15	10	6	17
81.	16	61	23	67	30	39	55	17	10	8	16	2	8	11	7	13	9	15	8	13	9
82.	13	49	36	63	25	35	26	11	9	12	12	10	9	10	12	12	12	11	8	14	6
83.	18	55	26	51	23	25	33	8	6	13	8	11	13	13	14	15	13	5	12	16	3
84.	30	68	30	65	29	38	44	8	7	13	6	11	13	13	15	14	13	5	12	14	5
85.	23	38	43	56	25	38	47	9	6	10	13	10	10	11	10	11	5	13	8	13	8
86.	19	69	31	67	29	38	46	5	6	6	13	8	10	11	10	11	11	7	13	14	11
87.	25	57	31	22	21	32	32	9	6	12	7	5	12	12	9	12	6	8	10	9	9
88.	17	43	29	44	14	25	14	6	8	8	13	8	11	12	12	7	11	9	12	9	13

Appendix XII (Contd.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
89.	21	70	46	65	27	37	43	11	8	10	13	5	11	12	9	12	9	10	13	9	8
90.	15	55	24	49	21	35	48	13	9	8	12	6	2	15	8	16	8	10	12	11	18
91.	31	61	28	54	23	38	67	10	4	13	14	12	13	11	8	11	9	7	8	12	8
92.	32	62	40	41	21	33	44	8	3	12	9	4	5	10	11	9	9	8	14	7	7
93.	21	75	35	71	30	34	55	5	7	15	12	9	7	14	7	7	13	9	14	13	10
94.	24	70	23	65	32	29	61	10	9	14	13	9	9	15	13	9	9	8	11	12	8
95.	20	70	16	67	29	38	62	15	5	12	3	11	9	15	9	3	4	8	12	8	7
96.	21	72	19	70	30	27	21	8	10	7	15	10	11	13	13	12	11	11	10	11	12
97.	25	60	43	37	17	23	46	11	3	11	8	4	13	9	9	8	9	5	10	6	11
98.	20	53	34	44	32	27	24	12	7	8	10	12	8	14	8	10	10	13	5	5	14
99.	24	67	33	47	25	36	50	5	6	10	7	2	10	15	13	16	12	13	10	9	11
100.	11	54	45	40	25	17	51	8	6	11	14	8	13	13	6	8	9	10	10	11	13
101.	15	62	42	49	23	24	34	12	7	13	8	9	12	9	4	12	9	12	7	9	11
102.	30	68	44	44	29	43	62	16	8	9	17	4	9	12	8	12	11	12	8	7	13
103.	10	69	21	64	28	33	40	7	8	15	9	13	14	9	13	15	9	8	10	17	17
104.	19	81	35	71	29	29	53	3	6	10	8	8	6	12	12	7	8	13	17	10	12

Appendix XII (Contd.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
105.	21	64	38	68	29	37	57	11	7	13	8	13	9	10	11	8	9	12	9	16	9
106.	24	63	33	47	31	35	46	13	6	16	15	13	12	14	6	8	9	9	13	10	14
107.	27	61	45	50	24	37	61	9	7	9	13	7	11	9	6	11	7	16	9	13	14
108.	10	70	22	61	26	27	37	8	9	9	13	10	9	14	12	13	11	8	10	14	11
109.	21	68	50	65	29	37	58	12	9	12	8	9	13	10	13	8	13	11	11	12	9
110.	20	67	24	59	32	28	51	4	7	14	14	5	6	11	5	10	9	9	7	12	11
111.	24	66	34	43	31	31	54	8	9	16	10	8	10	15	16	12	8	6	10	9	7
112.	23	67	40	48	28	35	46	15	6	11	5	9	6	11	15	10	7	10	13	12	12
113.	29	70	29	57	28	32	35	12	7	14	5	10	8	14	11	8	12	10	11	12	9
114.	21	73	24	40	30	37	64	15	9	14	9	9	11	11	9	4	9	10	13	10	9
115.	19	67	26	49	31	35	44	14	9	13	11	8	8	15	11	5	9	10	12	9	9
116.	28	71	42	49	24	37	25	10	7	10	12	6	12	16	7	10	15	13	14	7	13
117.	26	62	26	46	21	19	52	12	6	8	13	5	8	13	7	10	15	11	8	8	13
118.	28	53	41	55	22	26	41	17	7	10	10	12	14	9	12	5	9	8	11	9	8
119.	19	66	25	50	29	35	41	9	3	14	13	8	4	9	10	11	4	15	12	13	11
120.	21	52	44	40	29	38	56	7	9	10	18	10	10	15	9	15	10	8	11	11	11
121.	17	65	29	60	24	35	50	8	3	10	6	12	13	11	10	12	10	6	10	12	13

Appendix XII (Contd.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
122.	24	53	35	49	34	14	31	9	8	12	9	8	7	14	8	13	6	10	8	9	9
123.	25	75	23	50	23	43	50	13	9	12	11	7	4	16	7	16	9	13	9	12	17
124.	28	69	16	50	27	36	37	7	8	10	13	2	10	12	12	11	8	12	9	10	11
125.	27	69	27	54	34	41	39	14	10	10	14	8	10	12	11	12	14	12	10	9	8
126.	24	67	41	53	28	37	83	15	7	9	11	12	14	10	11	9	11	3	11	12	13
127.	17	53	40	51	27	35	48	11	6	9	12	7	11	13	12	14	8	5	11	8	12
128.	28	72	31	58	28	42	46	13	8	16	11	5	8	15	14	9	9	11	15	16	9
129.	21	46	58	38	23	42	48	10	9	10	12	6	6	14	9	18	7	12	8	11	17
130.	14	63	25	61	22	37	26	10	5	9	9	7	6	9	11	15	8	8	10	13	12
131.	24	66	17	61	29	36	29	10	6	14	6	7	12	9	14	14	9	14	10	11	5
132.	26	70	49	52	32	40	34	15	9	7	11	9	7	18	17	9	12	4	13	14	5
133.	25	57	24	52	22	43	52	12	7	10	15	7	12	16	7	19	9	15	10	7	13
134.	26	66	41	33	26	39	53	14	6	10	13	10	12	15	12	11	10	13	8	11	13
135.	22	81	36	51	30	40	70	5	9	13	5	4	4	13	14	8	5	9	7	10	7
136.	23	61	25	50	24	38	56	13	6	11	13	8	7	11	9	12	10	11	12	14	9

Appendix XII (Contd.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
137.	25	62	34	65	29	42	43	14	9	12	15	9	10	14	8	4	12	9	14	11	18
138.	25	70	26	56	21	30	52	12	7	7	7	7	11	13	9	13	6	11	10	16	13
139.	23	63	52	50	24	42	39	11	5	10	12	7	9	11	8	11	14	11	13	14	7
140.	18	74	44	51	18	38	51	8	6	13	12	8	6	14	11	16	6	11	10	14	8
141.	25	68	20	53	28	40	46	11	9	11	4	9	9	11	16	11	5	9	16	12	8
142.	24	67	41	52	32	40	33	9	9	7	10	9	7	17	15	7	14	4	13	14	5
143.	24	72	30	53	23	38	45	12	4	10	6	9	11	9	14	14	11	6	12	12	7
144.	24	67	28	59	29	40	55	4	7	11	12	6	8	13	7	11	11	9	12	11	10
145.	19	48	25	62	21	40	52	14	6	12	9	8	11	10	9	11	12	12	10	11	11
146.	23	76	28	51	25	42	51	3	7	15	6	8	11	15	13	6	4	11	10	12	11
147.	19	80	29	68	32	43	47	13	8	15	11	5	6	15	14	10	10	10	13	16	8
148.	23	61	38	50	32	42	29	10	6	11	9	10	8	10	9	8	12	11	12	10	10
149.	17	64	43	52	27	37	55	5	9	10	10	11	4	12	13	12	9	4	12	17	5
150.	23	55	23	41	29	43	28	10	4	10	12	12	13	11	9	10	8	10	12	12	11
151.	26	70	32	43	27	39	58	11	8	15	8	11	13	19	15	5	8	5	9	14	2
152.	19	63	31	58	21	30	45	12	5	10	8	9	6	11	9	14	8	6	8	12	9

Appendix XII (Contd.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
153.	27	73	25	54	29	44	43	9	6	7	7	10	9	10	10	4	8	11	10	9	8
154.	25	75	43	60	26	38	60	5	9	14	5	6	5	15	15	6	5	8	12	11	5
155.	33	82	26	58	28	43	60	11	8	7	12	6	10	13	9	15	8	13	6	17	10
156.	27	62	38	49	28	43	45	8	7	7	11	8	9	11	12	7	9	14	15	10	15
157.	25	65	24	56	26	41	40	10	5	11	12	10	8	8	11	5	7	13	8	11	11
158.	24	69	28	59	23	40	50	13	10	9	14	13	4	13	5	14	11	13	9	9	17
159.	22	73	23	53	23	43	54	12	10	10	12	5	8	14	7	18	7	13	10	11	17
160.	17	57	33	50	19	23	37	10	4	12	11	10	11	13	12	15	9	9	11	10	10
161.	22	66	32	38	22	43	51	16	7	7	15	6	6	15	6	14	11	14	11	8	14
162.	28	59	54	41	30	39	65	5	9	14	7	6	5	13	13	8	7	8	12	13	7
163.	24	67	37	45	29	40	54	14	8	10	7	6	13	13	12	11	7	8	13	7	10
164.	23	63	26	59	29	38	30	9	3	14	12	3	11	11	12	11	12	10	6	13	16
165.	17	53	32	45	17	18	38	16	4	11	14	11	8	9	11	14	9	4	7	14	12
166.	29	63	30	54	31	41	44	16	8	11	18	7	15	13	11	12	14	4	7	5	15
167.	32	71	35	48	29	40	45	14	9	9	11	8	10	12	8	18	11	14	11	11	14
168.	32	74	28	63	29	44	56	15	9	10	12	5	9	13	11	17	10	12	14	14	11

Appendix XII (Contd.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
169.	20	51	37	67	22	30	34	10	8	13	16	6	9	12	12	15	9	13	13	9	17
170.	28	61	46	58	24	43	46	8	7	12	4	11	15	13	16	14	9	11	13	7	10
171.	19	70	35	64	27	38	53	9	5	14	12	9	9	13	9	13	11	11	11	13	10
172.	21	52	29	44	19	35	28	13	8	10	8	6	11	15	19	14	10	3	3	9	7
173.	18	67	23	59	27	11	49	8	4	12	8	6	10	11	13	18	7	12	10	10	2
174.	16	69	37	69	19	19	54	9	4	16	12	14	9	11	11	9	9	12	9	13	6
175.	14	68	49	41	26	25	49	7	1	8	10	6	10	9	9	6	13	9	9	13	12
176.	22	67	38	53	27	28	48	7	6	13	9	3	11	6	12	9	16	11	9	9	14
177.	16	70	37	43	22	27	54	4	2	14	10	13	8	6	10	14	8	10	8	11	10
178.	11	59	61	44	18	12	49	8	6	13	11	8	15	10	10	18	8	11	13	13	12
179.	13	54	43	44	26	27	46	13	6	8	10	10	11	13	2	14	9	11	12	12	12
180.	19	76	24	64	23	38	49	12	5	12	13	6	5	12	11	12	8	14	11	9	8
181.	14	67	19	60	28	27	45	12	5	6	9	11	12	11	12	14	13	10	6	9	14
182.	19	73	48	56	34	37	58	5	8	15	9	8	7	15	5	14	10	11	15	13	10
183.	15	70	28	59	29	30	38	12	5	10	2	9	13	10	8	14	11	8	11	8	13
184.	20	66	31	57	22	31	29	11	3	15	16	10	7	14	8	11	10	11	12	11	7

Appendix XII (Contd.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
185.	12	59	44	50	18	24	59	7	1	11	12	6	6	9	17	10	15	6	5	10	17
186.	14	66	40	63	25	28	50	7	5	11	11	11	11	10	5	11	11	9	13	12	13
187.	12	68	30	11	20	27	64	9	4	14	13	10	13	10	11	10	12	6	9	12	15
188.	16	81	45	67	28	36	48	7	4	11	8	10	10	12	12	9	13	8	9	7	10
189.	18	67	37	47	24	38	39	10	4	12	12	9	10	16	6	14	6	10	10	10	14
190.	12	71	25	52	22	23	49	11	10	12	15	9	8	10	8	16	14	9	10	11	11
191.	13	67	19	55	27	30	45	12	10	10	18	9	11	10	9	15	13	9	8	11	10
192.	21	63	31	61	25	29	39	5	2	6	18	9	11	12	15	8	10	11	7	12	13
193.	17	70	20	59	33	38	56	9	8	14	11	7	9	15	8	16	14	6	7	17	9
194.	13	64	37	44	24	37	48	11	2	13	11	12	10	8	16	8	11	13	10	11	10
195.	15	70	17	53	11	10	48	8	4	6	16	8	10	12	14	14	14	6	12	14	16
196.	19	75	56	55	13	30	59	2	7	12	11	11	8	10	8	16	11	3	12	11	10
197.	14	45	29	48	25	37	38	12	9	14	6	8	12	14	10	17	8	7	12	15	10
198.	21	64	33	48	27	33	50	8	4	12	6	11	10	14	12	9	7	11	14	12	8
199.	16	69	35	50	29	38	61	10	4	10	11	6	10	10	10	7	14	14	11	7	10
200.	20	83	35	51	24	39	54	13	9	15	11	4	9	13	14	16	10	8	9	11	7

Appendix XII (Contd.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
201.	16	45	29	40	23	39	37	10	7	10	18	8	4	11	4	14	6	12	16	18	14
202.	19	58	25	40	18	34	38	8	7	14	15	6	8	15	3	8	12	14	10	12	14
203.	19	62	39	59	26	29	45	12	5	16	12	10	12	12	13	10	9	6	8	14	10
204.	14	54	41	37	29	37	64	9	2	9	11	14	9	10	11	12	11	9	12	6	13
205.	18	69	41	52	26	32	58	13	6	11	6	5	9	8	11	17	12	11	9	6	12
206.	24	70	38	47	31	37	58	4	6	11	14	5	8	16	8	14	8	9	12	11	12
207.	15	54	46	61	21	31	61	15	9	10	11	8	9	9	10	17	12	12	6	8	13
208.	15	71	19	67	28	31	23	11	6	12	14	6	12	13	10	9	6	8	12	9	14
209.	21	82	29	65	30	33	60	7	9	12	14	2	7	17	13	15	12	7	6	12	8
210.	13	37	45	55	28	14	48	13	3	13	5	12	6	9	8	15	12	10	9	14	9
211.	29	70	26	49	30	38	69	8	7	10	16	7	10	11	9	12	5	10	8	12	17
212.	14	51	46	42	20	24	54	11	6	14	12	9	9	11	8	10	14	9	12	11	14
213.	23	70	29	63	31	36	56	7	7	8	16	7	7	15	12	10	10	9	13	13	16
214.	25	72	33	57	31	37	60	4	6	12	11	7	8	14	9	14	5	13	6	13	7
215.	18	84	45	55	21	28	55	10	8	13	16	7	8	18	12	12	11	10	15	18	9

Appendix XII (Contd.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
216.	25	54	33	60	29	34	53	6	9	14	6	7	9	15	9	12	13	7	13	14	5
217.	15	52	34	26	11	24	57	10	4	12	14	10	12	12	16	14	8	10	12	12	8
218.	26	70	48	39	25	26	53	9	4	9	8	7	10	12	8	12	11	11	7	10	13
219.	21	80	42	55	17	29	42	10	4	7	15	6	9	16	8	14	10	10	7	10	8
220.	29	81	23	59	28	38	68	10	6	10	10	10	12	14	12	14	10	9	7	14	20
221.	24	65	42	35	29	42	67	7	9	7	12	4	8	11	11	7	9	15	10	10	10
222.	22	69	19	42	29	36	59	14	9	15	6	5	10	16	10	7	3	12	7	10	10
223.	27	75	28	36	31	40	68	11	10	13	14	6	11	10	7	11	7	9	10	11	11
224.	19	62	35	37	27	38	62	12	5	9	10	9	9	7	9	11	11	11	10	12	7
225.	16	46	46	36	21	14	54	6	6	9	10	6	9	8	9	5	13	8	7	17	11
226.	33	83	21	57	31	42	68	14	10	19	10	8	16	16	18	7	9	2	8	15	4
227.	21	63	38	60	31	32	48	14	4	10	14	6	8	11	12	18	8	4	10	18	14
228.	26	70	37	48	32	42	67	10	10	7	14	11	12	11	11	10	11	11	4	7	8
229.	24	73	32	57	25	34	53	6	4	16	12	12	2	14	10	14	10	14	12	10	12
230.	22	65	37	65	33	30	39	11	8	12	16	5	8	15	8	16	4	11	12	18	12

Appendix XII (Contd.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
231.	22	66	28	57	25	37	67	11	9	6	16	11	17	10	9	9	8	12	10	8	16
232.	46	80	19	66	37	44	74	8	8	11	11	4	6	15	12	4	11	8	13	17	13
233.	21	46	33	40	26	37	70	8	1	10	12	6	11	10	11	11	10	5	13	11	8
234.	17	55	23	62	19	38	67	9	4	8	12	9	8	11	12	12	8	13	8	8	9
235.	40	72	34	66	29	46	35	12	9	11	12	10	11	14	11	12	9	10	12	13	11
236.	33	67	39	61	30	38	47	11	9	10	13	7	8	16	9	11	11	9	12	10	2
237.	34	73	28	63	29	39	54	8	8	13	7	8	4	17	12	12	9	8	11	16	8
238.	24	70	27	61	26	39	67	6	10	13	14	9	10	9	10	10	8	12	14	8	11
239.	29	68	42	67	31	42	66	15	7	13	6	10	10	14	13	9	7	12	9	10	12
240.	39	67	39	59	32	38	48	7	9	10	10	9	9	13	11	8	7	5	13	16	12
241.	17	45	49	41	19	16	46	16	2	10	8	7	9	9	10	5	8	3	11	8	7
242.	28	53	38	47	21	34	46	8	6	10	9	5	6	9	12	12	8	8	8	11	17
243.	29	72	38	61	30	37	48	14	10	11	11	8	9	16	11	13	7	12	9	14	12
244.	30	64	41	68	28	45	64	9	6	14	17	12	13	14	12	12	10	10	12	18	10
245.	28	52	35	41	29	36	38	12	8	14	13	11	14	15	14	8	10	12	17	12	10

Appendix XII (Contd.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
246.	30	65	31	61	27	45	68	9	5	12	13	11	10	9	10	10	8	9	11	9	10
247.	25	66	23	50	26	40	70	10	4	4	9	9	14	11	12	8	12	13	10	10	7
248.	35	71	22	61	29	38	51	14	9	7	9	11	14	11	14	7	2	12	7	13	10
249.	33	67	28	47	24	34	48	4	8	7	17	6	11	14	2	7	14	17	14	7	14
250.	33	66	35	54	28	37	52	13	7	12	16	4	1	15	14	13	8	12	12	14	12
251.	26	70	23	70	23	40	61	5	10	8	12	7	9	8	8	7	6	14	13	6	16
252.	23	63	33	56	25	38	70	7	7	14	16	11	5	14	8	9	7	8	15	9	13
253.	29	53	48	60	25	38	69	8	3	7	13	11	12	12	10	14	12	15	7	11	13
254.	34	72	35	51	15	14	51	14	5	14	12	9	8	14	12	18	9	11	9	12	9
255.	28	61	35	57	32	42	56	4	5	11	7	9	5	15	7	10	11	7	9	12	6
256.	22	67	21	32	26	31	40	11	4	10	9	10	15	10	11	9	10	10	7	10	14
257.	23	64	23	60	32	43	61	9	5	4	9	10	2	15	7	9	9	7	10	14	14
258.	24	63	30	46	32	44	59	14	4	11	12	10	10	11	10	10	6	12	16	10	11
259.	11	55	48	50	18	22	19	7	7	14	10	3	9	10	9	12	6	9	10	16	12
260.	16	70	36	52	24	42	47	10	3	11	15	8	13	16	16	16	6	11	5	8	10

Appendix XII (Contd.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
261.	27	59	43	56	26	26	41	9	4	10	6	11	12	11	12	14	9	6	10	11	9
262.	24	65	41	56	29	36	60	9	10	10	13	7	11	8	10	11	6	13	16	11	12
263.	27	71	29	66	25	43	48	12	5	15	3	11	6	13	12	16	12	10	12	19	3
264.	18	45	40	57	17	10	36	12	5	15	12	9	12	8	14	7	13	12	11	13	11
265.	29	68	33	32	35	45	67	6	2	8	9	8	13	9	12	10	12	9	6	13	16
266.	17	47	26	17	26	30	41	12	4	7	11	8	10	11	9	12	13	10	11	6	12
267.	12	54	34	60	19	30	33	12	5	14	10	11	5	12	14	17	10	8	10	11	14
268.	14	63	40	38	20	28	40	13	5	12	12	9	12	11	15	10	12	9	6	10	16
269.	18	61	27	49	23	32	37	13	5	12	12	10	9	12	9	17	12	11	12	9	12
270.	25	73	27	50	36	46	58	14	8	12	7	9	14	10	16	5	4	12	9	7	7
271.	19	39	28	29	16	29	62	11	2	13	15	11	11	12	11	11	14	8	14	11	15
272.	16	68	22	51	32	53	46	11	4	10	8	11	8	10	10	5	10	11	13	14	5
273.	20	57	35	44	25	38	47	9	7	14	8	10	10	13	15	11	10	9	7	12	10
274.	19	80	37	22	27	37	62	10	9	4	7	9	10	11	11	3	9	11	12	11	17
275.	25	54	28	53	28	45	57	8	7	14	14	12	9	10	13	9	7	8	5	11	15

Appendix XII (Contd.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
276.	26	58	32	63	28	43	57	9	7	14	9	10	10	12	16	8	9	8	5	14	14
277.	14	39	28	63	17	11	38	9	3	8	9	10	9	12	12	10	10	12	14	12	14
278.	20	81	50	58	20	37	59	7	5	10	13	11	6	12	8	15	8	13	12	8	13
279.	17	62	36	50	19	29	30	13	5	6	10	8	9	6	17	14	8	16	11	13	14
280.	14	50	44	47	18	28	38	14	5	10	11	6	9	9	10	16	8	9	11	11	7
281.	19	67	29	44	19	29	23	10	5	15	12	6	8	10	12	16	14	12	8	10	12
282.	26	67	25	61	34	46	57	9	8	9	15	6	14	16	11	15	16	12	12	10	9
283.	27	53	33	45	23	38	42	8	8	8	12	7	14	12	9	18	11	8	12	3	14
284.	19	59	30	39	20	29	40	14	8	12	13	9	8	8	8	12	9	9	10	13	16
285.	22	55	36	31	18	26	52	9	5	11	9	10	8	14	10	8	13	6	8	12	13
286.	21	62	36	41	19	37	54	5	4	17	6	10	10	12	10	2	8	8	13	9	8
287.	25	70	45	66	20	38	54	6	9	11	6	11	6	11	9	5	17	10	8	18	8
288.	29	73	33	55	20	40	71	12	9	9	13	7	9	20	7	15	6	12	13	12	12
289.	26	62	17	51	25	41	43	8	9	7	14	5	16	10	10	14	8	8	5	14	13
290.	24	59	23	44	22	29	48	12	6	13	16	10	10	16	16	7	12	10	9	9	11

Appendix XII (Contd.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
291.	26	65	24	34	20	32	50	9	8	15	7	9	13	14	16	7	8	10	8	12	8
292.	23	59	30	48	37	48	45	13	7	11	15	9	11	5	9	13	12	15	13	14	12
293.	19	61	42	60	21	30	63	10	6	13	14	11	11	8	16	16	11	10	5	9	9
294.	20	80	29	51	18	37	49	7	7	12	15	8	16	14	9	6	13	8	14	5	14
295.	23	45	45	29	16	37	83	11	7	12	9	12	14	10	7	7	12	12	10	10	11
296.	27	61	25	43	18	36	40	12	7	12	12	6	12	11	13	17	10	7	12	10	10
297.	28	66	41	52	22	38	71	7	9	10	14	7	9	14	8	12	9	8	11	13	14
298.	21	67	34	58	12	37	33	10	6	11	17	11	14	10	13	10	9	13	11	15	13
299.	24	61	40	55	15	38	68	13	9	8	16	13	4	9	10	12	6	7	12	13	10
300.	25	67	29	42	21	38	45	9	9	7	11	9	8	9	11	5	11	7	12	11	16
301.	32	73	31	55	17	38	70	9	9	10	17	6	13	10	6	16	12	11	16	6	12
302.	26	57	31	46	17	37	38	8	8	9	10	4	10	15	8	13	10	9	8	12	12
303.	26	54	15	44	20	34	51	11	10	12	10	9	13	15	14	7	6	14	13	11	5

BIBLIOGRAPHY

*ABRAHAM, P.A.: "An Experimental Study of Certain Personality Traits and Achievement of Secondary School Pupils." Unpublished Doctoral Thesis in Psychology, Kerala University, 1969.

***AGARWAL, S.K.: "A Psycho-Social Study of Academic Under-Achievement at Secondary School Level in the State of Rajasthan." Unpublished Doctoral Thesis in Education, Rajasthan University, 1975.

AGGARWAL, Y.P. & BHUSHAN, B.: "Self-Concept and Scholastic Achievement." Journal of Educational Research and Extension, Volume 4, Number 2, October, 1967.

AGRAWAL, S.: "A Study of Medical Aptitude and Other Psychological Variables Associated with Proficiency in Medical Examination of U.P." Unpublished Doctoral Thesis in Psychology, Agra University, 1973.

AIKEN, L.R.: "Attitude Towards Mathematics." Review of Educational Research, Volume 40, 1970.

AIKEN, L.R.: "Update of Attitudes and Other Affective Variables in Learning Mathematics." Review of Educational Research, Volume 46, 1976.

AINSWORTH, E.M.: "The Relationship Between Motivation, Personality, Intelligence and School Attainment in a Secondary Modern School." British Journal of Educational Psychology, Volume 37, Number 1, February, 1967.

ALLEN, E.A.: "Attitude of Children and Adolescents in School." Journal of Educational Research, London, November, 1960.

ALLPORT, G.W.: Personality – A Psychological Interpretation. Henry Holt & Co., Inc., New York, 1950.

ALLPORT, G.W. "Attitudes". In Fishbein Martin (Ed.) Reading in Attitude Theory and Measurement. John Wiley and Sons, Inc., New York, 1967.

ALTUS, W.D.: "A College Achiever and Non-Achiever Scale for the Minnesota Multiphasic Personality Inventory." Journal of Applied Psychology, Volume 32, 1948.

ANASTASI, A.: Psychological Testing. Macmillan Publishing Co., Inc., New York, 1976.

ASKOV, E.N. & FISCHBACH, T.J.: "An Investigation of Primary Pupils Attitudes Towards Reading." Journal of Experimental Education, Volume 41, 1973.

AUSTIN, A.W.: "Socio-Economic Factors in the Achievements and Aspirations of the Merit Scholars." Personnel Guidance Journal, Volume 42, 1964.

AWARTANI, M. & GRAY, M.W.: "Cultural Influences on Sex Differentials in Mathematics Aptitude and Achievement." International Journal of Mathematical Education in Science and Technology, Volume 20, Number 2, March-April, 1989.

BALASUBRAMANIAN, T. & FEROZE, M.: "A Comparative Study of the Achievement in Mathematics of Urban and Rural Students of Standard X in Some of the High Schools of Coimbatore." Journal of Educational Research and Extension, Volume III, Number 1, July, 1966.

BANKS, O. & FINLAYSON, D.: Success and Failure in the Secondary School. Methuen, London, 1973.

BARAHENI, M.N.: "An Enquiry into Attitudinal Concomitants of Success and Failure at School." Educational Research, Volume 5, 1962.

BASU, A.K.: "Personality Factors and Academic Performance". Journal of Education and Psychology, Volume 38, 1970.

BAZZINI, L.: "The New Government Programmes for Italian Primary Schools". Educational Studies in Mathematics, Volume 19, Number 3, August, 1988.

**BEEDAWAT, S.S.: "A Study of Academic Under Achievement Among Students." Unpublished Doctoral Thesis in Education, Rajasthan University, 1976.

BELL, H.M.: "The Self-Concept of Bright Under-Achieving High School Students as Revealed by an Objective Check List". Personal Guidance and Journal, Volume 39, Number 3, 1960.

BENBOW, C.P. & STANLEY, J.C.: "Sex Differences in Mathematical Ability: Fact or Artifact?" Science, Volume 210, 1980.

BENBOW, C.P. & STANLEY, J.C.: "Consequences in High School and College of Sex Differences in Mathematical Reasoning Ability: A Longitudinal Perspective". American Educational Research Journal, Volume 19, 1982.

BENBOW, C.P. & STANLEY, J.C.: "Sex Differences in Mathematical Reasnoning Ability: More Facts". Science, Volume 222, 1983.

BENDIG, A.W. & HUGHES, J.B.: "Student Attitude and Achievement in a Course in Introductory Statistics". Journal of Educational Psychology, Volume 45, 1954.

BENDIG, A.W.: "Extraversion, Neuroticism, and Student Achievement in Introductory Psychology". Journal of Educational Research, Volume 53, 1960.

BETZ, N.E.: "Mathematics Anxiety: What is it?" Paper presented at the Meeting of the American Psychological Association, (ERIC Reproduction Series ED. 149 220), San Francisco, California, 1977.

**BHADURI, A.: "A Comparative Study of Certain Psychological Characteristics of the Over and the Under Achievers in Higher Secondary Schools." Unpublished Doctoral Thesis in Psychology. Calcutta University, 1971.

BHATIA, H.R.: General Psychology. Oxford & IBH Publishing Co., (Sixth Printing), New Delhi, 1984.

BHATNAGAR, R.P.: "A Study of Some of the Personality Factors as Predictors of Academic Achievement." C.I.E. Studies in Education and Psychology, New Delhi, Publication Number 63, 1968.

BIERHOFF-ALFERNON, D.: "Teachers' Marks as Related to Characteristics of 9th and 10th Graders" (Germ.). Psychologie in Erziehing and Uterricht, Volume 23, Number 4, 1976.

BINGHAM, M.B.: Aptitudes and Aptitude Testing. Harper and Brothers Publication, New York, 1937.

BLOOMBERG, M.: "The Prediction of Scholastic Success Through the Use of a Forced Choice Problems and Attitude Inventory". Dissertation Abstracts, Volume 15, 1955.

BOZMAN, E.F.: Everyman's Encyclopedia. Fifth Edition, J.M. Dent & Sons Ltd., The Aldine Press, Volume 8, Lobau-Myxomycetes, London, 1967.

BRAR, J.S. "Relationship Between Extraversion/Introversion, Neuroticism and Academic Achievement: Experience of the Army Educational Corps." Indian Educational Review, Volume 11, Number 3, July, 1976.

BROADBENT, D.E.: Perception and Communication. Pergamon Press, London, 1958.

BURGESS, E.: "Personality Factors of Over and Under Achievers in Engineering". Pennsylvania State University. Abstract of Dissertations, Volume 16, 1953.

BUTCHER, H.J. & GORSUCH, R.: "The Prediction of Academic Achievement in Junior High School and High School." IPAT Information Bulletin, Number 4, Laboratory of Personality Assessment, University of Illinois, 1960.

BUTCHER, H.J., AINSWORTH, M. and NESBITT, J.E.: "Personality Factors and School Achievement: A Comparison of British and American Children." British Journal of Educational Psychology, Volume 33, 1963.

BUXTON, C.E.: "Evaluation of Forced Choice, and Likert Type Tests of Motivation to Academic Achievement." British Journal of Education and Psychology, Volume 36, Number 2, 1966.

CAROLINE NGAILIANKIM: "An Investigation into the Attitude and Study Habits Related to Achievement in Mathematics of Class IX Students in Shillong." Unpublished M. Phil Dissertation in Education, North-Eastern Hill University, Shillong, 1988.

CARTER, H.D.: "Over-Achievers and Under-Achievers in the Junior High School." California Journal of Educational Research, Volume 12, 1963.

CARTNELL, L.A.: "An Investigation of Adolescents' Academic Achievement." American Educational Research, Volume 20, Number 4, 1983.

CATTELL, R.B., SEALEY, A.P. and SWEENEY, A.B.: "What can Personality and Motivation Source Trait Measurements Add to the Practice of School Achievement." British Journal of Education and Psychology, Volume 36, 1966.

CATTELL, R.B.: Quoted by Hall, C.S. & Lindzey, G. Theories of Personality (Second Edition). John Wiley & Sons, Inc., New York, 1967.

CATTELL, R.B., BARTON, K. and DIELMAN, T.E.: "Prediction of School Achievement from Motivation, Personality and Ability Measures." Psychological Reports, Volume 30, Number 1, 1972.

CHANDRA, A. & KUNDU, R.K.: "Relationship Between Personality Factors and Academic Achievement of Students." Journal of Education and Psychology, Volume 39, Number 1, April, 1981.

CHAUHAN , S.S.: Advanced Educational Psychology (Seventh Edition). Vikas Publishing House Pvt. Ltd., New Delhi, 1984.

CHEUNG, K.C.: "Outcomes of Schooling: Mathematics Achievement and Attitude Towards Mathematics Learning in Hong-kong." Educational Studies in Mathematics, Volume 19, Number 2, May, 1988.

****CHHIKARA, M.S.: "An Investigation into the Relation-ship of Reasoning Abilities with Achievement of Concepts in Life Sciences." Unpublished Doctoral Thesis in Education. Jamia Milia Islamia, 1985.

CHILD, D.: "The Relationships between Introversion - Extra-version, Neuroticism and Performance in School Exami-nations." British Journal of Educational Psychology, Volume 34, 1964.

***CHOPRA, S.L.: "A Study of Some Non-Intellectual Correlates of Academic Achievement." Unpublished D. Litt. In Education. Lucknow University, 1982.

COOPER, J.B. & LEWIS, J.H.: "Parent Evaluation as Related to Social Ideology and Academic Achievement." Journal of General Psychology, Volume 101, 1962.

COULSON, J., CARR, C.T., HUTCHINSON, L. & EAGLE, D.: The New Oxford Encyclopedic Dictionary. Bay Books Pvt. Ltd., Oxford University Press, 1983.

CRONBACH, L.J.: Educational Psychology. Harcourt Brace & Co., New York, 1954.

CRONBACH, L.J.: Educational Psychology. Harcourt Brace and World, New York, 1963.

CROW, D. & CROW, A.: Educational Psychology. Eurasia Publishing House Pvt. Ltd., New Delhi, 1969.

****DAS, S.: "Peer Influence and Educational Aspiration of Secondary School Students, A Study in Relation to their Academic Achievement." Unpublished Doctoral Thesis in Education, Maharaja Sayajirao University of Baroda, 1986.

DAVIDS, A. & SIDMAN, J.: "A Pilot Study: Impulsivity, Time Orientation, and Delayed Gratification in Future Scientists and in Under-Achieving High School Students." Exceptional Children, Volume 29, 1962.

DECK, D. & BARNETTE, J.J.: Measuring Attitudes Toward Reading in large Scale Assessment. Centre for Cooperative Research with Schools, (ERIC Document Reproduction Service Number ED. 123407). University Park, Penn: Pennsylvania State University, 1976.

**** DEKA, U.: "School Failure: A Causal-Comparative Study of High and Low Achievers." Unpublished Doctoral Thesis in Education, Gauhati University, 1985.

DEPARTMENT OF EDUCATION, ALLAHABAD UNIVERSITY.: Report on Causes of Failures in High School Examination. Ministry of Education Financed Project, January, 1961.

DEPARTMENT OF EDUCATION.: National Policy on Education. Ministry of Human Resource Development, Government of India, New Delhi, May, 1986.

DEPARTMENT OF EDUCATION, GOVT. OF MEGHALAYA.: "Incentive Awards for Mathematics, Science Teachers." The Shillong Times, Volume XLIV, Number 206, March 29, 1989, p. 3, Column 3.

DESAI, H.G.: "Under-Achievement Syndroma Among High School Boys." Journal of Education and Psychology, Volume XXXVI, Number 1 & 2, April-July, 1978.

DOTSON, E. & TEMPLER, D.I.: "Grades, Attendance and Extraversion." Psychological Reports, Volume 25, Number 2, 1969.

DOWD, R.J.: "Underachieving Students of High Capacity". Journal of Higher Education, Volume 23, 1952.

****DWIVEDI, S.K.: "Performance on Linear Programme in a Segment of Biology in Relation to Level of Aspiration and Socio-Economic Status". Unpublished Doctoral Thesis in Education, 1983.

ECKERT, R.E.: "Analysing the Superior College Student." School and Society, Volume 41, 1935.

EGNER, R.E. & OBELSKY, A.J.: "The Significance of Stereotyped Conditioning for Education." Journal of Higher Education, Volume 28, 1957.

ELAMARAN, M. & KANDARAJ, M.: "Preparation of Instructional Material for Teaching Mathematics in Standard X." Research in Classroom, Volume III, NCERT, New Delhi, 1967.

ELIZABETH.: "A Study of Personality of High School Students." A Survey of Research in Psychology. The Indian Council of Social Science Research, New Delhi, 1972.

ENTWISTLE, N.J. & SHIRLEY, C.: "Neuroticism and School Attainment in Linear Relationship". British Journal of Educational Psychology, Volume 38, 1961.

ENTWISTLE, N.J.: "Academic Motivation and School Attainment." British Journal of Education and Psychology, Volume 38, Number 2, June, 1968.

ERB, E.C.: "Conformity and Achievement in College." Personnel Guidance Journal, Volume 39, 1961.

ETHINGTON, C.A. & WOLFLE, L.M.: "A Structural Model of Mathematics Achievement for Men and Women." American Educational Research Journal, Volume 23, Number 1, Spring, 1986.

EYSENCK, H.J.: Dimensions of Personality. Routledge and Keagan Paul, London. 1947.

EYSENCK, H.L.: The Dynamics of Anxiety and Hysteria. Routledge and Keagan Paul, London, 1957.

EYSENCK, H.J. and COCKSON, D. "Personality in Primary School Children." British Journal of Education and Psychology, Volume 39, Number 2, June, 1966.

EYSENCK, H.J.: The Structure of Human Personality, (Third Edition). Methuen & Co., New York, 1971.

EYSENCK, H.J. (Ed.): Encyclopedia of Psychology, Volume 1. Bath Search Press, London, 1972.

FENNEMA, E.: "Mathematics: What Research Says About Sex Differences." (Columbus, Ohio: ERIC Science, Mathematical and Environmental Education. Clearing House in Cooperation with Centre for Science and Mathematics Education), 1974.

FENNEMA, E. & SHERMAN, J.A.: "Mathematics Attitude Scales: Instruments Designed to Measure Attitudes Toward the Learning of Mathematics by Females and Males." Journal for Research in Mathematics Education. Volume 7, 1976.

FENNEMA, E. & SHERMAN, J.: "Sex-Related Differences in Mathematics Achievement, Spatial Visualization and Affective Factors." American Educational Research Journal, Volume 14, Number 1, 1977.

FINGER, J.A. & SCHLESSER, G.E.: "Academic Performance of Public and Private School Students." Journal of Educational Psychology. Volume 54, 1963.

FINK, M.: "Cross Validation of an Under-Achievement Scale." California Journal of Educational Research, Volume 14, 1963.

FINLAYSON, D.S.: "A Follow Up Study of School Achievement in Relation to Personality." British Journal of Educational Psychology, Volume 40, Number 3, November 1970.

FLEEMING, E.G.: "College Achievement, Intelligence, Personality and Emotion." Journal of Applied Psychology, Volume 16, 1932.

FRANK, J.D.: "Individual Differences in Certain Aspects in the Level of Aspirations." American Journal of Psychology, Volume 47, 1935.

FRANKEL, E.: "A Comparative Study of Achieving and Under-Achieving High School Boys of High Intellectual Ability." Journal of Educational Research, Volume 53, 1960.

FRANKS, C.M.: "Personality Factors and the Rate Conditioning." British Journal of Psychology, Volume 48, 1957.

FREDENBURGH, F.A.: The Psychology of Personality and Adjustment. Cummings Publishing Co., Philippines, 1971.

FREEMAN, F.S.: Theory and Practice of Psychological Testing, (3rd Indian Edition). Oxford and IBH, Bombay, 1971.

FRENCH, J.L.: Educating the Gifted. Henry Holt, New York (Ed.), 1960.

FURNEAUX, W.D.: "The Selection of University Students." Report to Imperial College of Science and Technology. London, 1957.

GARRETT, H.E.: "A Review and Interpretation of Factors Related to Scholastic Success in Colleges of Arts and Sciences and Teacher's College." Journal of Experimental Education, Volume 18, 1949.

GARRETT, H.E.: General Psychology, Second Edition (3rd Indian Reprint). Eurasia Publishing House Pvt. Ltd., New Delhi, 1975.

GARRETT, H.E.: Statistics in Psychology and Education. Vakils, Feffer and Simons Ltd., Bombay, 1981.

***GHUMAN, M.S.: "A Study of Aptitudes, Personality Traits and Achievement Motivation of Academic Over-Achievers and Under-Achievers." Unpublished Doctoral Thesis in Psychology. Ravishankar University, 1976.

GILBERT, C.D.: "A Study of the Inter-Relationship of Factors Affecting Sixth Grade Students in Respect to Mathematics." School Science and Mathematics, Volume 6, 1977.

GOH, D.S. & MOORE, C.: "Personality and Academic Achievement in Three Educational Levels." Psychological Reports, Volume 43, Number 1, August, 1978.

GOOD, C.V.: Dictionary of Education. McGraw-Hill, New York, 1959.

GOODSTEIN, L.D., CRITES, J.O. & HEILBRUN, A.B. Jr.: "Personality Correlates of Academic Adjustment." Psychological Reports, Volume 12, 1963.

****GOPALACHARYULU, R.V.V.: "A Study of Relationship Between Certain Psycho-Sociological Factors and Achievement of Students-Teachers in Teacher Training Institutes of Andhra Pradesh." Unpublished Doctoral Thesis in Education, Sri Venkateswara University, 1984.

GOUGH, H.G.: "Factors Related to Differential Achievement Among Gifted Persons (Mimeographed)." Berkeley, University of California, 1955. Cited by J.C. Gowan's Dynamics of the Under-Achievement of Gifted Students. Exceptional Children, Volume 24, 1957.

GOULD, R. & KAPLAN, N.: "The Relationship of 'Level of Aspiration' to Academic and Personality Factors." Journal of Social Psychology, Volume 11, 1940.

GREENBERG, J.W., GERVER, J.M., CHALL, J. & DAVIDSON, H.H.: "Attitudes of Children from a Deprived Environment Toward Achievement Related Concepts." Journal of Educational Research, Volume 59, 1965.

GREWAL, J.S.: Manual for Occupational Aspiration Scale (OAS). National Psychological Corporation, Agra, 1984.

GROFF, P.J.: "Children's Attitudes Towards Reading and Their Critical Reading Abilities in Four Content-Type Materials." Journal of Educational Research, Volume 55, 1962.

GUILFORD, R.R. & VOAS, W.M.: "Personality Test and Scholastic Attainment." Personality Journal, Volume 9, 1930.

GUILFORD, J.P.: Personality. McGraw-Hill, New York, 1959.

****GUPTA, P.L.: "A Study of Personality Characteristics of Ninth Grade Over and Under-Achieving Boys and Girls at Different Levels of Achievement Motivation." Unpublished Doctoral Thesis in Education, Punjabi University, 1983.

HALADYNA, T. & THOMAS, G.: "The Attitudes of Elementary School Children Toward School and Subject Matters." Paper presented at the Meeting of the American Educational Research Association (ERIC Document Reproduction Series Number ED. 139 837), New York, 1977.

HALLER, A.O. & MILLER, I.W.: Occupational Aspiration Scale: Theory, Structure and Correlates. Department of Rural Sociology, University of Wisconsin, Madison, 1963.

HARRIS, D.: "The Relation to College Grades of Some Factors Other Than Intelligence." Archives of Psychology, Volume 131, 1931.

HARRIS, D.: "Factors Affecting College Grades." A Review of the Literature - 1930-1937. Psychological Bulletin Volume 37, 1940.

HELD, O.C.: "An Attempt to Predict the Success of University Freshmen in Their Adjustment to Scholastic Work." University Pitab Bulletin, 1931.

HERSHEY, G.: "College Grades in Relation to Inventory Measures of Master's Thesis." Michigan State University, 1958. Cited by Henry Clay Lmith, Personality Adjustment. McGraw-Hill, New York, 1961.

HIMMELWEIT, H.T.: "A Comparative Study of Normal and Neurotic Persons." British Journal of Psychology, Volume 37, 1946.

HIMMELWEIT, H.T. & SUMMERFIELD, A.: "Student Selection an Experimental Investigation III." British Journal of Sociology, Volume 2, 1951.

HIRST, P.H. & PETERS, R.S.: The Logic of Education. Routledge & Keagan Paul, London, 1970.

HOLLAND, J.L.: "The Prediction of College Grades from Personality and Aptitude Variables." Journal of Educational Psychology, Volume 51, Number 5, October, 1960.

HOLMES, F.S.: "The Prediction of Academic Success in a General College Curriculum." IPAT Information Bulletin, Number 4, Laboratory of Personality Assessment, University of Illinois, 1960.

HOLT, R.R.: "Level of Aspiration: Ambition or Defence?" Journal of Experimental Psychology, Volume 36, 1946.

HOPPE, F.: "Erfolg Und Misserfolg." Psychol. Forsch, Volume 14, 1930.

HOUNSHELL, P.B. & HILL, S.R.: "The Microcomputer and Achievement and Attitudes in High School Biology." Journal of Research in Science Teaching, Volume 26, Number 6, September 1989.

HUNT, G.E.: "Mathematics Anxiety - Where Do We Go From Here?" Locus on Learning Problems in Mathematics, Volume 7, Number 2, 1985.

HURLOCK, E.B.: Adolescent Development. McGraw-Hill, Kogakuslia Ltd., London, 1973.

*** IYER, K.K.: "Some Factors Related to Under-Achievement in Mathematics of Secondary School Students." Unpublished Doctoral Thesis in Education, Kerala University, 1977.

*** JAIN, D.K.: "A Study of Significant Correlates of High School Failures in Mathematics and English with Special Reference to Jammu Divsion." Unpublished Doctoral Thesis in Education, Jammu University, 1979.

JAIN, S.: "The Impact of Reading on the Achievement of Pupils." The Educational Review, Volume XCII, Number 2, February 1986.

JAMUAR, K.K.: "Personality and Achievement." Psychological Studies, Volume 6, Mysore, 1961.

JAMUAR, K.K.: "Achievement and Some Background Factors." Psychological Studies, Volume 8, Mysore, 1963.

** JAYAGOPAL, R.: "Personality Profile of the Under and High-Achievers of Some of the Schools in the City of Madras." Unpublished Doctoral Thesis in Psychology, Madras University, 1974.

* JHA, V.: "An Investigation into Some Factors Related to Achievement in Science by Students in Secondary Schools." Unpublished Doctoral Thesis in Education, Patna University, 1970.

JONES, J.B.: "Some Personal Social Factors Contributing to Academic Failure at Texas Southern University." In R.L. Sutherland et al., (Eds.) Personality Factors on the College Campus: Review of a Symposium. Hogg Foundation for Mental Health, Austin, Texas, 1962.

KATZ, D.: "The Functional Approach to the Study of Attitudes." In M. Fishbein (Ed.) Readings in Attitude Theory and Measurement. John Wiley and Sons, Inc., New York, 1967.

KAUL, L.: "Personality Traits of High and Low Achievers in Mathematics." Journal of Education and Psychology Review, Volume IX, Number 3, 1969.

KEIMOWITZ, R.I. & ANSBACHER, H.L.: "Personality and Achievement in Mathematics." Journal of Individual Psychology, Volume 16, 1960.

KELLY, A.: Girls and Science: International Study of Sex Differences in School Science Achievement. Alquist and Wiskell, Stockholm, 1978.

KHENGLAWT, L.: "A Study of Some Personality Characteristics of Low, Normal and High-Achievers in Mathematics of Class X in Aizawl." Unpublished M.A. Dissertation in Education, North-Eastern Hill University, Mizoram Campus, Aizawl, 1982.

KLINE, P.: "Extraversion, Neuroticism and Academic Performance Among Ghanaian University Students." British Journal of Educational Psychology, volume 36, 1966.

KLINE, P. & GALE, A.: "Extraversion, Neuroticism and Performance in Psychology Examination." British Journal of Educational Psychology, Volume 41, Number 1, February, 1971.

KLOOSTERMAN, P. "Self-Confidence and Motivation in Mathematics." Journal of Educational Psychology, Volume 80, Number 3, 1988.

*** KOUL, L.: "Personality Needs of High and Low Achievers in Mathematics." Himachal Pradesh University, 1978.

KRETCH & CRUTCHFIELD.: Theory and Problems of Social Psychology. McGraw-Hill Book Co. Inc., New York, 1948.

KRIPPNER, S.: "The Vocational Preference of High Achieving and Low-Achieving Junior High School Students." Gifted Child Quarterly, Volume 5, 1961.

KULKARNI, S.S., NAIDU, C.A.S. & ARYA, N.L.: "A Survey of Mathematics Achievement in India." Indian Educational Review, Volume 2, 1970.

*** KULSHRESHTA, L.: "A Study of Certain Factors Related to Different Patterns of Achievement Among Bright Students." Unpublished Doctoral Thesis in Education, Agra University, 1981.

**** KUMAR, A.: "A Study of Ego-Involvement, Level of Aspiration and Associated Factors in Relation to Achievement at Graduation Level." Unpublished Doctoral Thesis in Education, Gorakhpur University, 1986.

KUNDU, C.L.: Educational Psychology. Sterling Publishers Pvt. Ltd., New Delhi, 1976.

**** LALL, R.: "Child Rearing Attitudes, Personal Problems and Personality Factors as Correlation of Academic Achievement." Unpublished Doctoral Thesis in Psychology, Bhagalpur University, 1984.

LYNN, R.: "Two Personality Characteristics Related to Academic Achievement." British Journal of Educational Psychology, Volume 29, 1959.

LYNN, R. & GORDON, I.E. "The Relation of Neuroticism and Extroversion to Intelligence of Educational Attainment." British Journal of Educational Psychology, Volume 31, Number 2, June, 1961.

MAC DONALD, F.J. Educational Psychology. Wadsworth Publishing Co., Selmont, California, 1965.

MALLOY, J. "The Prediction of College Achievement with the Life Experience Inventory." Educational and Psychological Measurement, Volume 15, 1955.

MALPASS, L.F.: "Some Relationships Between Students' Perceptions of School and Their Achievement." Journal of Educational Psychology, Volume 44, 1953.

MANGAL, S.K.: Educational Psychology. Parkash Brothers, Ludhiana, 1983.

MARSHALL, M.V. & SIMPSON, E.W. "Vocational Choice and College Grades." Journal of Educational Research, Volume 27, 1943.

MASQAD, M.: "Extraversion, Neuroticism, Intelligence and Academic Achievement in Northern Nigeria." British Journal of Educational Psychology, Volume 50, Number 1, 1980.

*** MATHEW, T.: "Some Personality Factors Related to Under-Achievement in Science." Unpublished Doctoral Thesis in Education, Kerala University, 1976.

McCLELLAND, D.C. et al.: The Achievement Motive. Princeton, N.J.D. Van Nostrand, 1953.

McKEACHIE, W.J. & DOYLE, C.L.: Psychology. Addison Wesley, 1966.

**** MEHNA, V.H.: "An Investigation into Some Factors Affecting Academic Achievement in Science of IX Standard Students of Greater Bombay." Unpublished Doctoral Thesis in Education, Bombay University, 1986.

** MENON, S.K.: "A Comparative Study of the Personality Characteristics of Over-Achievers and Under-Achievers of High Ability." Unpublished Doctoral Thesis in Psychology, Kerala University, 1973.

*** MENON, P.N.: "Performance of Students at Polytechnics in Relation to Their Academic Achievement, Intelligence, Differential Aptitudes, Adjustment and Aspiration Level." Unpublished Doctoral Thesis in Education. Maharaja Sayajirao University of Baroda, 1982.

MICHEELS, W.J. & KARNES, M.R.: Measuring Educational Achievement, Volume 24, McGraw-Hill, New York, 1950.

MOHAN, V. & NEHRU, K.: "Differentiation of Over and Under-Achievers on 16 Personality Factors." Psychological Studies, Volume 17, 1972.

MOHAN, J. et al.: "High School Science Achievement as a Function of Persistence and Intelligence." Journal of Education and Psychology, Volume XXXII, Number 4, 1975.

MOHAN, V.: "Neuroticism, Extraversion and Academic Achievement." Indian International Publications, Allahabad, 1976.

MOHAN, J., SEHGAL, M. & BHANDARI, A.: "Study of Personality and Academic Achievement of Children." Journal of Education and Psychology, Volume 39, Number 3, October, 1981.

MOHAN, J., SEHGAL, M. & BHANDARI, A.: "Sociometric Status, Personality, Academic Achievement and Personal Problems." Indian Psychological Review, Volume 22, Number 2, 1982.

MOHAN, J. & GULATI, A.: "Academic Achievement: A Review of Determinants." Indian Psychological Review, Volume 30, Number 4, 1986.

MURPHY, G., MURPHY, L.B. & NEWCOMB, T.M.: Experimental Social Psychology, (Revised Ed.). Harper, New York, 1937.

MUTHAYYA, B.C.: "Frustration, Reaction and Achievement Motive of High-Achievers and Low-Achievers in the Scholastic Field." Psychological Studies, Volume 9, Mysore, 1964.

MUTHAYYA, B.C.: "Some Correlates of Achievement Motive Among High and Low-Achievers in the Scholastic Field." Journal of Psychological Researches, 1965.

MYERS, R.C.: "The Academic Over-Achiever: Stereotyped Aspects." Journal of Experimental Education, Volume 18, 1950.

NATIONAL RESEARCH COUNCIL.: Everybody Counts. A Report to the Nation on the Future of Mathematics Education. Washington, D.C., National Academy Press, 1989.

NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS.: Report of the Commission on Standards for School Mathematics Curriculum and Evaluation. Reston, Va. The Council, 1989.

NEALE, D.C.: "The Role of Attitudes in Learning Mathematics." Arithmetic Teacher, Volume 16, 1969.

NEEL, M.O. and MATHEWS, C.O.: "Needs of Superior Students." Journal of Higher Education, Volume 6, 1935.

NEWCOMB, T.M.: "Studying Social Behaviour". In T.G. Andrews (Ed.), Methods of Psychology. Wiley, New York, 1952.

NICHOLS, R.C. & DAVIS, J.A.: "Characteristics of Students of High Academic Aptitude." Personnel Guidance Journal, Volume 42, 1964.

NIELSON, P.J.: "Attitude Toward Reading and Reading Related Concepts Among Elementary Students." Reading Horizons, Volume 18, 1978.

NORFLEET, M.A.: "Personality Characteristics of Achieving and Under-Achieving High Ability Senior Women." Personnel and Guidance Journal, Volume 46, 1968.

OHUCHE, R.O.: Help Your Children Learn Mathematics. Mathematics Association of Nigeria Publication, 1980.

ONYEMUNWA, S.G.: "Mathematics Education in Nigeria Finding a Lasting Solution." Journal of Educational Research and Extension, Volume 25, Number 3, January, 1989.

OWENS, W.A. & JOHNSON, W.C.: "Some Measured Personality Traits of Collegiate Under-Achievers." Journal of Educational Psychology, Volume 40, 1949.

PAL, S.K.: "Personality Study of Law, Engineer, Medical and Teacher Training Students." Unpublished Doctoral Thesis in Education, Nagpur University, 1961.

*** PAL, G.: "An Enquiry into the Factors Involved in the Learning of Science by Adolescent Pupils." Unpublished Doctoral Thesis in Education, Calcutta University, 1982.

PARNELL, R.W.: "The Relationship of Masculine and Feminine Physical Traits to Academic and Athletic Performance." British Journal of Medical Psychology, 1954.

PASSOW, A.H. & GOLDBERG, M.L.: "The Talented Youth Project – A Progress Report." Exceptional Children, Volume 28, 1962.

PATHY, M.K.: "A Comparative Study of the Attitude of the High School Dropouts Towards School Subjects, Subject Teachers and Subject Achievement." Journal of Educational Research and Extension, Volume 25, Number 3, January, 1989.

**** PATIL, G.G.: "A Differential Study of Intelligence, Interest and Attitude of the B.Ed. College Students as Contributory Factor Towards Their Achievements in the Compulsory Subjects." Unpublished Doctoral Thesis in Education, Nagpur University, 1984.

PATTISON, P. & GRIEVE, N.: "Do Spatial Skills Contribute to Sex Differences in Different Types of Mathematics Problems?" Journal of Educational Psychology, Volume 76, 1984.

PAUL-CENTI.: "Personality Factors Related to College Success." Journal of Educational Research, Volume 55, Number 4, December-January, 1962.

PERL, T.H.: "Discriminating Factors and Sex Differences in Electing Mathematics." Unpublished Doctoral Dissertation, Stanford University, 1979.

PERRY.: Teaching Mathematics in Secondary Schools. Education Pamphlet: Department of Education and Science, U.K., Number 36, 1968.

PERUMAL, N. & VISVESVARAN, H.: "A Study of Scientific Attitude of Pupils of Standard IX in Relation to Their Achievement in Science in Some High Schools in Coimbatore." Journal of Educational Research and Extension, Volume V, Number 1, July, 1968.

PESKIN, A.: Teacher Understanding of Students' Attitude and Achievement in Seventh Grade Mathematics. Ann Arbor Mich. Uni., Micro. Nos. 65, 1965.

PIERCE, J.V.: "Achiever and Under-Achiever: A Comparison." The Yearbook of Education, The Gifted Child. The University of London, Institute of Education and Teachers College, Columbia University, New York, 1952.

PIERCE, J.V.: "The Educational Motivation Patterns of Superior Students Who Do and Do Not Achieve in High School." Research Project 208(7136) U.S. office of Education, Department of Health, Education and Welfare, 1959.

PIERCE, J.V.: "Personality and Achievement Among Able High School Boys." Journal of Individual Psychology, Volume 17, 1961.

PRENTER, I.L. & STEWARD, R.: "Educational and Vocational Aspirations of New Zealand Adolescent Girls in Relation to Achievement Motivation." New Zealand Journal of Educational Studies, Volume 7, Number 1, May, 1972.

PRESTON, R.C. & BOTEL, M.: "The Relation of Reading Skill and Other Factors to the Academic Achievement of 2048 College Students." Journal of Experimental Education, Volume 20, 1952.

PRINCE, M.: The Unconscious, (Second Edition). The Macmillan Company, New York, 1929.

QUINN, B. & JADAV, A.D.: "Causal Relationship Between Attitude and Achievement for Elementary Grade Mathematics and Reading." Journal of Educational Research, Volume 80, Number 6, July/August, 1987.

**RAI, P.N.: "A Comparative Study of a Few Differential Personality Correlates of Low and High Achievers." Unpublished Doctoral Thesis in Education, Agra University, 1974.

RAO, S.N.: "A Study of the Sense of Responsibility and Its Relation to Academic Achievement." Psychological Studies, Volume 9, Mysore, 1964.

RAO, G.: "A Study of Some Factors Related to Scholastic Achievement." C.I.E. Studies in Education and Psychology, Publication Number 63, 1968.

RAO, D.B.: "How to Avoid Tensions." The Educational Review, Volume XCI, Number 3, March, 1985.

RAPPAPORT, D.: "The New Mathematics and Its Aftermath." The Education Digest, Volume XLII, Number 5, January, 1977.

RED, S.B., McCARY, J.L. & JOHNSON, B.: "A Study of the Relationship Between Aspirational Levels and Academic Achievement." Journal of Educational Research, Volume 55, 1962.

*** REDDY, I.V.R.: "Academic Adjustment in Relation to Scholastic Achievement of Secondary School Pupils – A Longitudinal Study." Unpublished Doctoral Thesis in Psychology, Sri Venkateswara University, 1978.

REYES, L.H.: "Affective Variables and Mathematics Education." Elementary School Journal, Volume 84, 1984.

RIDDING, L.W.: "An Investigation of Personality Measures Associated with Over and Under-Achievers in English and Arithmetic." British Journal of Educational Psychology, Volume 37, 1967.

RIEDESEL, C.A. & BURNS, P.C.: "Reasearch on the Teaching of Elementary School Mathematics". In R.M.W. Travers (Ed.): Second Handbook of Research on Teaching, AERA, Rand McNally, Chicago, 1973.

ROBERTS, H.E.: "Factors Affecting the Academic Under-Achievement of Bright High School Students." Journal of Educational Research, Volume 56, 1962.

ROBINSON, M.L.: Attitudes and Achievement: A Complex Relationship. Mansfield, P.A., Mansfield State College, (ERIC Document Reproduction Service Number ED.111678), 1975.

ROSENBERG, M.J.: Attitude Organization and Change. Yale University Press, New Haven, 1960.

ROSENBERG, L.A. et al.: "The Prediction of Academic Achievement with the California Psychological Inventory." Journal of Applied Psychology, Volume 46, 1962.

ROWELL, C.G.: "An Investigation of Factors Related to Change in Attitude Toward Reading." Journal of Reading Behaviour, Volume 5, 1972/1973.

RYAN, F.R. & DAVIE, J.S.: "Social Acceptance, Academic Achievement, and Aptitude Among High School Students." Journal of Educational Research, Volume 52, 1958.

SAMANT, B.B.: "A Survey of Teaching of Mathematics in Secondary Schools with Special Reference to Bombay Province." Unpublished Doctoral Thesis in Education, Bombay University, 1944.

SATHIYAGIRIRAJAN, S. & RAO, T.R.S.: "A Comparative Study of the Academic Achievement of Pupils of Standard X in English and Composite Mathematics." Journal of Educational Research and Extension, Volume IV, Number 2, October, 1967.

SAVAGE, R.D.: "Personality Factors and Academic Performance." British Journal of Educational Psychology, Volume 32, Number 3, 1962.

*SAXENA, P.C.: "A Study of Interests, Need Patterns and Adjustment Problems of Over and Under-Achievers." Unpublished Doctoral Thesis in Educationa, Allahabad University, 1972.

SAXENA, S.K. & DWIVEDI, K.: "Improving Achievement in Science Practicals at High School Level: An Exploratory Study." Indian Psychological Review, Volume 18, Number 1-4, Special Issue, 1979.

SCHOFIELD, H.L. & START, K.B.: "Mathematics Attitude and Achievement Among Student Teachers." Australian Journal of Education, Volume 22, 1978.

SCHOFIELD, H.L.: "Sex, Grade Level, and the Relationship Between Mathematics Attitude and Achievement in Children." Journal of Educational Research, Volume 75, Number 5, May/June 1982.

SCHULTZ, D.G. & RICCIUTTI, H.N.: "Level of Aspiration Measures and College Achievement." Journal of General Psychology, Volume 51, 1954.

**SEETHA, B.C.: "An Inquiry into the Psychological and Social Factors Affecting Academic Achievement." Unpublished Doctoral Thesis in Psychology, Bangalore University, 1975.

SEWELL, W.H. & HAUSER, R.M.: "Causes and Consequences of Higher Education: Models of the Status Attainment Process." American Journal of Agricultural Economics, Volume 54, 1972.

SHARADA, Y.G.: "The Construction and Standardization of an Achievement Test in Mathematics for Class IX (Following the CBSE Pattern)." Unpublished M.Ed. Dissertation, Institute of Correspondence Course and Continuing Education, Madurai-Kamaraj University, 1984.

**SHARMA, G.S.: "Attributes of Underachieving Undergraduate Students." Unpublished Doctoral Thesis in Education, Meerut University, 1978.

SHARMA, V.P. & GUPTA, A.: Manual for Educational Aspiration Scale (E.A.S.). National Psychological Corporation, Agra, 1980.

SHARMA, B.D.: "The Mathematical Quest." Perceptions in Science. North-Eastern Hill University Publications, Shillong, 1985.

SHERMAN, M.: Personality. Pergamon Press, New York, 1979.

SHERMAN, J.: "Mathematics, Spatial Visualization and Related Factors: Changes in Girls and Boys, Grades 8-11". Journal of Educational Psychology, Volume 72, Number 4, 1980.

****SHINDE, Y.K.: "A Study of Non-Formal Science Activities in Secondary Schools of Maharashtra State with Special Reference to Their Impact on Scientific Attitude and Achievement in Science." Unpublished Doctoral Thesis in Education, Bombay University, 1982.

SIDHU, K.S.: The Teaching of Mathematics. Sterling Publishers Pvt. Ltd., New Delhi, 1984.

SILLS, D.L.: International Encyclopedia of the Social Sciences. The Macmillan Company & The Free Press, Volume 1, 1968.

****SINGH, B.: "A Study of Some Possible Contributing Factors to High and Low-Achievement in Mathematics of the High School Students of Orissa." Unpublished Doctoral Thesis in Education, Sambalpur University, 1986.

*SINHA, D.N.: "A Psychological Analysis of Some Factors Associated with Success and Failure in University Education." Unpublished Doctoral Thesis in Psychology, Allahabad University, 1965.

SINHA,D.N.:"A Psychological Analysis of some Factors Associated with Success and Failure in University Education: A Summary of the Findings." Indian Educational Review, Volume 1, Number 1, July, 1966.

**SINHA, N.C.P.: "A Study of Intelligence and Some Personality Factors in Relation to Academic Achievement of School Students." Unpublished Doctoral Thesis in Psychology, Magadh University, 1967.

SIR WILFRED COCKCROFT.: "Queen Handmaid or Both?" The Times of India. Section 1, Number 25, Volume CLII, Metro New Delhi, January 25, 1989, p. 8. Column 2.

***SOMASUNDARAN, M.: "A Comparative Study of Certain Personality Variables Related to Over-Normal and Under-Achievement in Secondary School Mathematics." Unpublished Doctoral Thesis in Education, Calicut University, 1980.

****SONTAKEY, V.V.: "A Comparative Study of Personality Factors and Achievement Motivation of High and Low Achievers in Natural and Biological Sciences." Unpublished Doctoral Thesis in Education, Nagpur University, 1986.

SORENSON, H.: Psychology in Education. Tata McGraw-Hill, (TMH Edition), New Delhi, 1977.

**SRIVASTAVA, G.P.: "A Study of Personality Factors as Predictors of Academic Achievement of High School Students." Unpublished Doctoral Thesis in Education, Banaras HIndu University, 1976.

STACY, C.L. & DeMARTINO, M.F.: Understanding Human Motivation. Cleveland, 1958.

STAGNER, R.: "The Relation of Personality to Academic Aptitude and Achievement." Journal of Educational Research, Volume 26, 1933.

STAGNER, R.: Testing Student Achievements and Aptitudes by J. Stanley Ahmann. The Centre for Applied Research in Education, Inc., Washington D.C., U.S.A., 1962.

STALLINGS, J.: "Factors Influencing Women's Decisions to Enroll in Advanced Mathematics Courses." Report to the U.S. National Institute of Education, 1979.

STRANG, R.M.: Behaviour and Background of Students in College and Secondary Schools. Harper, New York, 1937.

SUNDARARAJAN, S. & KRISHNAMURTHY, S.: "Higher Secondary Students Attitude Towards the Study of History and Their Achievement in it." Experiments in Education, Volume XVI, Number 12, December, 1988.

SUYDAM, M.N. & WEAVER, J.F.: "Research on Mathematics Learning." In J.N. Payne (Ed.), Mathematics Learning in Early Childhood: Thirty-Seventh Yearbook. National Council of Teachers of Mathematics, Reston, Virginia, 1975.

**TANDON, S.: "A Psychological and Ecological Study of Under-Achievers." Unpublished Doctoral Thesis in Education, Banaras Hindu University, 1978.

TEAHAN, J.E.: "Future Time Perspective, Optimism and Academic Achievement." Journal of Abnormal Social Psychology, Volume 57, 1958.

TERAOKA, T.: "An Investigation on the Standard Score of Sociability as an Index of Social Status and the Application of it." Japan Journal of Educational Psychology, Volume 5, 1958.

THAKUR, T.: The Academic Achievement of High School Boys: A Study. SIE, Assam, 1974.

THURSTONE, L.L. & CHAVE, E.J.: The Measurement of Attitude. University of Chicago Press, Chicago, 1928.

THURSTONE, L.L.: Theory of Attitude Measurement. Psychological Research Association, 1936.

THURSTONE, L.L. "Comment". American Journal of Sociology, Volume 52, 1946.

TIEBOUT, H.M.: "The Misnamed Lazy Student." Educational Record, Volume 24, 1943.

TIWARI, G. & MORBHATT, K.: "Effect of Anxiety and Aspiration on Academic Achievement of Adolescent Boys and Girls." Asian Journal of Psychology and Education, Volume 6, Number 1, 1980.

**** TIWARI, A.D.: "An Investigation into the Interrelationship Between Measures of Selected Guilford's S-1 Factors and Set Concept Achievement of Secondary Level Students of Delhi State." Unpublished Doctoral Thesis in Education. Jamia Milia Islamia, 1986.

TODD, F.J., TERRELL, G. & FRANK, C.E.: "Differences Between Normal and Under-Achievers of Superior Ability." Journal of Applied Psychology, Volume 46, 1962.

TRAVERS, R.M.W.: Educational Psychology. Macmillan Company, New York, 1973.

TRAXLER, A.E.: Techniques of Guidance. Revised Edition, Harper & Brothers, New York, 1957.

UHLINGER, C.A. & STEPHENS, M.W.: "Relation of Achievement Motivation to Academic Achievement in Students of Superior Ability". Journal of Educational Psychology, Volume 51, 1960.

UNIYAL, M.P. & SHUKLA, G.C.: "Academic Achievement and Behaviour in Level of Aspiration Situations." Indian Psychological Review, Volume 10, Number 1, 1973.

UNIYAL, M.P. & SAH, B.: "The Level of Aspiration of Teacher Trainees of Rural and Urban Areas in Relation to Their Achievement." IER A Research Journal, Volume XVI, Number 1, January, 1981.

*VANARASE, S.J.: "Ability and Scholastic Underachievement." Unpublished Doctoral Thesis in Psychology. Poona University, 1970.

VERMA, O.P. & UPADHYAY, S.N.: "Some Psychological Correlates of School Achievement." Indian Psychological Review, Volume 20, Number 4, December, 1981.

*VIDHU, M.: "The Relationship of Neuroticism and Extraversion to Intelligence and Educational Achievement at Different Age Levels." Unpublished Doctoral Thesis in Psychology, Panjab University, 1968.

WARBURTON, F.W. & HADLEY, S.T.: "The Prediction of Achievement in Teacher-Training Courses of College Students Studying to be Teachers." IPAT Information Bulletin, Number 4, Laboratory of Personality Assessment, University of Illinois, 1960.

WARBURTON, F.W., BUTCHER, H.J. & FORREST, G.W.: "Predicting Student Performance in a University Department of Education." British Journal of Educational Psychology, Volume 33, 1963.

WATLEY, D.J. & MARTIN, H.T.: "Prediction of Academic Success in a College of Business Administration." Personnel Guidance Journal, Volume 49, 1962.

WATLEY, D.J. & MERWIN, J.C.: "The Effectiveness of Variables for Predicting Academic Achievement for Business Students." Journal of Experimental Education, Volume 33, 1964.

WATSON, J.B.: Behaviourism. Keagan Paul, London, 1930.

WEBB, S.C.: "Two Cross Validation of the Opinion, Attitude and Interest Survey." Educational and Psychological Measurement, Volume 25, 1965.

WEBSTER, A. MERRIAM.: Webster's New Collegiate Dictionary. Indian Edition. Scientific Book Agency, Calcutta, 1983.

WEDEMEYER, C.A.: "Gifted Achievers and Non-Achievers." Journal of Higher Education, Volume 24, 1953.

WEIGAND, G.: "Goal Aspiration and Academic Success." Personnel Guidance Journal, Volume 31, 1953.

WEIGAND, G.: "Adaptiveness and the Role of Parents in Academic Success." Personnel Guidance Journal, Volume 35, 1957.

WEITZ, H., CLARKS, M. & JONES, O.: "The Relationships Between Choice of a Major Field of Study and Academic Preparation and Performance." Educational and Psychological Measurement, Volume 15, 1955.

WHITE, H.D.J.: "An Application of Mental Tests to University Students." British Journal of Educational Psychology, Volume 1, 1931.

WHITTAKER, J.O.: Introduction to Psychology (International Students Edition). W.B. Saunders Company, 1970.

WILSON, R.C. & MORROW, W.R.: "School and Career, Adjustment of Bright High-Achieving and Under-Achieving High School Boys." Journal of General Psychology, Volume 101, 1962.

WILSON, G.D.: Dimension of Personality. Wiley, New York, 1971.

WITHERSPOON, P. & MELBERG, M.E.: "RElationship Between Grade Point Averages and Sectional SCores of the Guilford Zimmermen Temperament Survey." Educational and Psychological Measurement, Volume 19, 1959.

WOLF, F.M. & BLIXT, S.L.: "A Cross-Sectional Cross Lagged, Panel Analysis of Mathematics Achievement and Attitudes: Implications for the Interpretation of the Direction of Predictive Validity." Educational and Psychological Measurement, Volume 41, 1981.

WOODMAN, E.M.: "Description of a Guidance Instrument Designed to Measure Attitudes Related to Academic Success in College." Educational and Psychological Measurement, Volume 12, 1952.

*** ZACHARIA, T.: "Impact of Attitude and Interest on Achievement of Secondary School Pupils in Social Studies." Unpublished Doctoral Thesis in Education. Kerala University, 1977.

---

* These are abstracts taken from M.B. Buch (Ed.) Survey of Research in Education, CASE, M.S. University of Baroda, 1974.

** These are abstracts taken from M.B. Buch (Ed.) Second Survey of Research in Education, Society for Educational Research and Development, Baroda, 1979.

*** These are abstracts taken from M.B. Buch (Ed.) Third Survey of Research in Education (1978-1983), NCERT, New Delhi, 1987.

**** These are abstracts taken from M.B. Buch (Ed.) Fourth Survey of Research in Education (Yet to be published).
