

THE RELATIONSHIP BETWEEN CURIOSITY AND ACADEMIC
ACHIEVEMENT AMONG BLACK AND WHITE JUNIOR HIGH SCHOOL
SCIENCE PUPILS IN CAPE TOWN.

A minor dissertation submitted to the University of
Cape Town in partial fulfilment of the
requirements for the degree of
MASTER OF EDUCATION

by

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September 1989

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ACKNOWLEDGEMENTS

The writer wishes to acknowledge her indebtedness and gratitude to all who rendered practical assistance and showed an interest in the completion of this study.

In particular she wishes to thank the following:-

My supervisor, Professor K. Rochford, for his enthusiasm, support, guidance, patience and helpful suggestions.

The Department of Education and Training for granting a short period of study leave.

The librarians of the Cape Education Department Library, for their helpful service.

The pupils, science teachers and high school principals, who took part in the survey, for their willingness, cooperation and assistance.

Mrs. G. Thorburn, who showed an interest in the investigation and passed on personal insights.

The financial assistance of the University of Cape Town, Anglo-American and the Human Sciences Research Council

towards the costs of this research is hereby acknowledged. Opinions expressed, or conclusions reached are those of the writer, and are not to be regarded as a reflection of the opinions and conclusions of the Human Sciences research Council.

My family, brothers and sisters for giving constant support and encouragement.

Mr. Donald Cook, Teaching Methods Unit, University of Cape Town.

Mrs. Helga Muller, Typist/Word processor.

My parents who sacrificed so much to enable me to complete my basic education in faith and with a vision for the future.

My grateful appreciation to my son, Monde, for his sacrifice, understanding and unfailing support in encouraging me to complete this task.

I wish to thank God who enabled this investigation to proceed and succeed in miraculous ways.

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LIST OF ABBREVIATIONS

EXPO	Young Scientists Exhibition
MM1	Maw and Maw Test No. 1
MM2	Maw and Maw Test No. 2
GLOB	Global Project Test
CONS	Consistency Test
NSD	No Significant Difference

ABSTRACT

In this investigation an ex-post facto research method was used to gather the curiosity scores and academic science achievement results of approximately 200 pupils in one black and two predominantly white schools in Cape Town suburbs. Curiosity scores were also obtained for 150 pupils from five other high schools who submitted projects for the annual Young Scientists Exhibition (EXPO) in June 1988.

The data was collected by means of two instruments devised and validated by Maw & Maw (1964) and by author-designed tests of curiosity, after refinement using a pilot study. The scores were analysed by means of t-tests, χ^2 - (chi-square) tests and correlations.

It was found that:-

- 1) No significant differences existed between the samples of black and white junior high school science pupils on measures of curiosity.
- 2) No overall significant difference was found between high achieving and low achieving science pupils on the curiosity tests given to both the standard 6 and standard 7 pupils in the three chosen schools.
- 3) A highly significant difference on measures of curiosity was found between the group of Expo pupils (voluntary young scientists) and the ordinary groups of science pupils from the three different schools.
- 4) Significant correlations were found between the science pupils' inherent curiosity levels and their achievement in general science in several instances.

**"LIFE WAS MEANT TO BE LIVED, AND CURIOSITY MUST BE KEPT
ALIVE."**

(ELEANOR ROOSEVELT

1884 - 1962)

CHAPTER 1

INTRODUCTION

1.1 THE PURPOSE OF THE STUDY

In this study an attempt is made to measure the curiosity of general science pupils in local urban schools, to determine whether this is appreciably associated with their academic achievement in general science in the junior secondary school; to account for the presence or absence of any such relationship; and to discuss its possible implications for general science teaching.

More specifically, this investigation seeks answers to the following four questions:-

- (i) Is a high level of curiosity, as described and measured by scientists and science educators, a characteristic of competent South African science pupils in black and white schools?
- (ii) Do marked differences in curiosity exist between pupils who achieve well in general science, and those who underachieve relative to their peers in general science?

- (iii) Which one of several different measures of curiosity best discriminates between high and low achievers in general science in different schools?
- (iv) Do the pupils who submit projects voluntarily for the annual inter-school Young Scientists' Exhibition (EXPO) score significantly better on measures of curiosity than other science pupils of the same age?

1.2 ORIGIN AND BACKGROUND OF THE PROBLEM

Few black pupils (approximately 10%) follow careers in science after matriculation. Some achieve high marks in science but follow other careers, while others have relatively low achievements in science at school. The problem appears to be aggravated by the tendency for these pupils to have a restricted vision of their individual futures. Many believe their opportunities for advancement are slight, and are frustrated or near despair. It is suggested that many such science pupils are naturally curious, but their potential to develop this curiosity fully in schools is restricted.

Peterson (1979 : 185) points out that science educators and scientists have acknowledged the importance of curiosity as a human resource which facilitates

learning, intellectual development and the pursuit of scientific discovery.

If many South African Blacks tend to be highly curious, it may be argued that their levels of academic achievement ought to be high as well. This investigation seeks to explore this aspect in more detail.

However, Campbell (1971 : 319) remarks that few measures have been produced in this area of curiosity, and the need for the development of valid and reliable instruments remains important.

Maw and Maw (1968 : 465) have also acknowledged the paucity of validated instruments, and the present study hopes to make a positive contribution in this area in the African context.

1.3 THE NATURE OF THE PROBLEM

Curiosity and creativity are as natural to the average pupil as to the genius (Kneller , 1965). Curious and creative children need to be encouraged to actualize their original thinking towards its full potential if the intellectual, emotional and social development of the curious child is to be enhanced.

It is suggested that the early recognition of children with unusual ideas and talents is important in South Africa and that creative, curious activities should be encouraged by teachers. Hand in hand with the identification of curiosity is our need to know what kinds of measures of curiosity, given in what manner, might predict enhanced academic achievement of pupils in science.

Cropley (1967 : 80) asserts that even infant teachers are aware of the curiosity of the school beginner and his willingness to seek challenges to his new-found skills. He has a tendency to raise problems and to ask illogical questions, and an ability to visualise extension of given situations which are "logically" impossible. It is thus pertinent to ask whether attitudes seen in pre-schoolers might not also be utilized in fostering the learning of more senior pupils.

1.4 THE IMPORTANCE OF THE PROBLEM

Hendricks and Scott (1987 : 119) believe that curiosity must be encouraged and supported from the beginning of a child's education if a child is to remain an active learner. They also maintain that curiosity, interest and motivation must develop if higher goals are to be

achieved. Thus there would appear to be a need to arouse and maintain curiosity in science pupils during science lessons.

Investigators such as Barnard, Standler and Spock (1966 : 54) discovered that one of the outstanding characteristics of a scientist is curiosity. The future scientist often investigates the reasons for unexpected results or difficulties. He does so by trying things out, usually in an informal way initially.

This implies that, during his school years, the young pupil-scientist should be exposed to similar situations and experiences in which he can learn the fun and excitement of searching for solutions.

In their study of curiosity in America, Harty, Anderson and Enochs (1984 : 311) found that positive relationships existed between the curiosity of elementary school youngsters and their attitudes toward science and interest in science. The present study proposes to investigate related aspects of this among junior high school pupils in Africa.

Koran and Longino (1982 : 19) suggest that highly curious youngsters achieve better in science than students with lower curiosity levels because of their

exploration of events and objects for longer periods of time and their use of many more senses. Also these youngsters tended to recall experiences longer, comprehend them better, and tend to achieve a more complete concept learning.

1.5. DEFINITION OF TERMS

In this study, the term **urban** refers to schools located in Cape Town suburbs. Most pupils sampled in these schools will have lived in Cape Town for most of their lives.

Junior high school refers to standards 5, 6 and 7 (school year levels 7, 8 and 9; age range 12 - 16 years).

The word **black** refers to the Africans, excluding Coloureds (mixed blood) and Indians.

Because of the shortage of validated standardized curiosity tests, for the purpose of this investigation, pupils are regarded as **curious** according to Maw and Maw's (1964) definition of curiosity which states:

The child

(a) reacts positively to new, strange, incongruous or mysterious elements in his environment by moving

towards them, by exploring them or by manipulating them,

- (b) exhibits a need or a desire to know more about himself and his environment,
- (c) scans his surroundings seeking new experiences, and
- (d) persists in examining and exploring stimuli in order to know more about them.

The term **science** refers to general science i.e. a combined course of biology, physics and chemistry which is compulsory at the junior high school level.

1.6. HYPOTHESES

The following initial hypotheses form the basis for this investigation:-

1. There is no significant difference between the frequencies of responses of black and white junior high school science pupils to stimulus items on selected measures of curiosity.
2. There is no significant difference between the mean scores of academically high-achieving junior high school science pupils and academically low-achieving junior high school pupils on measures of curiosity, within the same class.

3. There are no significant correlations between pupils' inherent curiosity levels and their achievements on tests and examinations in general science in standards 6 and 7.

4. There are no significant differences between the mean scores of the EXPO group of pupils on measures of curiosity and those of ordinary/normal classes of science pupils of the same age.

1.7. PROCEDURE FOR COLLECTION AND TREATMENT OF THE DATA

A pilot study was run in 1987 using Maw and Maw's two curiosity tests on 150 black pupils from Standard 5 to 7 in two schools. As a result of these trials minor modifications were made to the wording of the tests for use in 1988. In 1988 the Global Project Test was also developed. Groups of items for the test were first presented to 20 science teachers from different schools to determine what items they found most curious, as part of the validation procedure. Refer to Appendices 1, 2 and 3.

The three refined tests of curiosity were administered in 1988 to science pupils, to pupils from one black school and two predominantly white multiracial schools and also to Expo pupils from five white schools.

Their reliabilities were calculated by using the test - retest method with a 7 day interval. t-tests, χ^2 tests and correlations were used to analyse the data.

More specific hypotheses dealing with the different measures of curiosity, the different schools and the different standards (science classes) are set out in detail in Chapter 3.

1.8. SUMMARY

It has been established from previous studies that there is a significant relationship between attitude toward science, interest in science and curiosity among certain groups of students.

There also appears to be a correlation between curiosity and achievement in science in the elementary classes, but apparently no such relationship has been established among junior high school science pupils. In particular no study in this research area has been carried out with black and white junior science pupils in the Western Cape in South Africa.

There appears to be a need to identify and nurture potential scientists at an early age in the junior classes. The present study thus seeks to identify

relationships between pupils' science scores and their curiosity levels for the purpose of early diagnosis, prediction and the fostering of the natural abilities of **all** the young scientists in our country.

CHAPTER 2

LITERATURE REVIEW

2.1. HISTORICAL BACKGROUND OF CURIOSITY

The earliest work on curiosity was undertaken with animals such as rats. This led to the formulation of several theories of curiosity and exploratory behaviour in the early 1950's which were based entirely on data obtained from the laboratory rat. (Fiske & Maddi, 1961).

Since Berlyne (1960) interest has also focused on the exploratory activities of human beings. He related human curiosity to complexity of stimuli and novelty.

Investigations into curiosity in children have been concerned with variables such as quantity and the quality of children's questions and the influence of intelligence, their need for achievement, and, the effects of socio-economic status upon question content and number (Fiske and Maddi, 1961).

Maw and Maw (1964) constructed and validated tests to differentiate the high from the low on curiosity in primary school pupils.

Recent interest in creativity in children has raised questions about the nature of curiosity and how it influences the initiation and stimulation of creative thought and behaviour. Thus, the psychological concept of curiosity is of relatively recent origin. In 1965, Fowler suggested that curiosity is "a behaviour without a definition." (Fowler, 1965 : 23).

Peterson and Lowery (1968 : 347) described the construct "curiosity" as follows:

"It is composed of various exploratory behaviours such as approaching, looking, listening, smelling, tasting, touching, manipulating and questioning, where each behaviour suggested that their child desired to know further information simply for the sake of knowing."

On the other hand, Beswick and Tallmodge (1971 : 456) interpreted curiosity as an individual's drive and readiness to seek out and resolve conceptual conflict.

Jenkins (1969 : 128) distinguishes between curiosity and interest. He regards curiosity as being present when an individual exhibits a need or desire to know more about himself and/or his environment in the absence of a connected, clearly defined goal toward which the individual is pointed. Interest is exhibited when the desire to know is based upon a clearly defined goal connected to that interest.

Jenkins thus concurs with Maw and Maw's definitions of curiosity in 1964 which states that the child

- (a) reacts positively to new, strange, incongruous or mysterious elements in his environment by moving towards them, by exploring them or by manipulating them,
- (b) exhibits a need or a desire to know more about himself and his environment,
- (c) scans his surroundings seeking new experiences, and
- (d) persists in examining and exploring stimuli in order to know more about them.

Murzova, a Russian psychologist, carried out studies in the USSR in 1955 on types of literature which "interested" school children and found that books that tended to raise questions, offered chances to guess answers, and required thought on the part of the child were more favoured than those which simply gave information (Neal, 1970 : 635).

Maw and Maw (1968) and Campbell (1971) reported that few empirical investigations involving school age children's curiosity had been produced in the area of curiosity and they attributed this to a lack of valid instruments at that time.

However, Harty and Beall (1984) designed a scale to measure elementary school aged American youngsters' curiosity in a science learning context, and this was used for the identification of science gifted children.

2.2 CLASSIFICATION OF CURIOSITY BEHAVIOUR

Curiosity has been defined by various authors according to the form it takes.

Epistematic curiosity is usually stirred up by a thought-provoking experience which contradicts expectations and leaves the student perplexed. In human beings it leads to exploratory behaviour which not only seeks information about the environment, but also motivates toward the acquisition of knowledge.

Epistematic behaviour is divided into three categories, viz observations, consultation and directed thinking, and it is aimed to equip the pupil with knowledge (Neal, 1970 : 633).

Perceptual curiosity refers to states of high arousal that can be relieved by specific exploration, and in which the pupil seeks specific knowledge. Curiosity is aroused by tangible stimuli such as objects, mazes and

visual or auditory patterns. For example, an animal can be disturbed because of a lack of information concerning his environment (Berlyne, 1960).

Reactive curiosity is a tendency to (a) approach and explore relatively new stimulus situations; (b) approach and explore incongruous complex stimuli; and (c) vary stimulation in the presence of frequently experienced stimulation (Penny and McCann, 1964 : 323).

Diversive curiosity is the need to seek new experiences or to extend one's knowledge into the unknown (Day, 1968 : 37).

Specific curiosity is the aroused state of an organism when confronted by an ambiguous or unclear stimulus under unfavourable conditions, and results in specific exploration (Ibid).

If the above five forms of curiosity are authentic categories, implications and recommendations for the learning of general science in African schools would appear to be as follows:-

1. Pupils should be provided with a variety in materials which are familiar but moderately novel to

them and which are increasingly difficult and challenging.

2. Skills or concepts previously learnt should be used in an altered manner or at a more complicated level.
3. Stimulating activities and situations which provoke thought and reasoning should be provided. Micro-computers and puzzles are possibilities.
4. Pupils should be encouraged to manipulate and rearrange things.
5. Pupils should be encouraged to initiate projects.

2.3. FACTORS INFLUENCING CURIOSITY

The curiosity motive or drive for exploration is dependent on many factors both inside and outside the organism.

The rate of arousal potential differs from individual to individual and from occasion to occasion (Berlyne, 1960).

Hurlock (1978 : 294) states that a child with a poor personal and social adjustment is far less curious than the outer-directed child.

Harty and Beall (1984 : 426) and Koran & Longino (1982 : 18) maintain that **curiosity** appears to be **aroused** as a result of surprise, doubt, perplexity, contradiction, bafflement, cognitive conflict, novelty, complexity, incongruity, ambiguity, lack of clarity and change.

Thus, in the teaching of general science, Koran & Longino (1982) caution that some properties of objects or events are more likely to evoke curiosity than others.

Possible implications of this for teaching general science are: (i) Put the pupils in familiar situations, but vary the stimulation. (ii) Place them in investigative situations which would result in unexpected outcomes.

According to Saxe and Stollak (1971 : 373) **parental reinforcement** and **modelling** foster children's curiosity.

Endsley et. al. (1979 : 336) report that the most curious children had mothers who were themselves more curious and more encouraging of their children's curiosity. Also highly curious older students participate more in the presence of non-threatening adults (Peters, 1978: 392).

Possible implication of this for the teaching of science in African schools are : (i) If parents and teachers exhibit curiosity then pupils might also develop curiosity. (ii) Encouraging, friendly teachers and parents may be preferable to critical ones. (iii) Pupils need teachers who can encourage their questions or modes of enquiry and investigation.

Interest. Pupils' curiosity varies depending on what catches their interest. For example, they tend to be more interested in things that move than in things that are still. They are more interested in an object that makes things happen than in an object to which things are happening. Curiosity reaches a peak with things that seem mysterious and magical (Victor, 1970 : 12).

Some implications of this for the learning of general science in African schools might be that African pupils need to be exposed to local industries and use made of their school laboratories.

They also need to be encouraged to manipulate and rearrange things and apparatus. Less emphasis may need to be put on teacher demonstrations. The pupils themselves should make and see things happening.

Contradiction. In approaching new or unusual objects the child may alternate between fear and curiosity. However, unless the stimulus is more fear-provoking than curiosity-provoking, curiosity usually dominates and the child is motivated to explore the object (Hurlock, 1978 : 206). Thus, in field work and laboratory situations, for example, contradicting pupils' expectations may stimulate them to know and discover more.

Relaxed classroom conditions under which pupils are allowed to move freely but purposefully in search of learning are known to foster curiosity (Arnstine, 1969: 602). In such situations, it has been claimed that students tend to pursue learning for their own satisfaction (Carll, 1968 : 62).

Social pressures in the form of warnings and punishments check young children's use of exploration to satisfy their curiosity. To the older children objects are seen from the perspective of how they can be used for some purpose or avoided in order to prevent pain or social

displeasure (Getzels & Jackson, 1975 : 116. Hurlock, 1978 : 205).

2.4 CURIOSITY AND LEARNING

According to Jenkins (1969), research in Indiana supports the existence of a significant relationship between curiosity and learning. Berlyne concurs that learning motivated by curiosity can give rise not only to particularly rapid and lasting acquisition of knowledge, but also to knowledge in which ideas are fruitfully pieced together into coherent structures (Berlyne, 1966). This implies that the intrinsically motivated pupils may be able to deal more successfully with unanticipated problems after their formal schooling has ended.

Berlyne recommends that a pupil's natural curiosity be cultivated so that he will discover new knowledge through his own activities.

A high level of specific curiosity indicates an interest in approaching and exploring high levels of novelty, complexity, incongruity etc. This should lead to the development of an individual who seeks to learn and to develop (Day : 1968).

In the learning situation, Pestalozzi, Froebel, Binet and Montessori regard curiosity - the instinct of play, the instinct to manipulate - as "a natural guide to learning." However, they warn that unguided play cannot be depended upon to bring about learning (Torrance, 1970 : 34). Finally Paradowski emphasises that curiosity arousal tends to increase significantly both intentional learning and incidental learning (Paradowski, 1967 : 50).

In the light of the above, it seems desirable that educators supply materials and guidance necessary for the development of curiosity. The aim should be to convert aimless touching and fumbling into systematic construction and direct the instinct into a channel of useful activity. It is the view of the writer that school science, as such, can provide a powerful medium in which this can occur under the influence of appropriately skilled teachers.

2.5 CURIOSITY AND THE LEARNING OF SCIENCE

According to Peterson (1975), science educators and scientists are concerned for the preservation and encouragement of curiosity in students. In his investigation of inquiry and curiosity in biology, Tamir (1978) noted that there was a high correlation between inquiry

performance and level of curiosity among pupils in Israel but this was not reflected in the performance of individuals. The current study seeks to discover whether a similar situation exists with regard to aspects of achievement among South African science pupils.

In a study of scientific curiosity and inquiry among high school students in Israel, Tamir (1979), concluded that there is a close relationship between the nature of instruction and the development of scientific curiosity. He asserts that a more inquiry-oriented instruction results in a higher level of students' involvement which will raise their scientific curiosity, especially at the responding level.

Harty, Anderson & Enochs (1984 : 309) maintain that interest in science, attitudes toward science and curiosity have long been known to have an influence on science teaching or learning situations.

In an investigation into the effects of structured science experiences on curiosity among fourth grade children in Indiana, Jenkins (1969 : 135) found that the number of structured experiences positively affected children's curiosity toward a science concept, although the curiosity level was not necessarily increased.

Follis and Krockover (1982 : 57) suggest that content should be presented in a way that draws upon the child's curiosity and engages the child in problem solving experiences to promote advanced abstract thinking and superior abilities.

Cobie and Rice (1983, : 48) state that students need to become more actively involved in science and to explore areas that are meaningful to them through laboratory experiences, field studies and library investigations.

Koran and Longino (1982 : 19) concur; highly curious children will probably outperform children displaying a lower degree of curiosity because they will explore objects and events with a greater number of their senses and for longer periods of time, thus understanding better what they are experiencing, remembering it better, and facilitating more complete concept learning.

In his research to determine scientific curiosity in the American secondary school, Campbell (1972) learnt that senior high school students showed lower levels of curiosity than their junior high school counterparts. This appeared to be partly due to a decline in their level of involvement.

In a study of scientific curiosity of children in Israel and U.S. secondary schools, Hofstein, Ben Zvi and Welch (1981) found that students who choose a career in science exhibit a higher level of curiosity than those who do not.

2.6 CURIOSITY ACROSS THE CULTURES

There is need to investigate whether different forms of curiosity are universal; for example among black and white science pupils in South Africa. In their study of curiosity among American elementary school science pupils, Peterson and Lowery (1968) report that the amount of curiosity expressed by youngsters was significantly correlated with racial-ethnic origin.

In 1979 Peterson learnt that (a) there was an unexplained difference found between racial-ethnic groups in the amount and form of curiosity responses to strange and novel objects. (b) Also black elementary school children exhibited significantly more curiosity through sensory motor responses ($P < 0,05$) than their white peers in such situations. (c) Curiosity behaviour decreased in general among students in the presence of the adult. (d) When left alone in a scientifically enriched environment, the average response of pupils to novel materials was to reach out

and explore with their senses and for some time regroup or reorganize the material in new ways.

Of interest was that in Peterson's study in 1975, the presence of an adult was found to affect the amount and form of curiosity exhibited by the child. This, however, depended upon the child's age and racial ethnic identity.

2.7 SUMMARY

Conclusions, questions and implications drawn from the present survey may be summarized as follows:

There seems to be an uncertainty surrounding the exact nature of curiosity. Regarding specific curiosity, the pupil is involved in an exploration of something which is incomplete and reveals uncertainty as to its true nature. On the other hand, diversive curiosity is the need to seek new experiences, while exploration curiosity is the need to seek new experiences, and exploration of the 'unknown'. Further clarification of the concept is important if curiosity, as such, is to be operationally measurable.

If pupils are to learn and develop their knowledge in science, to what extent will curiosity outshadow fear, and vice versa? In the event of an unusual, new, ambiguous object or situation, what kind of stimulus is curiosity-provoking? What kind of stimulus is fear provoking?

How does one distinguish between an interest in something and being curious about it?

From the findings of this literature survey it may be concluded that:

1. Children appear to ask more questions under reinforced conditions.
2. Pupils of certain ages manipulate objects and make more guesses in the presence of a friendly, encouraging adult, with the cultural factor important.
3. Pupils need relaxed classroom environments in which to facilitate and develop self-initiated learning.
4. They may well benefit from opportunities and materials to satisfy their curiosity drives.
5. They tend to need guidance from teachers and need both teachers and parents to serve as models.
6. Highly curious pupils do not necessarily perform academically better than those who are less curious.

7. Teachers need to encourage both sensory motor curiosity and verbal curiosity in their science classes.
8. Educationists should encourage the study of optional topics to meet the pupils' differing curiosity needs.

CHAPTER 3.

EXPERIMENTAL DESIGN, SAMPLE, CRITERION AND PREDICTORS

In this chapter the setting for the investigation is presented, and the characteristics of the three populations chosen for study are described, together with reasons for their selection. The research methods employed in the investigation are identified and the design, development, trials and refinement of the instruments are described. The format of the statistical analysis is also explained.

3.1 THE SETTING FOR THE INVESTIGATION

The entire study was conducted in three local schools. Two of these, School No. 1 and School No. 2 are private multi-racial schools of whom approximately 70% are of local European background. The rest are blacks who tend to come from middle to upper class backgrounds. Pupils in School No. 3, the black high school, are from less privileged home backgrounds and ill-equipped primary and high schools.

3.2 THE POPULATIONS SELECTED

Seven opportunistic samples were used from a total of approximately 500 junior high school pupils, of whom 283 were chosen for more intensive investigation. The sizes of the samples varied from $N = 14$ to $N = 150$.

The great majority of pupils were tested between 1987 and 1988, and minor items of missing data were gathered early in 1989.

The nature and characteristics of the seven samples are as follows:

Sample 1 consisted of 22 std 6 pupils (year 8) from school No. 1.

Sample 2 consisted of 29 std 7 pupils (year 9) from school No. 1.

They were both tested in small groups during August/September 1987 and in August 1988.

Sample 3 consisted of 21 std 6 pupils from school No. 2

Sample 4 consisted of 14 std 7 pupils from school No. 2.

They were both tested in April and August 1988.

Sample 5 consisted of 24 std 6 pupils from school No. 3.

Sample 6 consisted of 23 std 7 pupils from school No. 3.

They were both tested in small groups in August 1988.

Sample 7 consisted of 150 boys and girls randomly selected from five schools who were participating voluntarily in the annual Expo exhibition for young scientists in August 1988.

They were all tested in small groups on one day at the University of Cape Town while their exhibits were on public display.

(Samples 1 to 7 add up to 283 pupils).

3.3 SELECTION OF RESEARCH METHODS

For this investigation the ex post facto research method has been employed. Cohen and Manion (1980 : 148) state that this method is particularly suitable in educational contexts where an independent variable or variables lie outside the researcher's control; for example, when investigating relationships between academic achievement and independent variables such as race, sex, age or, in this case, curiosity.

3.4 HYPOTHESES FOR EACH SAMPLE

The following hypotheses form the basis for this investigation:-

- (1) There are no significant differences between the frequencies of responses of black and white junior high school science pupils to items on selected measures of curiosity.
- (2) There are no significant differences between the mean scores of academically high achieving junior

high school science pupils and academically low achieving junior high school science pupils on measures of curiosity, within the same class, at all three schools.

- (3) There is a significant correlation between science pupils' inherent curiosity levels and their achievement on tests and examinations in general science in standards 6 and 7, at all three schools.
- (4) There are no significant differences between science pupils' preference changes when offered a choice of apparatus for project work in junior high school science when presented perceptually at three different levels of curiosity arousal, viz:-
 - (a) a mere written description of the apparatus on choice,
 - (b) words plus pictures of the apparatus on choice.
 - (c) the apparatus itself on choice.
- (5) There are no significant differences between the mean scores of EXPO pupils on measures of curiosity and the mean curiosity scores of
 - (a) std 6 and 7 science pupils from school No. 1,
and

- (b) std 6 and 7 science pupils from school No. 2,
and
- (c) std 6 and 7 science pupils from school No. 3.

3.5. SELECTION OF DEPENDENT AND INDEPENDENT VARIABLES

For six of the seven samples, the standard 6 and 7 science pupils' academic achievement in science quarterly examination results for 1988 were chosen as the dependent variables.

The independent variables were:

- 1 The first two curiosity tests developed by Maw and Maw in 1964.
- 2 The Global Project Test of curiosity developed by the author in 1988.
- 3 The Consistency Test of curiosity developed by the author in 1988.

3.6 SELECTION OF STATISTICAL TESTS

t-tests were used to detect significant differences between the mean scores of high and low curiosity pupils on their science examinations.

χ^2 -tests (chi-square) were used to analyse the different frequencies of responses obtained with the Consistency Test, among the different sample groups.

3.7 THE SELECTION, DESIGN, DEVELOPMENT, REFINEMENT AND PROPERTIES OF THE CURIOSITY TESTS

1. The Maw and Maw tests of curiosity

Curiosity is usually assessed from the subjects' preference for actual stimuli, or from their expressed preference for certain verbally described activities. Preference for actual stimuli is made by asking the subjects to indicate which one of simultaneously presented stimuli they find of most interest.

The Maw and Maw I test of curiosity consists of 20 pairs of figures. One story can be told for each sign. A circle is to be drawn around the one in each pair which the pupil would want discussed. Appendix I contains a complete copy of this test.

The Maw and Maw 2 test of curiosity consists of a list of 40 things which a person did or what a person does. A tick is put in front of the alternative which best shows what the pupil thinks of it. Appendix II contains a complete copy of this test.

2 The Global Project Test for Curiosity

Consuegra (1982) and Follis and Krockover (1982) have noted that curiosity and enthusiasm for experimentation are basic characteristics of science gifted students.

Candrall (1971) found that questions with four alternatives aroused more curiosity than two alternative questions, the assumption being that the former produced more uncertainty and conflict than two alternatives. Describing scientifically gifted children, Cooke (1970 : 17) mentions characteristics which would be useful in identifying the science prone pupil, viz., the pupil is curious about what makes things work, and is willing to work independently on a science project for long periods of time.

Thus items chosen for the Project Test are related to science which may stimulate curiosity. They include things that can be assembled, taken to pieces, are interesting for their shape and texture, illustrate themes, have a story, and are things related to everyday use.

Groups of these items were first presented to 20 science teachers to determine what they would choose, and to note which items they found to be the most curious. Thus preferences for particular items were partly validated with reference to science teachers themselves on the assumption that they constituted an appropriate sample for determining inherent scientific curiosity, provided that, independently, they reached a large measure of agreement.

Thus, after trials, this third instrument, the Project Test, was finally composed of 10 items featuring characteristics such as novelty, complexity of stimuli, change etc., within the content of science learning.

The pupils were asked to draw a circle around the one choice in which they were most interested, and about which they would like to do a project or experiment. Both words and pictures were used to eliminate difficulties in interpreting the instrument in the pilot trials.

Appendix III contains a complete copy of this test.

3 The consistency Test for Curiosity

The Consistency Test is a sub-section of the Project Test. It refers to the number of times a pupil is consistent in his choice of items in the Global project test when these items are successively presented (i) verbally and (ii) in words and pictures and (iii) by the apparatus itself.

4 Trials

In a rehearsal to check whether South African pupils would be able to understand the instructions and procedure of the tests evolved in America, a pilot study

was carried out in Cape Town in 1987 using Maw and Maw's two curiosity tests for elementary children. In the 2nd test on What You Think, the following unfamiliar words were explained to the black pupils: "explore", "gadget", and "jumping jack". The pupils were asked to raise their hands if they experienced any difficulty, and all pupils were able to complete the assigned tasks satisfactorily.

3.8 REFINEMENT AND PROPERTIES OF THE MEASURES

- i) The June science examination papers were checked and moderated by the headmasters and/or heads of department in the three schools.
- ii) The degree of validity of the three tests purporting to measure curiosity, administered in each school, was established by intercorrelating the pupils' scores on them.
- iii) The reliability of the curiosity test MM1 was calculated by using the test - retest method over an interval of seven days, with a class of 16 subjects, and yielded $r = 0.78$.

Table 3.1 presents the means and the distribution of scores of pupils from the three schools on the various refined measures used in this study. The wide spreads of scores obtained by pupils in all the samples on all

the tests indicates that the instruments employed discriminate between pupils of different levels of curiosity within each class.

TABLE : 3.1 **DISTRIBUTIONS OF SCORES OF PUPILS FROM THREE SCHOOLS ON THE FIVE DATA-GATHERING INSTRUMENTS.**

Combined Samples I - VI (Schools No. 1, 2 and 3).

Variable	N	Mean	Max Possible Score	Range	St. Dev.
MM1	133	25.1	40	1 - 40	12.2
MM2	133	135.3	195	91 - 189	15.7
GLOB	133	10.4	20	2 - 20	3.9
CONS	133	4.1	10	0 - 10	2.7

Sample I - School No. 1

Variable	N	Mean	Range
MM1	22	23.9	1 - 38
MM2	22	131.8	100 - 159
GLOB	22	8.3	2 - 16
CONS	22	4.1	1 - 9
JUNE SCIENCE EXAM MARKS	22	46.3	25 - 72

Sample II - School No. 1

Variable	N	Mean	Range
MM1	29	15.3	1 - 37
MM2	29	131.0	105 - 150
GLOB	29	8.1	2 - 14
CONS	29	2.4	0 - 10
JUNE SCIENCE EXAM MARKS	29	50.9	21 - 88

Sample III - School No. 2

Variable	N	Mean	Range
MM1	21	28.7	6 - 38
MM2	21	135.6	92 - 189
GLOB	21	12.5	6 - 20
CONS	21	4.0	1 - 7
JUNE SCIENCE EXAM MARKS	21	65.7	37 - 95

Sample IV - School No. 2

Variable	N	Mean	Range
MM1	14	30.0	18 - 38
MM2	14	146.6	110 - 181
GLOB	14	12.0	6 - 16
CONS	14	3.5	0 - 8
JUNE SCIENCE EXAM MARKS	14	48.4	24.0 - 74.0

Sample V - School No. 3

Variable	N	Mean	Range
MM1	24	28.5	4 - 39
MM2	24	135.4	116 - 152
GLOB	24	11.9	4 - 19
CONS	24	6.3	0 - 9
JUNE SCIENCE EXAM MARKS	24	51.9	28 - 84

Sample VI - School No. 3

Variable	N	Mean	Range
MM1	23	28.9	3 - 40
MM2	23	137.2	91 - 161
GLOB	23	10.8	6 - 16
CONS	23	4.7	0 - 10
JUNE SCIENCE EXAM MARKS	23	54.1	32.0 - 86.0

3.9 SUMMARY OF EXPERIMENTAL PROCEDURE

The plan outlining the sequence of steps in the investigation is summarized below:

PHASE ONE : 1987

STEP 1 Maw and Maw tests of curiosity, which were designed for elementary children in America, were selected as the starting point of the investigation.

They were chosen to see whether use of the tests in modified form might be feasible in South Africa with junior high school science pupils whose home language may or may not be English.

STEP 2 The two curiosity tests were given in August/September as trial on 150 black pupils from std 5 to std 6, to check understanding of instructions for the tests, and to establish that the tests produced a wide range of scores.

PHASE TWO: 1988

STEP 1 The Global Project Test was developed in an attempt to produce another curiosity test which might be particularly suitable for South

African science pupils within the context of the prescribed general science syllabus.

STEP 2 Groups of the items chosen for the test were presented to science teachers to determine what they would choose as items which they found most curious, and the common preferences were recorded.

STEP 3 The test was given to the seven pupil samples described earlier in Section 3.2

STEP 4 The June examination results for samples 1-6 were gathered.

PHASE 3 : 1989

Minor items of missing data such as latest monthly test results were collected early in the year, and the data was analysed.

CHAPTER 4

In this Chapter, the significant results of the investigation are presented and analysed. The results may be summarized by taking each of the hypothesis, i.e. one to five, in their order. An explanation and discussion of the emerging significant differences will occur in the following Chapter 5.

Hypothesis No. 1.

"That there is no significant difference between the frequencies of response of black and white junior high school science pupils on selected measures of curiosity," was largely confirmed. On the Global Project Test however, significant chi-square differences in frequencies were found on two items:-

- (i) With the std 6 pupils in school No. 1 and the std 6 pupils in school No. 3 on question 7.
(See Table 4.1)A
($\chi^2 = 20,72$; $df = 3$; $p = 0,01$)

TABLE 4.1(A) FREQUENCIES OF RESPONSES OF STD 6 PUPILS IN SCHOOLS NO. 1 AND 3 ON QUESTION 7 OF THE GLOBAL PROJECT TEST.

	PREFERENCE / CHOICE				
	Filter Paper	Plastic	Silk Cloth	Fishing Net	Total
School 1	27	9	22	11	69
School 3	7	26	16	11	60
	34	35	38	22	129

(ii) With the std 7 pupils in school No 1 and the std 7 science pupils in school No 2 on question 3 (See Table 4.2).

$$(X^2 = 18,89; \text{ df} = 3; P < 0,01)$$

TABLE 4.1(B): FREQUENCIES OF RESPONSES OF STD 7 PUPILS IN SCHOOLS NO. 1 AND 2 ON QUESTION 3 OF THE GLOBAL TEST.

	Packet of Sugar	Bicarbonate of Soda	Soap Powder	Enos	Total
School 1	19	28	14	18	79
School 2	2	10	2	21	40
	26	38	16	39	119

No significant differences occurred between the mean scores of the samples of black and white pupils on Maw & Maw's two tests of curiosity (Table 4.2), or on any other other items of the Global Project Test.

Appendix V contains a complete record of the other

differences between the samples on questions 2, 4, and 7 of the Global Project Test which were not significant.

TABLE 4.2. MEAN SCORES OF SAMPLES OF BLACK AND WHITE PUPILS ON MAW AND MAW'S TWO TESTS OF CURIOSITY.

Sample of Black Pupils Std 6 & 7 (n = 51)			Sample of White Pupils Std 6 & 7 (n = 82)		
	\bar{X}	SD		\bar{X}	SD
MM1	19.0	13.6	MM1	28.9	9.5
MM2	131.3	11.0	MM2	137.8	17.6

Hypothesis No. 2

"That there is no significant difference between the mean curiosity scores of high achieving junior high school science pupils and low achieving junior high school science pupils on the June science examinations within the same class," was confirmed with most of the samples.

Below is the set out of the complete record of results and statistical analysis. The only significant difference was obtained with the top and bottom Std. 6 and the top and bottom Std 7 science pupils in School No. 3 on the MM2.

On Maw & Maw test 1 (MM1) the top science pupils did score higher than the academically weaker science

pupils, but the greater mean curiosity scores were not statistically significant, probably due to the small sizes of the pupil samples.

On Maw & Maw test 1, no statistically significant differences were found between the mean curiosity scores of:-

(i) the top and bottom std 6 and the top and bottom std 7 science pupils in school No. 1:-

Std 6 : $\bar{X}_1 = 20,6$; $\bar{X}_2 = 11,5$; (N=6, N=6);

$t = 1,18$.

Std 7 : $\bar{Y}_1 = 16,7$; $\bar{Y}_2 = 12,0$; (N = 13, N = 13)

$t_2 = 0,92$

(ii) the top and bottom std 6 and the top and bottom std 7 science pupils in school No. 2:-

Std 6 : $\bar{X}_1 = 31,0$; $\bar{X}_2 = 26,3$; (N = 9, N = 9);

$t_1 = 1,2$

Std 7 : $\bar{Y}_1 = 30,1$; $\bar{Y}_2 = 30,0$; (N₁ = 7, N₂ = 7);

$t_2 = 0,68$

(iii) the top and bottom std 6 and the top and bottom std 7 science pupils in school No. 3:

$$\text{Std 6 : } \bar{X}_1 = 31,0; \bar{X}_2 = 26,0; (N = 11, N_2 = 11);$$

$$t_1 = 1,3.$$

$$\text{Std 7 : } \bar{Y}_1 = 32,3; \bar{Y}_2 = 25,8; (N_1 = 11, N_2 = 11)$$

$$t_2 = 1,5.$$

On Maw & Maw test 2, no significant difference was found between the mean curiosity scores of:-

(i) the top and bottom std 6 and the top and bottom std 7 science pupils in school No. 1:

$$\text{Std 6 : } \bar{X}_1 = 132,0; \bar{X}_2 = 128,0; (N_1=N_2=6);$$

$$t_1 = 1,6$$

$$\text{Std 7 : } \bar{Y}_1 = 119,9; \bar{Y}_2 = 131,6; (N_1= N_2= 13);$$

$$t_2 = 1,12.$$

(ii) the top and bottom std 6 and the top and bottom std 7 science pupils in school No. 2

$$\text{Std 6 : } \bar{X}_1 = 135,2; \bar{X}_2 = 123,2; (N_1= N_2 = 9);$$

$$t_1 = 0,53$$

$$\text{Std 7 : } \bar{Y}_1 = 153,8; \bar{Y}_2 = 139,4; (N_1= N_2 = 7);$$

$$t_2 = 1,12.$$

However, statistically significant differences were found between the top and bottom std 6 and the top and bottom std 7 science pupils in school No. 3:-

$$\text{Std 6 : } \bar{X}_1 = 145,0; \bar{X}_2 = 136,0; (N_1 = N_2 = 11);$$

$$t_1 = 2,3; p = 0,05$$

$$\text{Std 7 : } \bar{Y}_1 = 146,0; \bar{Y}_2 = 127,9; (N_1 = N_2 = 11);$$

$$t_2 = 2,82; p = 0,01$$

On the Global Project Test, no significant difference was found between the mean curiosity scores of:

(i) the top and bottom std 6 and the top and bottom std 7 science pupils in school No. 1.

$$\text{Std 6 : } \bar{X}_1 = 9,3; \bar{X}_2 = 6,3; (N_1 = N_2 = 6);$$

$$t_1 = 1,3$$

$$\text{Std 7 : } \bar{Y}_1 = 6,8; \bar{Y}_2 = 4,6; (N_1 = N_2 = 13);$$

$$t_2 = 1,12$$

(ii) the top and bottom std 6 and the top and bottom std 7 science pupils in school No. 2.

$$\text{Std 6 : } \bar{X}_1 = 13,1; \bar{X}_2 = 12,3; (N_1 = N_2 = 9);$$

$$t_1 = 0,4$$

$$\text{Std 7 : } \bar{Y}_1 = 11,7; \bar{Y}_2 = 12,4; (N_1 = N_2 = 7);$$

$$t_2 = 0,7$$

(iii) the top and bottom std 6 and the top and bottom std 7 science pupils in school No. 3

$$\text{Std 6 : } \bar{X}_1 = 13,7; \bar{X}_2 = 10,1; (N_1 = N_2 = 11)$$

$$t_1 = 0,2;$$

$$\text{Std 7 : } \bar{Y}_1 = 10,8; \bar{Y}_2 = 11,0; (N_1 = N_2 = 11);$$

$$t_2 = 0,17;$$

On the Consistency Test, no significant differences were found between the mean curiosity scores of:-

(i) the top and bottom std 6 and the top and bottom std 7 science pupils in school No. 1.

$$\text{Std 6 : } \bar{X}_1 = 5,1; \bar{X}_2 = 4,5; (N_1 = N_2 = 6);$$

$$t = 0,5$$

$$\text{Std 7 : } \bar{Y}_1 = 2,7; \bar{Y}_2 = 1,8; (N_1 = N_2 = 6);$$

$$t = 0,95$$

(ii) the top and bottom std 6 and the top and bottom std 7 science pupils in school No. 2.

$$\text{Std 6 : } \bar{X}_1 = 3,4; \bar{X}_2 = 3,8; (N_1 = N_2 = 9);$$

$$t_1 = 0,26$$

$$\text{Std 7 : } \bar{Y}_1 = 2,8; \bar{Y}_2 = 4,1; (N_1 = N_2 = 7);$$

$$t_2 = 0,36.$$

(iii) the top and bottom std 6 and the top and bottom std 7 science pupils in school No 3

Std 6 : $\bar{X}_1 = 6,4$; $\bar{X}_2 = 6,3$; ($N_1=N_2=11$);

$t_1 = 0,2$

Std 7 : $\bar{Y}_1 = 6,5$; $\bar{Y}_2 = 3,1$; ($N_1=N_2=11$);

$t_2 = 1,06$

Hypothesis No. 3

"That there is a significant correlation between science pupils' inherent curiosity levels and their achievement in general science," was confirmed in some cases but refuted in other cases.

Sample I : Standard 6 science pupils in School No. 1

Scores on MM1 and MM2 are statistically related

($r = 0,39$), so they may be partly valid measures either of the same construct or of some common related construct. Scores on the author's Global Test of Curiosity are significant predictors of the June science marks but MM1 and MM2 tests of curiosity are not.

TABLE 4.3: CORRELATIONS AMONG THE FOUR CURIOSITY MEASURES AND JUNE MARKS IN GENERAL SCIENCE FOR SAMPLE I, STD 6 PUPILS IN SCHOOL NO. 1 (N = 22)

	MM1	MM2	GLOB	CONS	JUNE
MM1	1,00	0,39*	0,20	-0,23	-0,19
MM2		1,00	0,05	-0,14	0,16
GLOB			1,00	-0,09	0,42**
CONS				1,00	0,02
JUNE SCIENCE EXAM MARKS					1,00

* P = 0,07 (marginally significant)

** P = 0,05 (significant)

Sample II: Standard 7 science pupils in School No. 1

Scores on the curiosity tests MM1 and MM2 are again highly significantly related to each other ($r = 0,32$; $N = 29$; $p < 0,01$), and

Scores on MM1 are marginally related to GLOB scores ($r = 0,32$; $N = 29$; $p = 0,06$). Tables 4.3 and 4.4 reveal that scores on MM1 are significant predictors of the June science marks with std 7 but not with Std 6.

**TABLE 4.4 CORRELATIONS AMONG THE FOUR CURIOSITY MEASURES
AND JUNE MARK S IN GENERAL SCIENCE FOR SAMPLE
II, STD 7 PUPILS IN SCHOOL NO. 1 (N = 29)**

	MM1	MM2	GLOB	CONS	JUNE
MM1	1,00	0,53**	0,32*	0,27	0,35
MM2		1,00	0,04	0,19	0,09
GLOB			1,00	0,24	0,28
CONS				1,00	-0,05
JUNE EXAM SCIENCE MARKS					1.00

* $P < 0,10$ marginally significant

** $P < 0,01$ highly significant

Samples I and II combined (June science exam results omitted).

Scores on MM1 are related to MM2 scores, and the relationship is again statistically highly significant ($r = 0,44$; $N = 51$; $p = 0,001$).

Scores on MM1 are marginally related to GLOB scores ($r = 0,26$; $N = 51$; $p = 0,06$), so GLOB may be measuring something connected to MM1 which is not part of MM2.

TABLE 4.5 CORRELATIONS AMONG THE FOUR CURIOSITY MEASURES FOR SAMPLES I AND II, STD 6 & 7 PUPILS IN SCHOOL NO. 1. (N = 51).

	MM1	MM2	GLOB	CONS
MM1	1,00	0,44**	0,26*	0,14
MM2		1,00	0,04	0,04
GLOB			1,00	0,10
CONS				1,00

* P = 0,02 significant

** P < 0.01 highly significant

Sample III : School No. 2

Scores on MM1 are related to GLOB scores again.

Scores on MM1 are marginally significant predictor of June science marks.

TABLE 4.6 CORRELATIONS AMONG THE FOUR CURIOSITY MEASURES AND JUNE MARKS IN GENERAL SCIENCE FOR SAMPLE III, STD 6 PUPILS IN SCHOOL NO. 2 (N = 21).

	MM1	MM2	GLOB	CONS	JUNE
MM1	1,00	0,28	0,38*	-0,29	0,39*
MM2		1,00	0,22	0,11	0,05
GLOB			1,00	-0,05	0,06
CONS				1,00	-0,35
JUNE SCIENCE EXAM MARKS					1,00

* P < 0,10 Marginally significant

Sample IV : School No. 2

Scores on MM1 are again statistically significantly related to MM2 scores ($r = 0,54$; $N = 14$; $p = 0,05$)

TABLE 4.7: CORRELATIONS AMONG THE FOUR CURIOSITY MEASURES AND JUNE MARKS IN GENERAL SCIENCE FOR SAMPLE IV, STD 7 PUPILS IN SCHOOL NO. 2 (N = 14).

	MM1	MM2	GLOB	CONS	JUNE
MM1	1,00	0,54*	-0,03	-0,20	0,01
MM2		1,00	-0,02	0,14	0,38
GLOB			1,00	0,10	0,02
CONS				1,00	-0,39
JUNE					1,00

$P < 0,05$

Samples III and IV combined

(June science exam results omitted).

For these pupils, MM1 scores are significantly related to their MM2 scores ($r = 0,38$; $N = 35$; $p = 0,02$).

This confirms the trend found with School No. 1 with samples I and II. The results are set out in Table

4.8.

TABLE 4.8: CORRELATIONS AMONG THE FOUR CURIOSITY MEASURES FOR SAMPLES III & IV, STD 6 & 7 PUPILS IN SCHOOL NO. 2 (N = 35)

	MM1	MM2	GLOB	CONS
MM1	1,00	0,38*	0,25	-0,26
MM2		1,00	0,13	0,08
GLOB			1,00	0,02
CONS				1,00

P = 0,02 (significant)

Sample V: School No. 3

Scores on GLOB are marginally significantly related to the June science marks ($r = 0,36$; $N = 24$; $p = 0,09$)

as presented in Table 4.9.

TABLE 4.9: CORRELATIONS AMONG THE FOUR CURIOSITY MEASURES AND JUNE MARKS IN GENERAL SCIENCE FOR SAMPLE V, STD 6 PUPILS IN SCHOOL NO. 3 (N= 24).

	MM1	MM2	GLOB	CONS	JUNE
MM1	1,00	0,26	0,17	-0,27	0,33*
MM2		1,00	0,14	-0,25	-0,18
GLOB			1,00	0,28	0,36*
CONS				1,00	0,16
JUNE					1,00

$P < 0,10$ (marginally significant)

Sample VI: School No. 3.

MM1 is a marginally significant predictor of June science results ($r = 0,37$; $N = 23$; $p = 0,08$).

MM2 is significantly related to CONS scores ($r = 0,5$; $N = 23$; $P = 0,01$).

MM2 is a marginally significant predictor of June science scores ($r = 0,35$; $N = 23$; $p = 0,10$).

CONS is a significant predictor of June science scores ($r = 0,45$; $N = 23$; $p = 0,03$)

TABLE 4.10: CORRELATIONS AMONG THE FOUR CURIOSITY MEASURES AND JUNE MARKS IN GENERAL SCIENCE FOR SAMPLE VI, STD 7 PUPILS IN SCHOOL NO. 3. (N = 23)

	MM1	MM2	GLOB	CONS	JUNE
MM1	1,00	0,23	0,09	0,09	0,37*
MM2		1,00	0,06	0,50 ***	0,35*
GLOB			1,00	0,11	0,12
CONS				1,00	0,45**
JUNE					1,00

* $P < 0,10$

** $P < 0,05$

*** $P < 0,01$

Samples V and VI combined (N = 47)

No relationships are significant although Table 4.11 reveals:

for MM1-MM2, $r = 0,23$

for CONS-MM2, $r = 0,23$

for CONS-GLOB, $r = 0,23$

which tends to confirm the trend found with School No. 1 and School No. 2.

TABLE 4.11: CORRELATIONS AMONG THE FOUR CURIOSITY MEASURES FOR SAMPLES V & VI, COMBINED IN SCHOOL NO. 3 (N = 47)

	MM1	MM2	GLOB	CONS
MM1	1,00	0,23	0,13	0,07
MM2		1,00	0,07	0,23
GLOB			1,00	0,23
CONS				1,00

Samples III, IV, V, & VI combined

For the two private schools' junior high school pupils only MM1 and MM2 are significantly related ($r = 0,28$; $N = 82$; $p = 0,01$). (See Table 4.12).

TABLE 4.12: CORRELATIONS AMONG THE FOUR CURIOSITY MEASURES FOR SAMPLES III, IV, V & VI COMBINED, STD 6 & 7 PUPILS IN SCHOOL NO. 2 AND SCHOOL NO. 3 (N = 81)

	MM1	MM2	GLOB	CONS
MM1	1,00	0,28*	0,17	-0,13
MM2		1,00	0,11	0,11
GLOB			1,00	0,11
CONS				1,00

* P = 0,01

Samples I - VI combined

For junior high school pupils across the three different suburbs of Cape Town we find:-

- (i) MM2 scores are significantly related to MM1 scores ($r = 0,36$; $N = 133$; $p < 0,01$)
- (ii) MM1 scores are significantly related to GLOB scores ($r = 0,35$; $N = 133$; $p < 0,01$).
- (iii) MM2 scores are only marginally related to GLOB scores ($r = 0,17$; $N = 133$; $P = 0,05$) so the GLOB test may have more in common with MM1 than with MM2.

- (iv) GLOB and CONS scores are significantly related. ($r = 0,22$; $N = 133$; $p < 0,01$)

TABLE 4.13: CORRELATIONS AMONG THE FOUR CURIOSITY MEASURES FOR SAMPLES I - VI COMBINED: STD 6 & 7 PUPILS IN SCHOOLS NO. 1, NO. 2 AND NO. 3 (N = 133)

	MM1	MM2	GLOB	CONS
MM1	1,00	0,36**	0,35**	0,11
MM2		1,00	0,17*	0,14
GLOB			1,00	0,22**
CONS				1,00

** $P < 0,01$

* $P < 0,05$

Hypothesis No. 4

"That there are no significant differences between science pupils' preference changes when offered a range of apparatus for project work in junior high school science when presented perceptually at three different levels of curiosity arousal, viz:-

- (a) a mere written description of the apparatus on choice;
- (b) words plus pictures of the apparatus on choice;
- and
- (c) the apparatus itself on choice.

This hypothesis was refuted, as follows:-

On the ten item Global Project Test significant changes were found for all the samples of science pupils.

The results for the seven samples, shown in Table 4.14, give the numbers of pupils who changed their minds on this consistency test - up to the maximum number of ten times - as the perceptual presentation format of the items changed three times. The null hypothesis was that no pupils would change their minds about any of the preferences within any of the ten items as the presentation format (a), (b) and (c) above changed. It is clear that levels of curiosity arousal in science may be noticeably influenced by the presence or absence of apparatus or pictures of apparatus on display.

Table 4.14: Numbers of pupils making up to 10 changes on the Global Project Test.

SAMPLE SCHOOL		NUMBER OF CHANGES ON THE TEN-ITEM GLOBAL PROJECT TEST											Fre- quen- cies of changes of pupil prefer- ences
NO.	No. Std.	10	9	8	7	6	5	4	3	2	1	0	
I	1 6	-	1	2	1	2	3	3	2	5	3	-	
II	1 7	1	-	-	-	1	5	2	4	3	5	9	
III	2 6	-	-	-	2	2	5	5	5	4	1	-	
IV	2 7	-	-	1	-	3	-	2	4	1	1	1	
V	3 6	3	3	3	3	3	5	1	1	1	-	1	
VI	3 7	1	1	4	1	2	2	3	3	2	1	4	
VII	Expo	1	2	4	2	-	5	4	2	4	4	2	

Hypothesis No. 5

"That there are no significant differences between the mean scores of Expo pupils on measures of curiosity and science pupils from schools No. 1, No. 2 and No. 3, on measures of curiosity". The hypothesis is confirmed in some cases and refuted in other instances, as follows:-

(a) THE PROJECT TEST**(i) Expo pupils vs std 6 science pupils of school****No. 1**

On the project test significant chi-square differences were found between the frequencies of responses of the Expo pupils and the frequencies of responses of the std 6 science pupils of school No. 1:-

On question 2, $\chi^2 = 20,94$; $df=3$; $p < 0,001$ Table 4.15
 On question 9, $\chi^2 = 36,55$; $df=3$; $p < 0,001$ Table 4.16
 On question 10, $\chi^2 = 14,30$; $df=3$; $p < 0,01$ Table 4.17
 On question 8, $\chi^2 = 9,48$; $d=3$; $p < 0,02$ Table 4.18

TABLE 4.15: FREQUENCIES OF RESPONSES OF EXPO PUPILS VS STD 6 SCIENCE PUPILS OF SCHOOL NO. 1 ON QUESTION 2 OF THE GLOBAL PROJECT TEST.

	<u>Aeroplane</u>	<u>Machine Gun</u>	<u>Kite</u>	<u>Rocket</u>	<u>Total</u>
Expo	22	28	10	50	110
School No.1 Std. 6	16	21	21	10	68
	39	49	31	60	178

TABLE 4.16: FREQUENCIES OF RESPONSES OF EXPO PUPILS VS. STD 6 SCIENCE PUPILS OF SCHOOL NO. 1 ON QUESTION 9 OF THE GLOBAL PROJECT TEST

	<u>Prism</u>	<u>Bottles</u>	<u>Beakers</u>	<u>Straws</u>	<u>Total</u>
Expo	53	13	12	22	100
School No.1 Std 6	7	28	14	20	69
	60	41	26	42	169

TABLE 4.17: FREQUENCIES OF RESPONSES OF EXPO PUPILS VS STD 6 SCIENCE PUPILS OF SCHOOL NO. 1 ON QUESTION 10 OF THE GLOBAL PROJECT TEST.

	<u>Alarm Clock</u>	<u>Wheels</u>	<u>Torch</u>	<u>Calculator</u>	<u>Total</u>
Expo	20	13	8	68	109
School No.1 Std 6	8	5	19	36	68
	28	18	27	104	177

TABLE 4.18: FREQUENCIES OF RESPONSES OF EXPO PUPILS VS. STD 6 SCIENCE PUPILS OF SCHOOL NO. 1 ON QUESTION 8 OF THE GLOBAL PROJECT TEST.

	Distilled water	Sea Water	Sugar Solution	Rain Water	Total
Expo	22	45	14	28	109
School No.1 Std 6.	16	32	16	6	70
	38	77	30	34	179

(ii) Expo vs std 7 science pupils of school No. 1

The hypothesis is refuted.

On the project test a highly significant difference is found between the frequencies of responses of the Expo pupils and the frequencies of responses of the std 7 science pupils of school No. 1:-

On question 9, $\chi^2 = 29,49$; $df=3$; $p = 0.001$ Table 4.19

On question 8, $\chi^2 = 33,83$; $df=3$; $p = 0,001$ Table 4.20

TABLE 4.19: FREQUENCIES OF RESPONSES OF EXPO PUPILS VS STD 7 SCIENCE PUPILS OF SCHOOL NO. 1 ON QUESTION 8 OF THE GLOBAL PROJECT TEST.

	Distilled Water	Sea Water	Sugar Solution	Rain Water	Total
Expo	22	45	14	28	109
School No.1 Std 7	13	12	40	16	81
	35	57	54	44	190

TABLE 4.20: FREQUENCIES OF RESPONSES OF EXPO PUPILS VS. STD 7 SCIENCE PUPILS OF SCHOOL NO. 1 ON QUESTION 9 OF THE GLOBAL PROJECT TEST

	Prism	Bottles	Beakers	Straws	Total
Expo	53	13	12	22	100
School No.1 Std. 7	14	15	31	20	80
	67	28	43	42	180

(iii) Expo vs std 6 science pupils of school No. 2

The hypothesis is refuted.

A significant difference is found between the frequencies of responses of Expo pupils and the frequencies of responses of the std 6 science pupils of school No. 2.

On question 1, $\chi^2 = 18,10$; $df=3$; $p < 0,001$ Table 4.21

On question 5, $\chi^2 = 8,33$; $df=3$; $p < 0,05$ Table 4.22

TABLE 4.21: FREQUENCIES OF RESPONSES OF EXPO PUPILS VS. STD 6 SCIENCE PUPILS OF SCHOOL NO. 2 ON QUESTION 1 OF THE GLOBAL PROJECT TEST

	Glass Rod	Thermometer	Magnet	Magnifying Glass	Total
Expo	16	16	47	33	112
School No.2 Std 6	7	18	18	29	72
	23	34	65	62	184

TABLE 4.22: FREQUENCIES OF RESPONSES OF EXPO PUPILS VS STD 6 SCIENCE PUPILS OF SCHOOL NO. 2 ON QUESTION 5 OF THE GLOBAL PROJECT TEST

	Sweets	Matches	Marbles	Shells	Total
Expo	23	31	14	42	110
School No.2 Std. 6	25	26	9	14	74
	48	57	23	56	184

(iv) Expo vs. Std. 6 Science Pupils of School No. 3

The hypothesis is refuted.

A significant difference is found between the frequencies of responses of the Expo pupils and the frequencies of responses of the std 6 science pupils of school no. 3.

On question 8, $\chi^2 = 10,43$; $df=3$; $p=0,05$. Table 4.23

TABLE 4.23: FREQUENCIES OF RESPONSES OF EXPO PUPILS VS. STD 6 SCIENCE PUPILS OF SCHOOL NO. 3 ON QUESTION 8 OF THE GLOBAL PROJECT TEST

	Distilled Water	Sea Water	Sugar Solution	Rain Water	Total
Expo	22	45	14	28	109
School No.3 Std.6	29	24	5	11	69
	51	69	19	39	178

(v) Expo vs std 7 science pupils school No. 3

The hypothesis is refuted.

A highly significant difference is found between the frequencies of responses of the Expo pupils and the frequencies of responses of the std 7 science pupils of school no. 3.

On question 5, $\chi^2 = 16,09$; $df=3$; $p < 0.01$ Table 4.24

On question 6, $\chi^2 = 11,18$; $df=3$; $p < 0,01$ Table 4.25

TABLE 4.24: **FREQUENCIES OF RESPONSES OF EXPO PUPILS**
VS. STD 7 SCIENCE PUPILS OF SCHOOL NO. 3
ON QUESTION 5 OF THE GLOBAL PROJECT TEST

	<u>Sweets</u>	<u>Matches</u>	<u>Marbles</u>	<u>Shells</u>	<u>Total</u>
Expo	23	31	14	42	110
School No.3					
Std 7	12	20	26	14	72
	35	51	40	56	182

TABLE 4.25: FREQUENCIES OF RESPONSES OF EXPO PUPILS VS. STD 7 SCIENCE PUPILS OF SCHOOL NO. 3 ON QUESTION 6 OF THE GLOBAL PROJECT TEST.

	<u>Rocks</u>	<u>Cones</u>	<u>Owl Pellets</u>	<u>Birds</u>	<u>Total</u>
Expo	50	17	17	27	111
School No 3	32	7	25	9	73
	82	24	42	36	184

(b) **THE MAW AND MAW TESTS**

The hypothesis is refuted for the Expo pupils on Maw and Maw tests 1 and 2.

Table 4.26 shows that the Expo pupils rank the highest of all seven pupil samples on these tests of curiosity.

**TABLE 4.26: MEAN SCORES OF THE SEVEN PUPIL SAMPLES ON
MM1 AND MM2.**

MAW AND MAW TEST NO. 1

<u>Sample</u>	<u>Mean</u>	<u>N</u>	<u>Range</u>
I	23.95	22	1 - 38
II	15.27	29	1 - 37
III	28.71	21	6 - 38
IV	30.07	14	18 - 38
V	28.54	24	4 - 39
VI	28.87	23	3 - 40
Expo Pupils	33.00	150	7 - 40

MAW AND MAW TEST NO. 2

<u>Sample</u>	<u>Mean</u>	<u>N</u>	<u>Range</u>
I	131.77	22	120 - 159
II	131.00	29	105 - 150
III	135.57	21	92 - 189
IV	146.64	14	110 - 181
V	135.45	24	116 - 152
VI	137.22	23	91 - 161
Expo Pupils	158.36	150	89 - 190

OVERALL SUMMARY OF RESULTS

A. Class by Class

1. GLOB is a significant predictor of the June science results for the Std 6 science pupils at schools No. 1 and school No. 3. This is not the case at School No. 2.

2. MM1 and MM2 are significantly related at school No. 1 and School No. 3.

3. MM1 is a significant predictor of the June science results for the Std 7 science pupils at school No. 1 and school No.3

B. Per School

For the schools No. 1 and 2, MM1 scores are significantly related to their MM2 scores.

C. Overall Summary

1. No significant differences were found between black and white junior high school science pupils on measures of curiosity.

2. The higher scores on curiosity measures were obtained by the Expo pupils compared with the six samples of ordinary science pupils

3. All the science pupils, including the expo pupils, showed significant changes on the project test, consistency. Few were consistent in their choices as the medium of presentation varied. This is not the case for school No. 3.

4. No significant difference was found between high achieving pupils and low achieving pupils in all the curiosity tests given for both Std 6 and Std 7 pupils of the three chosen schools.

5. Significant correlations were found between the science pupils' curiosity scores and their achievements in general science in only two instances, with five other correlations being marginally significant. The available evidence does not point to a clear cut conclusion.

6. MM1 scores were found to be related to GLOB test scores especially at school No. 1.

7. GLOB test was found to be a significant predictor of the June science results for the Std 6 pupils at Schools No. 1 and School No. 3.

CONCLUSIONS:

(1) MM1 scores are significantly related to MM2 scores in all schools except school No. 3.

(2) There is an overall trend for MM1 scores to be related to GLOB scores.

CHAPTER 5

DISCUSSION OF RESULTS, IMPLICATIONS AND RECOMMENDATIONS

In this chapter, the results are discussed. The experimental design employed in the investigation is scrutinized and the implications and recommendations of the findings for further research are set out.

5.1. DISCUSSION OF FINDINGS

1. In this particular investigation no significant differences were found between the samples of black and white junior high school science pupils on measures of curiosity such as the global test, MM1 and MM2, except on question 7 with the std 6 pupils in schools No. 1 and 3 and with the std 7 pupils in schools No. 1 and 2.

This indicates that the black pupils' choices were comparable with those of other pupils from the multiracial private schools. This suggests that with simulating school conditions and facilities and highly qualified teachers they might compete with their counterparts on science activities which evoke curiosity.

2. In this study no significant differences were found to exist between high achieving science pupils and low achieving science pupils in the curiosity tests given to both the std 6 and std 7 pupils of the three chosen schools. However, statistical significance was difficult to establish because of the small numbers of science pupils in the high and low achievement sub-groups.

This leaves open the question as to whether curious low achievers may be keen to learn science, and might do well if they had both supportive teachers and facilities to interest them in science as a subject. It has been noted earlier, too, that a highly significant relationship was found to exist between science achievement and a positive attitude test score (Hough & Piper : 1982, 36).

3. The highly significant differences found between Expo pupils and the six classes of science pupils from the three different schools merit discussion.

- (a) Perhaps the Expo pupils were familiar with the use of a laboratory in making projects, and had chosen other items less frequently used by them such as prisms, rain water, sea water, alarm clocks, shells and magnets.

(b) They could be the most highly curious pupils in their schools, compared to the science pupils of other schools who were not selected according to their interest in being young scientists.

(c) The Expo pupils differed in some cases in their choices with the science teachers. The following items: Star fish, prisms, sea water, shells, were popular with both sets.

4. That few pupils were constant in their choices on the consistency project test, could indicate that the pupils may have been aroused differently by the three forms of presentation of a given choice. For example, a given picture might have been more curiosity-arousing than the apparatus itself in certain instances, or vice versa, or more interesting.

Other variables that could have influenced their changing choices are the pupils' beliefs and values, their perceptions and their general attitude toward either practical or theoretical science.

5. Some significant correlations were found between the science pupils' inherent curiosity levels and their achievement in general science in June 1988.

This applied to most classes from the three schools, but in some cases negative conclusion were obtained, leaving the conclusion open.

6. MM1 scores were found to be related to Global test scores, especially at school No. 1. It appears that these tests may have measured something common to them or related to them both.
7. The Global test was found to be a significant predictor of the June science marks for the std 6 pupils at one black school and one white private school. This could indicate that curiosity might be related to certain aspects of science learning and/or examination performance among pupils of comparable ability.
8. The Expo pupils outperformed on curiosity measures the other science pupils from other schools. This could be in agreement with the findings of Barnard and his associates (1966 : 54) that curiosity was one of the outstanding characteristics of scientists.

5.2 EXPERIMENTAL DESIGN CRITIQUE

No data-gathering method is free from error or bias, and so this study inevitably has methodological weaknesses. For example, the pupils from all the schools may have misunderstood certain terms in the tests, although they were asked to raise their hands for assistance when it was necessary.

The Maw and Maw test II could have been completed in 5-10 minutes instead of the 10-15 minutes allowed. More time could then have been allocated for the Global Project Test where pupils were to study the pictures and apparatus. This test could have been lengthened by including additional items, which both science teachers and Expo pupils found interesting, but which ordinary pupils did not.

The investigation could also have been extended to include later science examination results at the various schools, in follow-up years.

Results of the science pupils from the two private schools could have been influenced by the presence of the black researcher, as could have occurred with the Expo pupils, especially in the light of the findings of influence of the presence of ethnic adults on curiosity

among pupils, as reported by Peterson and Lowery (1968) in Section 2.6 of Chapter 2.

5.3 IMPLICATIONS

The findings revealed by the current investigation suggest several implications for teaching and testing science pupils at junior high school.

1. There appears to be a need to encourage and foster and/or nourish curiosity in both black and white science pupils at junior high school.
2. Science classrooms could offer more selected opportunities and facilities for pupils to explore and satisfy their inherent curiosity.
3. Teachers could be encouraged to reinforce curiosity in science pupils if it is significantly related to academic achievement.
4. Science educators could promote science curricula which offer optional topics and science programs fostering curiosity. Laboratories could be provided to encourage pupils to undertake or investigate science projects at schools.

5. The MM1 and MM2 curiosity tests designed for American pupils could be used with minimal changes to black and white pupils in the Western Cape, South Africa.

5.4. RECOMMENDATIONS

The following recommendations can be made for future research:-

1. The threefold combination of
 - (a) verbal description,
 - (b) words and pictures, and
 - (c) apparatusas items in a curiosity test is recommended for further research provided that pictures of the apparatus itself or very similar ones are used. Different pupils appear to prefer different forms of presentation of the choices.
2. The Global test for curiosity could be used with more black science pupils in rural junior high schools where most pupils are disadvantaged, but could exhibit higher levels of curiosity.
3. The Global test could be lengthened and perfected and applied to both black and white science pupils at senior high schools to measure their curiosity and to

correlate this with their achievement in science and choice of a career in science.

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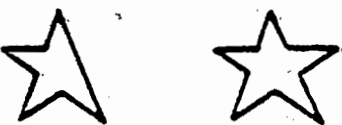





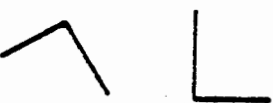
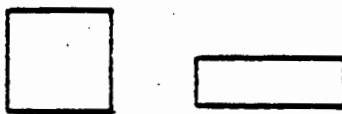
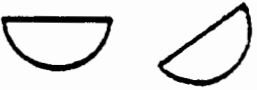
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Which to Discuss ?

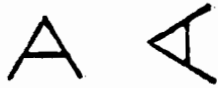
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- 1 
- 2 
- 3 
- 4 
- 5 
- 6 
- 7 
- 8 
- 9 
- 10 
- 11 
- 12 

13



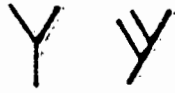
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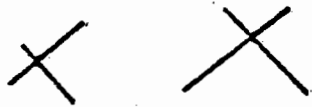
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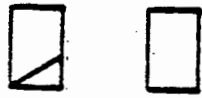
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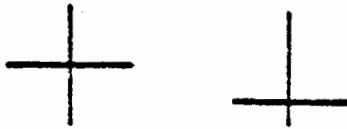
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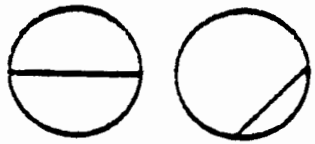
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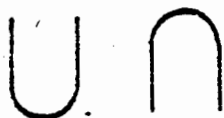
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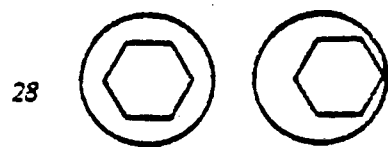
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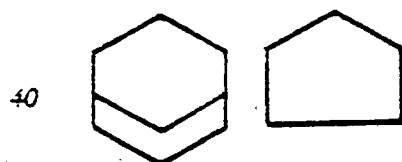
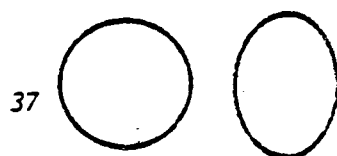
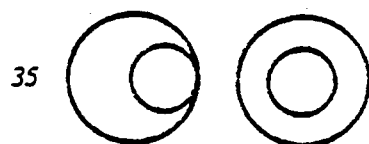
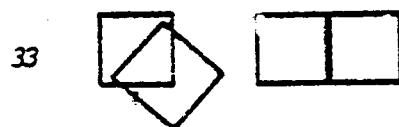


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APPENDIX I

The peculiar figure scores one point.

A score of 13 or less out of 40 indicates low curiosity.

A score of 37 out of 40 indicates high curiosity.

WHAT I THINK

Listed below are some things that a person did or what a person does. There are no right or wrong answers. Put a tick in front of the answer which best shows WHAT YOU THINK OF IT.

Remember, the best answer is the one which tells WHAT YOU THINK.

1. Looked inside another person's purse or bag.

Very		Neither Good		Very
_____ Good	_____ Good	_____ Nor Bad	_____ Bad	_____ Bad

2. Asked why the nurse came and looked at the children's throats.

Very		Neither Good		Very
_____ Good	_____ Good	_____ Nor Bad	_____ Bad	_____ Bad

3. Took the jumping jack apart.

Very		Neither Good		Very
_____ Good	_____ Good	_____ Nor Bad	_____ Bad	_____ Bad

4. Is always looking for new things.

Very		Neither Good		Very
_____ Good	_____ Good	_____ Nor Bad	_____ Bad	_____ Bad

5. Opened the teacher's cupboard to see what was inside.

Very		Neither Good		Very
_____ Good	_____ Good	_____ Nor Bad	_____ Bad	_____ Bad.

6. Does not ask questions but waits for others to tell what they want to tell.

Very		Neither Good		Very
_____ Good	_____ Good	_____ Nor Bad	_____ Bad	_____ Bad

7. Often reads books because of the pictures on the cover.

Very		Neither Good		Very
_____ Good	_____ Good	_____ Nor Bad	_____ Bad	_____ Bad

8. Makes up his or her mind quickly on almost everything.

Very		Neither Good		Very
_____ Good	_____ Good	_____ Nor Bad	_____ Bad	_____ Bad

9. Is curious about many things.

Very		Neither Good		Very
_____ Good	_____ Good	_____ Nor Bad	_____ Bad	_____ Bad

10. Spends a lot of time playing with old radios.

Very		Neither Good		Very
_____ Good	_____ Good	_____ Nor Bad	_____ Bad	_____ Bad

11. Takes things apart to see how they work.

Very		Neither Good		Very
_____ Good	_____ Good	_____ Nor Bad	_____ Bad	_____ Bad

12. Often uses the dictionary to look up new words.

Very		Neither Good		Very
_____ Good	_____ Good	_____ Nor Bad	_____ Bad	_____ Bad

13. Explores empty buildings.

Very		Neither Good		Very
_____ Good	_____ Good	_____ Nor Bad	_____ Bad	_____ Bad

14. Likes to puzzle over strange things.
Very _____ Neither Good _____ Very
_____ Good _____ Nor Bad _____ Bad _____ Bad
15. Sometimes doubts what other people say.
Very _____ Neither Good _____ Very
_____ Good _____ Nor Bad _____ Bad _____ Bad
16. Gets big-eyed over new things.
Very _____ Neither Good _____ Very
_____ Good _____ Nor Bad _____ Bad _____ Bad
17. Picks up strange things and examines them.
Very _____ Neither Good _____ Very
_____ Good _____ Nor Bad _____ Bad _____ Bad.
18. Often asks questions.
Very _____ Neither Good _____ Very
_____ Good _____ Nor Bad _____ Bad _____ Bad
19. Often looks into boxes and bags.
Very _____ Neither Good _____ Very
_____ Good _____ Nor Bad _____ Bad _____ Bad
20. Looked to see how a new ballpoint pen works.
Very _____ Neither Good _____ Very
_____ Good _____ Nor Bad _____ Bad _____ Bad.
21. Watched from the window as new neighbours moved into the house next door
Very _____ Neither Good _____ Very
_____ Good _____ Nor Bad _____ Bad _____ Bad
22. Believes almost everything he or she hears.
Very _____ Neither Good _____ Very
_____ Good _____ Nor Bad _____ Bad _____ Bad
23. Wants to know what other people are doing and thinking.
Very _____ Neither Good _____ Very
_____ Good _____ Nor Bad _____ Bad _____ Bad
24. Is interested in many things.
Very _____ Neither Good _____ Very
_____ Good _____ Nor Bad _____ Bad _____ Bad
25. Asks if there are other ways of doing things.
Very _____ Neither Good _____ Very
_____ Good _____ Nor Bad _____ Bad _____ Bad
26. Is interested in things that other people hardly notice.
Very _____ Neither Good _____ Very
_____ Good _____ Nor Bad _____ Bad _____ Bad
27. Wants to see things before believing them.
Very _____ Neither Good _____ Very
_____ Good _____ Nor Bad _____ Bad _____ Bad
28. Asked the neighbour why he was digging a hole by the side of his house.
Very _____ Neither Good _____ Very
_____ Good _____ Nor Bad _____ Bad _____ Bad

APPENDIX II

Very good = 5

Good = 4

Nether good nor bad = 3

Bad = 2

Very bad = 1

Reverse scoring on items 6 and 22

A score of 119 or less out of 195 indicates low curiosity.

A score of 151 or greater out of 195 indicates high curiosity.

APPENDIX III

THE GLOBAL PROJECT TEST

NAME: STANDARD:..... SEX:.....

IF YOU WERE A VERY KEEN STANDARD 6 SCIENCE PUPIL, INDICATE WITH A TICK (✓) WHICH ONE YOU WOULD LIKE TO DO A PROJECT ON OR AN EXPERIMENT WITH:

1. Glass rod; thermometer; magnet; magnifying glass. (tick one)
2. Aeroplane; Machine Gun; kite; rocket.
3. Packet of sugar; Bicarbonate of Soda; Soap Powder; Enos fruit salts.
4. Snail; star fish; tropical fish; frog
5. Box of sweets; box of shells; box of matches; box of marbles.
6. Rocks; cones; owl pellets, buds
7. Filter paper; plastic; silk cloth; fishing net.
8. Distilled water; sea water; sugar solution; rain water.
9. Prisms, bottles; beakers; cool drink straws;
10. Alarm Clock; Wheels; torch; Calculator.

APPENDIX III (cont.)

Each tick scores 2 points.

High curious pupils would choose the following items:

1. MAGNIFYING GLASS
2. ROCKET
3. ENOS FRUIT SALTS
4. STAR FISH
5. BOX OF SHELLS
6. ROCKS
7. FILTER PAPER
8. SEA WATER
9. PRISMS
10. CALCULATOR

APPENDIX IV

APPARATUS TEST

NAME: _____ STANDARD: _____ SEX: _____

Choose an item and tick under the appropriate column:

(a) (b) (c) (d)

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

APPENDIX V

THE GLOBAL PROJECT TEST RESULTS

		<u>Aeroplane</u>	<u>Machine Gun</u>	<u>Kite</u>	<u>Rocket</u>	
School 1	(6)	17	21	21	10	69
	(7)	33	13	16	17	79
		50	34	37	27	148

$\chi^2 = 8,85$ NSD

Frequencies of responses of Std 6 & 7 pupils in school No. 1 on Question 2 of the Global Project Test.

	<u>Filter Paper</u>	<u>Plastic</u>	<u>Silk Cloth</u>	<u>Fishing Net</u>	
School 3	19	8	20	21	68
School 1	26	16	23	14	79
	45	24	43	35	147

$\chi^2 = 5,775$ NSD

Frequencies of responses of Std 7 Pupils in Schools No. 1 and 3 on Question 7 of the Global Project Test.

	<u>Snail</u>	<u>Star Fish</u>	<u>Gold Fish</u>	<u>Frog</u>	
School No. 2	10	30	27	8	75
School NO. 1	21	32	12	6	71

$\chi^2 = 9,92$ NSD

Frequencies of responses of Std 6 Pupils in Schools No. 1 and 2 on Question 4 of the Global Project Test.

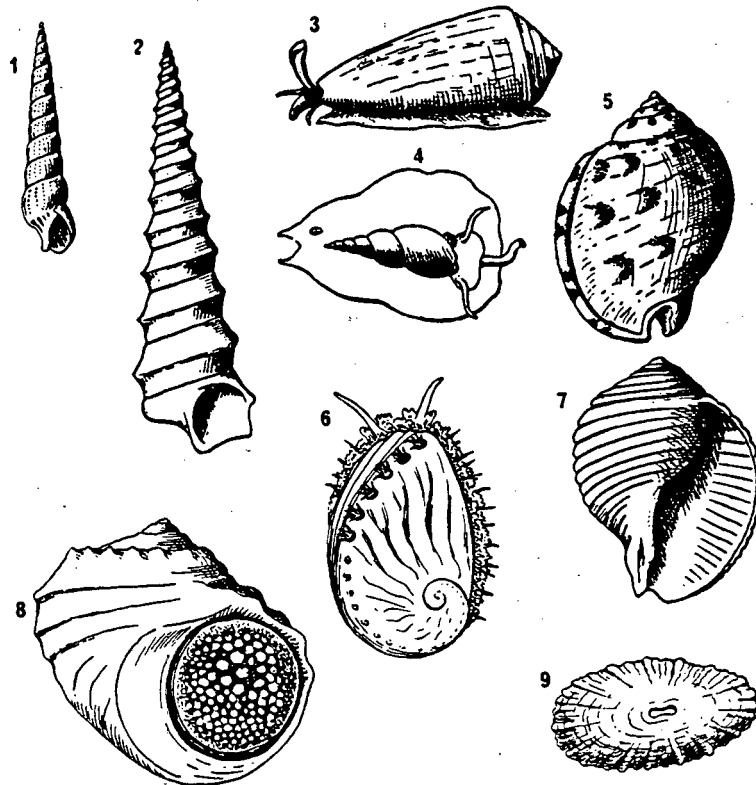
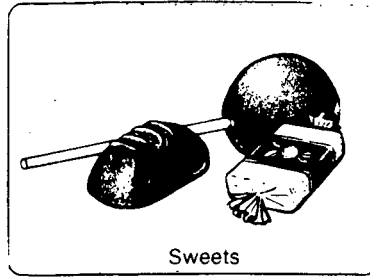
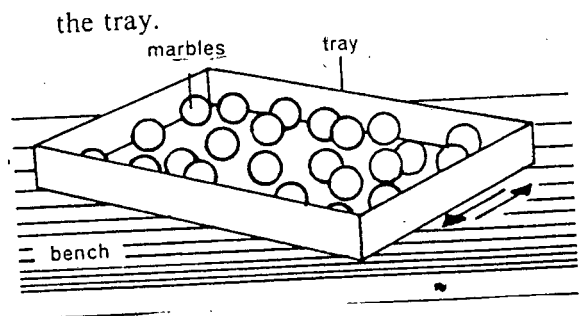
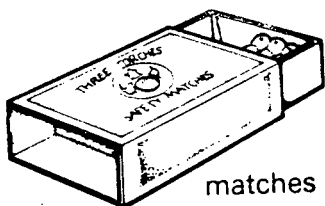
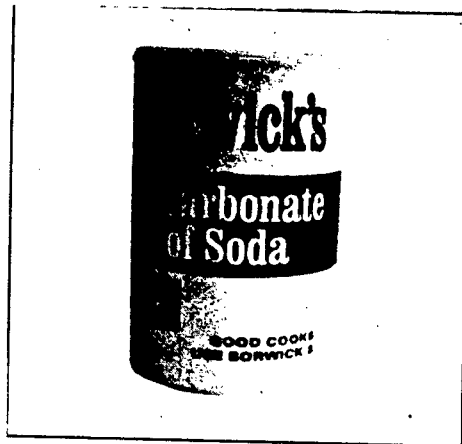


Fig. 12.2 The shells of some sea-snails: 1. Auger shell; 2. Screw shell; 3. Cone shell; 4. Plough shell; 5. Helmet shell; 6. Ear shell; 7. Barrel shell; 8. Top shell (abalone); 9. Key limpet shell.





SECTION A (PHYSICAL SCIENCE)QUESTION 1

Choose the correct word(s) from those given in brackets :

- (a) The main function of an electric cell is to produce (heat; an electric current; sound)
- (b) Which of the following would you normally find in an electric circuit : (cell; connecting wires; bar magnet) ?
- (c) Which of the following will conduct an electric current : (wood; glass; copper) ?
- (d) Which one of the following is an insulator : (Plastic; lead; graphite) ?
- (e) The symbol _____ is used to indicate a (cell; connector; switch)
- (f) When three bulbs are connected in series, they all glow (brighter; dimmer) than one bulb.
- (g) When more bulbs are connected in series in a circuit, the resistance of the circuit (increases; remains the same; decreases)
- (h) If the circuit is broken anywhere in a series circuit, the current (is reduced; is increased; stops)
- (i) The greater the resistance in a circuit, the (greater; smaller) the current. (10)

QUESTION 2

- (a) Complete the following by filling in the missing word(s) :
 - (i) The direction of the electric current is from the of the cell to the of the cell.
 - (ii) When two or more cells are connected in series, a is formed.
 - (iii) The bigger the current flowing through a bulb, the it glows.
 - (iv) Substances which allow the electric Current to pass through them are called
 - (v) Substances which do not allow the electric current to pass through them are called
 - (vi) If more bulbs are connected in, they all glow as brightly as the first bulb.
 - (vii) When light bulbs are connected in, branching of the current occurs.
 - (viii) Cells are connected in when the positive pole of one cell is connected to the negative pole of the next cell.
 - (ix) The current in a circuit is the same everywhere in the circuit. (10)

(b) Draw symbols for the following :

- (i) a connector
- (ii) an open switch
- (iii) a closed switch
- (vi) a bulb
- (v) a resistor

(5)

(c) Draw a neat circuit diagram to show a circuit containing three cells in series, one bulb in series, two bulbs in parallel and a switch.

(10)

QUESTION 3

(a) Name the three phases of matter.

(5)

(b) State whether the following are true or false :

- (i) Gas molecules move faster than liquid molecules.
- (ii) Diffusion takes place only in gases.
- (iii) Brownian motion occurs only in gases.
- (iv) There are no spaces between the particles of a liquid.
- (v) Smoke is a gas.

(10)

SECTION B (BIOLOGY)

QUESTION 1

I. Complete the following sentences by filling in the missing words.

- (a) A and a are underground stems.
- (b) The potato is an example of a
- (c) African violets can reproduce from
- (d) Vegetative reproduction is used widely in and (12)

QUESTION 2

(a) Draw a labelled diagram of the mycelium of bread mould showing clearly the sporangiophores, sporangia and the columella. (8)

3/.....

(b) Complete the following sentences

- (i) The branched filaments of a mycelium are called
- (ii) Hyphae that grow upwards, away from the substratum are called
- (iii) The tip of a sporangiophore swells to form a
- (iv) Spores develop inside the
- (v) Bread mould is greyish-white in colour because it has no

(10)

QUESTION 3

(a) Describe in your own words what is meant by :

- (i) self-pollination (3)
- (ii) cross-pollination (3)
- (iii) What are the four parts that make up a complete flower ? (4)
- (iv) What parts of the flower form the androecium ? (2)
- (v) Of what two parts does a stamen consist ? (2)
- (vi) What is meant by the gynaecium of a flower ? (1)
- (vii) Of what three parts does the pistil consist ? (3)
- (viii) What is found inside the ovary of a flower ? (2)

(20)

SECTION A (PHYSICAL SCIENCE)QUESTION I

Choose the correct answer from those given. Do not re-write the sentence. Write the letter next to the correct answer in your answer sheet.

- (a) The unit of force is the
- A. kilogram
 - B. joule
 - C. newton
 - D. watt
- (b) The work done on a body is equal to the
- A. force applied
 - B. energy transferred
 - C. power exerted
 - D. distance moved
- (c) A liquid exerts pressure
- A. horizontally
 - B. vertically
 - C. in all directions
 - D. downwards
- (d) A positive charge on an object is the result of
- A. an excess of electrons
 - B. a shortage of electrons
 - C. a shortage of protons
 - D. an excess of neutrons
- (e) An electric current is
- A. a movement of atoms along the wire
 - B. a movement of electrons along the wire
 - C. vibrations of the wire
 - D. caused by heat moving along the wire

- (f) The KWh is a unit of
- A. energy
 - B. power
 - C. current
 - D. potential difference
- (g) Which of the following substances is an element ?
- A. Hydrogen
 - B. water
 - C. sugar
 - D. common salt
- (h) Which of the following substances is a compound ?
- A. oxygen
 - B. hydrogen
 - C. sulphur
 - D. water
- (i) Light is a form of
- A. work
 - B. power
 - C. force
 - D. energy
- (j) The image in a plane mirror is
- A. smaller than the object
 - B. larger than the object
 - C. the same size as the object
 - D. sometimes smaller and sometimes larger.

(10 x 2) (20)

QUESTION 2

- (a) Fill in the missing words in the following sentences :

- (i) is done when a force acts on a body and the body
(ii) in the direction of the applied force.
(iii) and (iv) are two examples of forces
which act at a distance without making physical contact.
Stored energy is known as (v) and energy of
movement is known as The unit of energy is the
(vi) Power is the amount of (vii)
done per (viii)

/3.....

- (b) The measurements of a brick are 7cm x 9cm x 20cm, and its mass is 2,52 kg. What pressure does the brick exert if it stands on its smallest surface ? (20)

QUESTION 3

(a) Complete the following sentences :

- (i) What kind of electricity is caused by friction ?
(ii) Two kinds of electric charges are and
(iii) One of charge moves past any cross section of a conductor in second(s) when a current of flows.
(iv) The more cells connected in series, the the current in the circuit and the more resistors in series, the is the total resistance and the smaller is the The thicker the conductor, the the resistance. (10)

SECTION B (BIOLOGY)

I. Fill in the missing word(s) :

- (a) The smallest living unit of which organisms are composed is a (1)
(b) The living content of a cell is called and it is sub-divided into and (3)
(c) Give three differences between a plant and an animal cell (6)
(d) Give one function of each of the following :
(i) Vacuole (ii) Chloroplast (iii) Nucleus (6)
(e) What is found in the vacuole (2)
(f) Plant cells are surrounded by a (1)
(g) A group of similar cells performing the same function is called a (1)
(h) The mouth cavity is lined with (1)
(i) has fine hairs and lines the respiratory track. (1)
(j) The heart and lungs are examples of (1)
(k) Each of the following statements have three possibilities. Select and underline the correct one.
(i) Animal cells usually have
(a) no vacuoles
(b) only minute vacuoles
(c) large vacuoles
(ii) Meristematic tissue is found in the
(a) dead bark of a tree
(b) leaves of plants
(c) growing points of roots

(iii) The bodies in plant cells with a green pigment are called

- (a) nuclei
- (b) chloroplasts
- (c) plastids

(iv) A cell wall is mostly made up of

- (a) cellulose
- (b) cutin
- (c) suberin

(4)

(27)

2. Name the three organs that you find in flowering plants and give one function of each. (5)

(b) Make a labelled drawing of the end portion of any young root showing its various parts.

6 + 3 = (9)

(c) Name three functions of leaves.

(9)

ST GEORGE'S GRAMMAR SCHOOL

STANDARD 7

PHYSICAL SCIENCE

JUNE 1988

Time : 1 hour

MARKS : 110

Instructions :

1. Answer all questions.
2. In section A, use the attached answer sheet. Choose *one* answer and mark the corresponding letter on the answer sheet with a cross.
3. In section B, *never answer on the question paper!*
4. Units may be used in substitutions but **must** be used in answers.
5. Be concise in descriptive and explanatory answers.
6. Neatness and clear presentation will count in your favour.
7. *Good luck.*

SECTION A (30 marks)

- 1) 2 positively charged polysterene balls are brought nearer to each other. As they come closer to each other the repulsive forces will
 - a) increase
 - b) decrease
 - c) remain constant
 - d) first decrease and then increase
- 2) A positively charged rod attracts a sphere. Therefore the sphere is
 - a) negatively charged
 - b) uncharged
 - c) positively charged
 - d) uncharged or negatively charged
- 3) The unit in which electrical charge is measured is the
 - a) ampere
 - b) volt
 - c) coulomb
 - d) ohm
- 4) The symbol for the unit of electric current
 - a) A
 - b) a
 - c) I
 - d) C
- 5) The instrument to measure potential difference is a (an)

- a) ammeter
- b) voltmeter
- c) ohmmeter
- d) electroscope

- 6) There is a current of 10 A in a conductor. The charge passing a point in the conductor in 15 s, is
 - a) 10 C
 - b) 15 C
 - c) 150 C
 - d) 1,5 C
- 7) A charge of 30 C flows past a point in a circuit in 10 s. The magnitude of the current is
 - a) 300 A
 - b) 1/3 A
 - c) 3 A
 - d) 30 A
- 8) The mathematical relationship between the resistance R of a resistor, the current I in it, and the voltage across it, is
 - a) $R = V/I$
 - b) $R = I/V$
 - c) $V = I/R$
 - d) $I = V R$
- 9) There is a 2 A current in a bulb connected to a 12 V battery. The resistance of the bulb is
 - a) 24 Ω
 - b) 6 Ω
 - c) 2 Ω
 - d) 12 Ω
- 10) The symbol for the SI unit of force is
 - a) kg
 - b) g
 - c) J
 - d) N
- 11) In the relationship: Work = force x distance, the force must always be
 - a) parallel to the direction of motion of the body
 - b) in the opposite direction to the body's motion
 - c) perpendicular to the direction of motion
 - d) in any direction with respect to the motion
- 12) A girl of weight 400 N climbs up a flight of stairs of 4 m high. The work she does in the process is
 - a) 10 J
 - b) 160 J
 - c) 1600 J
 - d) 0,1 J

- 13) A force of 10 N displaces a body 2 m in the direction of the force. The work done by the force is
 a) 10 J
 b) 5 J
 c) 0,2 J
 d) 20 J
- 14) A synonym for power is
 a) work
 b) energy
 c) force
 d) rate of work
- 15) What does it cost to use a 1000 W heater for 5 hours?
 (A unit costs 2 cents).
 a) 100 cents
 b) 400 cents
 c) 10 cents
 d) 50 cents

 SECTION B (80 MARKS)

QUESTION 1

- a) Describe how you would investigate the effects of charged objects on one another. (6)
- b) Formulate a general rule that can be deduced from this investigation. (4)
- c) How can you show that a glass rod and an ebonite rod which has been rubbed with silk and wool respectively, have opposite charges. (4)
- d) Sketch a negatively charged electroscope. (6)
- ((20))

QUESTION 2

- a) (i) Sketch the circuit diagram of a series circuit consisting of 2 cells, a switch, a resistor, a light bulb, an ammeter, and a voltmeter which is connected parallel to the resistor. (5)
- (ii) The voltmeter reading is 0,5 V and the ammeter reading is 0,25 A. What is the resistance of the resistor? (3)
- b) (i) Draw a simple sketch of a rheostat. (5)
- (ii) Explain how the rheostat must be connected in a circuit if it is to be used 1) as an ordinary resistor 2) as a variable resistor. (6)
- (iii) Explain how a rheostat works referring to your sketch in (i) (5)
- c) Name 4 factors that determine the resistance of a conductor. (4)

- d) A long wire has a resistance than a short one. (2)
 ((30))
-

QUESTION 3

- a) A 500 g mass-piece is suspended from a coil spring and extends the spring.
 (i) Calculate the weight of the mass-piece. (4)
 (ii) What is the magnitude of the force which causes the extension of the spring? (2)
- b) An object weighing 150 N is lifted vertically 5 m high in 10 s. Calculate:
 (i) the work done on the object, (4)
 (ii) the quantity of energy converted, (3)
 (iii) the power of the lift. (4)
- c) A family's electricity bill for a certain month is R 69,52. Calculate:
 (i) how many kWh (units) were used during the month, at a tariff of 8 c per kWh; (4)
 (ii) how much energy, in joules, was consumed. (4)
- d) 2 light bulbs are marked 80 W and 100 W respectively.
 (i) What difference do we notice when they burn? (2)
 (ii) Explain the difference indicated by the watt values. (3)
- ((30))
-

S T G E O R G E ' S G R A M M A R S C H O O L

STANDARD E

PHYSICAL SCIENCE

JUNE 1988

Time : 1 hour

MARKS : 100

Instructions :

1. Answer all questions.
2. In section A, use the attached answer sheet. Choose *one* answer and mark the corresponding letter on the answer sheet with a cross.
3. In section B, *never answer on the question paper!*
4. Units may be used in substitutions but **must** be used in answers.
5. Be concise in descriptive and explanatory answers.
6. Neatness and clear presentation will count in your favour.
7. *Good luck.*

SECTION A (30 marks)

- 1) There are forces of attraction between
 - a) positive charges
 - b) negative charges
 - c) like charges
 - d) opposite charges
- 2) Choose the correct statement :
 - a) metals are good conductors
 - b) metals are insulators
 - c) non-metals are good conductors
 - d) non-metals and metals are insulators
- 3) 2 cells are connected in series. The current that is provided by this arrangement of cells is
 - a) the same as that of only one cell
 - b) less than of only one cell
 - c) more than that of only one cell
 - d) zero
- 4) The resistance of a bulb A is large, compared with that of a bulb B. Bulb A is connected to a cell, and then bulb B is connected in its place.
 - a) A greater current flows when bulb A is connected
 - b) A greater current would flow through bulb B
 - c) The same amount of current flows through both A and B
 - d) It cannot be said which one will allow the larger current
- 5) If one bulb fuses in a
 - a) parallel connection, all the others also go out
 - b) parallel connection, the others keep on glowing
 - c) series connection, all others keep on glowing
 - d) series connection, the others will also break
- 6) The function of a fuse is to
 - a) prevent short circuits
 - b) prevent fire after a short circuit
 - c) ensure that an apparatus eg. a stove functions
 - d) break the current when a short circuit occurs
- 7) The effect applied in kettles, heaters and stoves is the
 - a) the heating effect
 - b) chemical effect
 - c) light effect
 - d) magnetic effect
- 8) In the vicinity of a conductor, there is
 - a) always a magnetic field
 - b) a magnetic field when the conductor carries a current
 - c) no magnetic field even when it carries a current
 - d) always an electric field
- 9) 2 carbon rods are connected to a battery and placed in a copper chloride solution. The positive terminal is called
 - a) the cathode
 - b) the anode
 - c) the insulator
 - d) the electrolyte
- 10) To separate a compound into the elements that constitute it
 - a) is impossible
 - b) needs energy
 - c) does not need energy
 - d) needs a nuclear reaction
- 11) The elements that make up water are
 - a) hydrogen and chlorine
 - b) oxygen and chlorine
 - c) hydrogen and oxygen
 - d) nitrogen and oxygen
- 12) Iron sulphide is
 - a) a mixture of iron and sulphur
 - b) a compound of iron and sulphur
 - c) an element
 - d) none of the above
- 13) Pure air is
 - a) a compound of oxygen and helium
 - b) a mixture of oxygen and carbon dioxide

- c) a mixture of oxygen and nitrogen
d) a compound of oxygen and nitrogen
- 14) Which one of the following elements is a non-metal ?
a) tin
b) mercury
c) sodium
d) iodine
- 15) At room temperature, the majority of the elements are
a) gases
b) liquids
c) solids
d) ionic

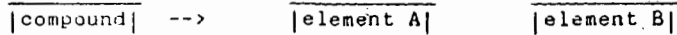
SECTION B (70 marks)

QUESTION 1

- a) cells are connected in series to form a battery.
(i) Explain how you would make the connections. (3)
(ii) Make a sketch of 3 torch cells connected in series. (3)
(iii) Why are cells connected in series ? (2)
(iv) Draw the symbolic representation of 3 cells connected in series and 3 cells connected in parallel. (4)
- b) (i) Explain how you set about making an electromagnet. (4)
(ii) Sketch the electromagnet complete with the circuit and indicate the conventional current direction, as well as the polarity of the electromagnet. (6)
(iii) Write down the rule which you applied in (ii) to determine the polarity of the electromagnet. (3)
(iv) Describe fully how you would set about testing the polarity of the electromagnet. (6)
- ((31))

QUESTION 2

- a) Mercury oxide is heated in a test tube.
(i) Describe all changes that can be observed. (3)
(ii) One of the substances which are formed is a colourless gas. What is the name of the gas ? How do you know that this gas is liberated ? (3)
- b) The following diagram represents the breaking up of a compound into its elements :



- (i) Replace the words in the boxes with the names of any correct substance. (6)
- (ii) Write down the energy conversion that takes place during the above reaction. (2)
- c) Classify the following well-known substances under the headings "Metal elements" and "Non-metal elements" :
1) iodine; 2) carbon; 3) lead; 4) chlorine; 5) nickel;
6) nitrogen; 7) aluminium; 8) iron; 9) mercury;
10) oxygen. (10)
- ((24))

QUESTION 3

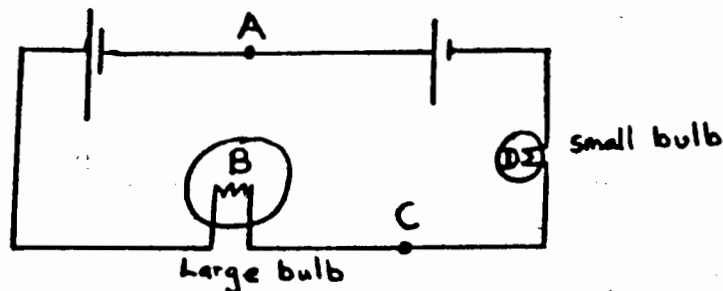
- a) How does the electrical conductivity of a metal differ from that of a non-metal? (5)
- b) Which elements have the greater densities ? Metals or non-metals ? (2)
- c) Which metal is a liquid at room temperature ? (2)
- d) Why is phosphorus stored in water ? (2)
- e) Potassium and sodium are stored in paraffin. Why ? (2)
- f) Name a non-metal which is a liquid at room temperature (2)
- ((15))

INSTRUCTIONS

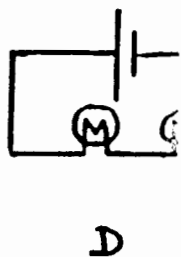
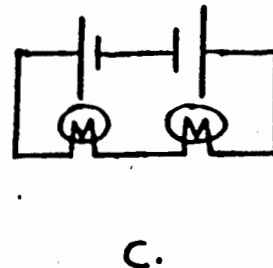
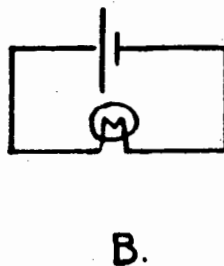
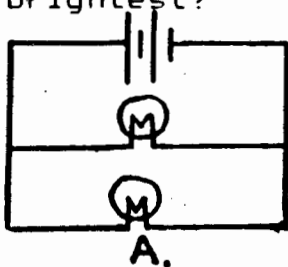
1. Answer Section A on the Answer Sheet provided with a cross in pencil
2. Answer Section B and C on separate sheets of paper.
3. Give diagrams where necessary.
4. Answer **ALL** questions
5. **ENJOY**

SECTION A

1. An electric current flowing through a wire is a flow of:
 - a) protons
 - b) neutrons
 - c) electrons
 - d) charges
2. The diagrams shows two cells connected in series to two bulbs. Where is the current the strongest?



- a) at A & C
 - b) at A, B, C & D
 - c) at B & D
 - d) at A
3. In which of the following circuits will the bulbs be the brightest?



4. In which of the circuits in 3. above will the lamps be the dimmest?

5. Current in a long straight copper conductor flows away from you. The direction of the magnetic field is:
- towards you
 - away from you
 - anticlockwise
 - clockwise
6. Electroplating is the:
- depositing of a metal on an object by electrolysis
 - liberation of a gas from an electrolyte
 - conversion of chemical to electrical energy
 - the production of a gas from a metal.
7. The solution used during electroplating is called:
- the insulator
 - the solvent
 - the electrode
 - the electrolyte
8. Which method is not suitable for separating a mixture of iron filings and sulphur:
- heating
 - add carbon disulphide and filter
 - add hydrochloric acid and filter
 - use a magnet
9. Which of the following statement/s is/are false?
- fungi reproduce sexually by means of spores.
 - the kalanchoe is a naturally occurring example of asexual reproduction by leaves.
 - the sweet potato is an example of an underground stem.
- (i) only
 - (ii) only
 - (iii) only
 - (i) and (iii)
 - (i), (ii) and (iii)
10. The collective term for the whorl of carpals in a flower is the:
- gynaecium
 - corolla
 - androecium
 - perianth
 - perigone
11. Which of the following statements is not a characteristic of insect pollinated flowers?
- the flowers are large and colourful
 - pollen is produced in relatively large quantities
 - stigmas are sticky or hairy
 - the pollen produced is rough
 - scent and nectar are produced by the flowers

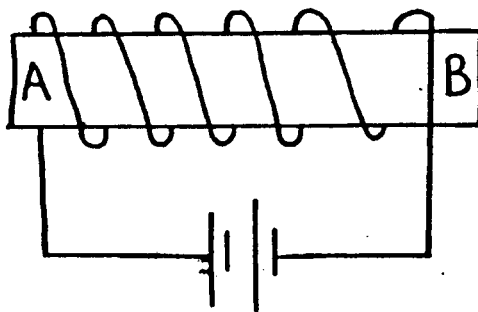
12. In monocotyledonous flowers the sepals petals and stamens occur in multiples of:
- a) four
 - b) four or five
 - c) three
 - d) five
 - e) three, four or five
13. A fruit farmer often places a beehive in an orchard in spring and summer. This is to:
- a) increase the amount of fruit produced
 - b) give the necessary shade to the hive
 - c) ensure sweet tasting honey
 - d) protect the trees from other insects
 - e) none of the above
14. Which of the following is not a simple dry fruit?
- a) nut
 - b) legume
 - c) achene
 - d) follicle
 - e) none of the above
15. The pollen grain of the flower is:
- a) the female sex cell
 - b) the cell used in vegetative reproduction
 - c) the male sex cell
 - d) only used as food for insects
 - e) none of the above
16. A saprophyte is an organism which:
- a) lives on dead organic matter
 - b) is able to produce its own nutrients
 - c) lives entirely off other organisms
 - d) lives on living organic matter
 - e) none of the above

SECTION B

ANSWER ON SEPARATE SHEETS

1. a) i) What is electricity?
ii) What is conventional current?
- b) Give diagrams to show the following instruments as used in a circuit diagram.
- i) a three celled battery
 - ii) a bulb
 - iii) a switch
 - iv) a fixed resistor

- c) Give a circuit diagram to show how two cells in series can be used to operate two bulbs in parallel, with switches so that each bulb can be switched on separately.
- d) Give: i) one advantage; and
ii) one disadvantage of wiring bulbs in series.
2. a) What is a short circuit?
b) With the aid of a diagram explain the working of a fuse and discuss the importance of a fuse in a household circuit.
3. a) A compass and iron filings are scattered around a current carrying wire
i) Give a diagram to show the magnetic field produced.
ii) Give the rule to determine the direction of the field in (i).
b) Use the diagram to determine the polarity of the ends of the electromagnet A and B.

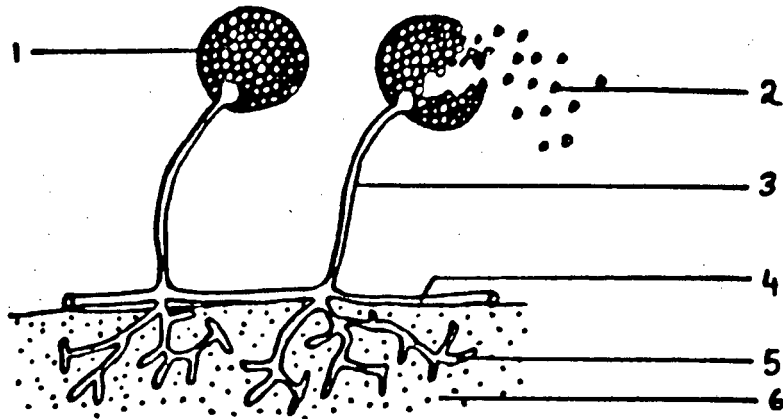


4. An electric current is passed through a solution of copper chloride.
i) Give a diagram of the apparatus
ii) Explain what happens
iii) State what type of energy changes occur
iv) If the copper chloride is replaced with water what would you see this time?
5. a) What is an element?
b) Name the three phases of matter
c) Explain in full a chemical method of separating a mixture of iron filings and sulphur

SECTION C

1. a) Define the following:
i) asexual reproduction
ii) a rhizome

- b) Examine the diagram below and supply the labels for the parts marked i - vi.



- c) i) give two advantages of asexual reproduction.
 ii) give two disadvantages of asexual reproduction.
2. a) Give one word for each of the following statements:
 i) the fusion of male and female sex cells.
 ii) the whorl of stamens.
 iii) the top of the pedicel on which the flower rests.
 iv) a perianth in which the sepals and the petals have the same structure and function.
 v) the tissue of the ovary to which the ovules are attached.
- b) What are the functions of the following:
 i) the calyx
 ii) the corolla
3. a) Name four ways in which certain flowers ensure self-pollination.
- b) i) What is the term used to describe the anther ripening before the stigma?
 ii) What is the term used to describe imperfect flowers occurring on separate plants?
4. a) What is the term used to describe the fertilized egg cell?
 b) Name five classes of simple fleshy fruits.
 c) What is the difference between multiple and aggregate compound fruits?

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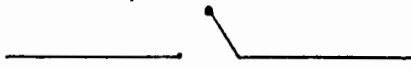



 Instructions: ANSWER ALL QUESTIONS

ANSWER SECTION A ON THE ANSWER SHEET PROVIDED

SECTION A

(2 Marks each)

1. Which of the following symbols represents a switch in an electric circuit?

- a) 
- b) 
- c) 
- d) 
- e) 

2. Which of the following statement/s is/are false?

- (i) conductors are materials which are able to carry an electric current
- (ii) the current in a series circuit is not the same at all points in the circuit
- (iii) if one lamp burns out in a series circuit, the other lamps will remain on

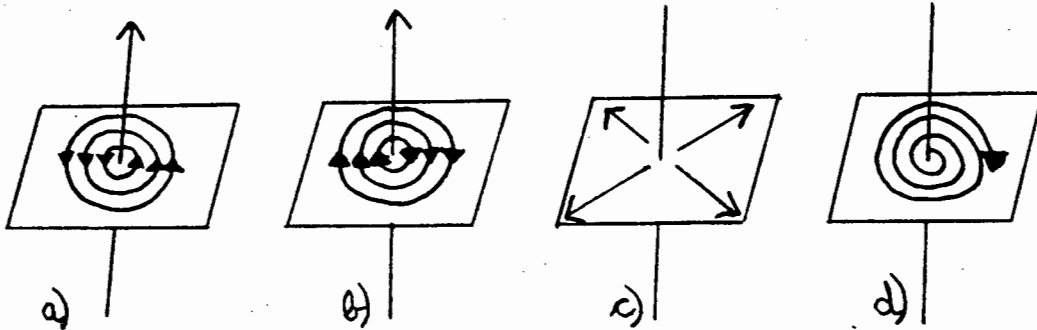
- a) (i) only
 b) (ii) only
 c) (iii) only
 d) (ii) and (iii)
 e) (i), (ii) and (iii)

3. Electrolysis is used in

- a) electroplating industry
 b) manufacture of water
 c) manufacture of certain elements
 d) manufacture of certain chemicals
 e) manufacture of certain elements and chemicals and in the electroplating industry

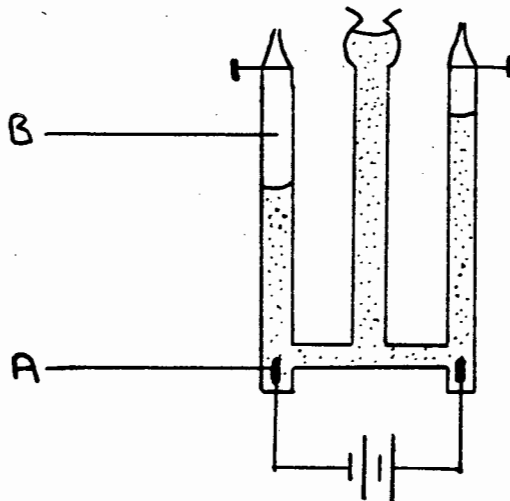
4. Which of the following are disadvantages of the heating effect of electricity
- (i) thick cables must be used to transport electricity from power stations as too much energy would be lost if thin cables were used
 - (ii) large electric motors require special cooling devices to prevent them from overheating
 - (iii) fires can result if too large a current is passed through a conducting wire
- a) (i) only
 - b) (ii) only
 - c) (iii) only
 - d) (ii) and (iii)
 - e) (i), (ii) and (iii)

5. There is a current flowing upwards in a long straight conductor. Which of the sketches below show the shape and direction of the magnetic field lines near the wire?



6. A metal which is a liquid at room temperature is-
- a) sodium
 - b) chlorine
 - c) bromine
 - d) mercury
 - e) iron

Questions 7, and 8 refer to the following diagram



7. The part labelled A is called the
- voltameter
 - electrolyte
 - anode
 - insulator
 - cathode
8. The gas being formed at B is
- carbon dioxide
 - hydrogen
 - nitrogen
 - oxygen
 - none of the above
9. Water is a
- compound of hydrogen, nitrogen and oxygen
 - mixture of oxygen and hydrogen
 - compound of hydrogen and nitrogen
 - mixture of hydrogen and nitrogen
 - compound of hydrogen and oxygen
10. Which of the following is the odd man out?
- carbon dioxide
 - oxygen
 - hydrogen
 - nitrogen
 - chlorine
11. Which of the following statement/s is/are false?
- fungi reproduce sexually by means of spores
 - the kalanchoe is a naturally occurring example of asexual reproduction by leaves
 - the sweet potato is an example of an underground stem
- (i) only
 - (ii) only
 - (iii) only
 - (i) and (iii)
 - (i), (ii) and (iii)
12. The collective term for the whorl of stamens in a flower is the
- gynaecium
 - corolla
 - androecium
 - perianth
 - perigone

13. Which of the following statements is not a characteristic of insect pollinated flowers?
- a) the flowers are large and colourful
 - b) pollen is produced in relatively large quantities
 - c) stigmas are sticky or hairy
 - d) the pollen produced is rough
 - e) scent and nectar are produced by the flowers
14. The term used to describe the anther ripening before the stigma, is
- a) cross-pollination
 - b) protogyny
 - c) self-pollination
 - d) fertilization
 - e) protandry
15. A saprophyte is an organism which
- a) lives on dead organic matter
 - b) is able to produce its own nutrients
 - c) lives entirely off other organisms
 - d) lives on living organic matter
 - e) none of the above
16. In dicotyledonous flowers the sepals petals and stamens occur in multiples of
- a) four
 - b) four or five
 - c) three
 - d) five
 - e) three, four or five
17. The outer ring of modified leaves in the flower is called the calyx. The leaves which form the calyx are called the
- a) carpels
 - b) petals
 - c) locules
 - d) sepals
 - e) none of the above
18. A fruit farmer often places a beehive in an orchard in spring and summer. This is to
- a) increase the amount of fruit produced
 - b) give the necessary shade to the hive
 - c) ensure sweet tasting honey
 - d) protect the trees from other insects
 - e) none of the above

SECTION B

(2 marks each)

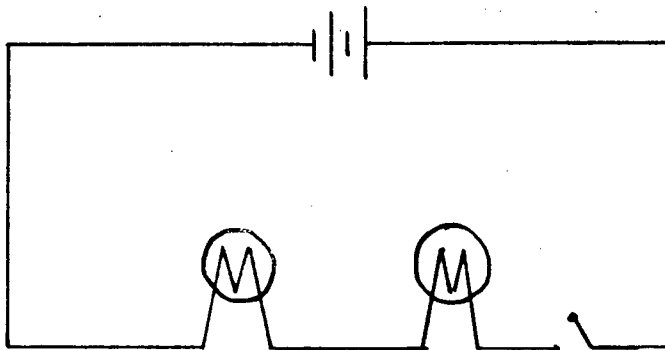
Give one word or phrase for each of the following statements.
Write down only the word or term.

1. The name of the apparatus which is used to separate water in its component parts.
2. The flow of positive charge from the positive terminal of the battery to the negative terminal of the battery.
3. Substances through which electricity cannot pass.
4. The process whereby a substance is broken down by electricity.
5. The property which allows a metal to be flattened using a hammer.
6. The rule which allows you to determine the direction of the magnetic field lines around an electric wire.
7. Reproduction which does not involve the fusion of sex cells.
8. The female structure of the flower.
9. The process of pollen transfer from the anther to the stigma of the same flower.
10. The stalk of the flower.
11. An underground stem which has nodes and internodes.
12. The process during which male and female gametes fuse.

SECTION C

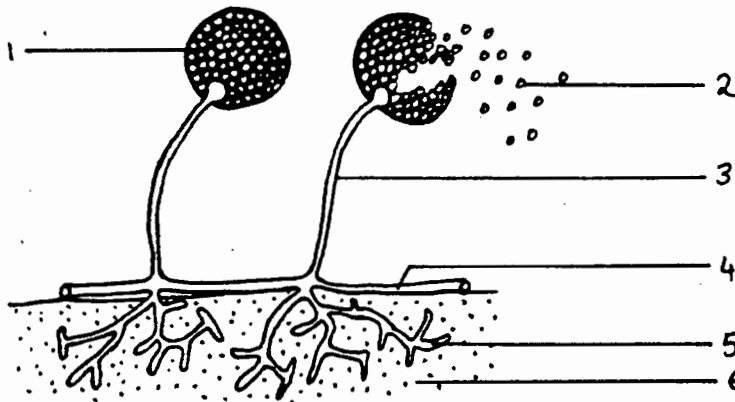
(70 marks)

1. a) Examine the following circuit and answer the question below.



- (i) Which symbol represents a battery in this circuit? (1)
 - (ii) How is the positive terminal of the battery shown in the symbol? (1)
 - (iii) Is it possible to switch the light bulbs on all at once and/or individually? Explain. (3)
 - (iv) Are the light bulbs connected in parallel or in series in this circuit? (1)
 - b) Name four advantages of lamps connected in parallel. (8)
2. a) (i) What is a short circuit? (3)
- (ii) Name two desirable characteristics of fuses (2)
- b) (i) Explain how you would determine the polarity of an electromagnet. (4)
- (ii) In what three ways could you increase the strength of an electromagnet.
- c) (i) What is a liquid which allows the passage of electricity through it called? (2)
- (ii) At which terminal is chlorine gas given off during the electrolysis of copper(II) chloride? (2)
3. a) (i) What are the three states in which matter can exist. (3)
- (ii) Give two differences between a mixture and a compound. (4)
- b) Name three properties of non-metals. (6)
4. a) (i) Define a root tuber. (3)
- (ii) On what property of plant cells does the ability of plants to grow from cuttings, depend? (2)
- b) Explain why vegetative reproduction can be both an advantage and a disadvantage with respect to genetic variability. (4)

c) Supply labels for the parts numbered 1 - 6 in the following diagram of bread mould.



5. a) What are the functions of the following parts of the flower.

- (i) sepals
- (ii) petals
- (iii) anther
- (iv) ovary

(8)

b) (i) Name three ways in which certain flowers ensure that they are self-pollinated.

(3)

(ii) What is the difference between a monoecious and a dioecious plant?

(4)

THE END

JMJ

ST JOSEPH'S COLLEGE

JUNE 1988

TIME: 90 MIN

STD 7

GENERAL SCIENCE

MARKS: 222

INSTRUCTIONS:

1. Don't Panic!
2. Answer Section A on the sheet provided.
3. Answer ALL questions.
4. Diagrams may be used to assist an explanation

SECTION A

(3 marks each)

1. A householder complained that he was using too much electricity. An electrician came and tested the various household appliances and his results are shown below. Which appliance is faulty.

(a) Table lamp	50W
(b) Electric iron	500W
(c) Water Heater	2000W
(d) Radio	5000W
(e) Electric Cooker	6000W

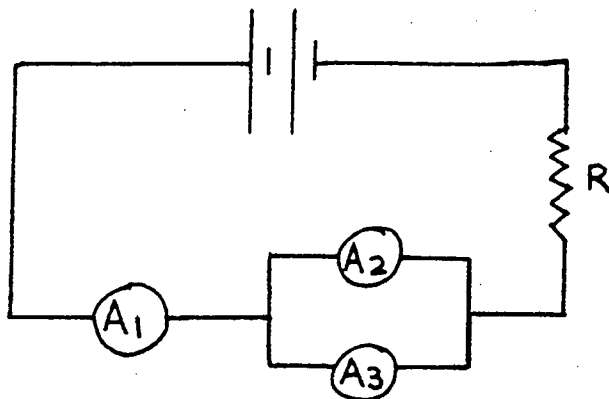
2. The gold leaf electroscope is used to:

- I charge an uncharged object
- II test whether an object is charged
- III determine the sign of the charge on an object

The correct statements are:

- (a) I and II
 - (b) I and III
 - (c) II and III
 - (d) I, II and III
 - (e) III only
3. A current of 4A flows in a conductor. The amount of charge flowing past a point in the conductor in 20s is:
- (a) 80C
 - (b) 0,2C
 - (c) 5C
 - (d) 24C
 - (e) 0,5C

QUESTIONS 4 & 5 ARE BASED ON THE ACCOMPANYING SKETCH



Three ammeters are connected in a circuit as shown in the diagram.

4. Select the correct statement.

- (a) All the meters will show the same reading.
- (b) A_1 will show the smallest reading
- (c) The reading on A_1 will be the sum of the other two readings.
- (d) The sum of the readings on A_2 and A_3 will be more than that on A_1
- (e) The sum of the readings on A_2 and A_3 will be less than that on A_1

5. The resistor R is replaced by a switch.
When the switch is closed:

- (a) the readings on all three meters will be less than with the resistor in
- (b) the readings on all three meters will be the same as with the resistor in
- (c) there will be no current through any of the meters
- (d) the meters will show extremely high readings, because the battery is short circuited
- (e) meter A_1 will have a higher reading but A_2 and A_3 will remain the same.

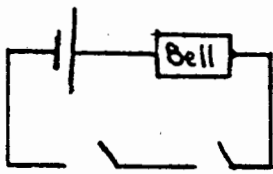
6. A pupil of mass 56kg carries his school case of mass 3.5kg up a 4m staircase in 45s. The work he does is:

- (a) 14J
- (b) 140J
- (c) 2240J
- (d) 2380J
- (e) 52.9J

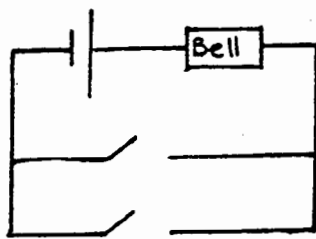
7. The watt is the name given to:

- (a) N.m.
- (b) J/s
- (c) J.s
- (d) J.m
- (e) kg.m.s

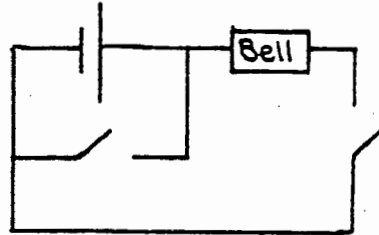
8. A pupil wants to connect a battery, a cell, a bell and a bell push at the front door and a bell push at the back door so that the bell rings if either bell-push is touched. Which of the following circuits should be used?



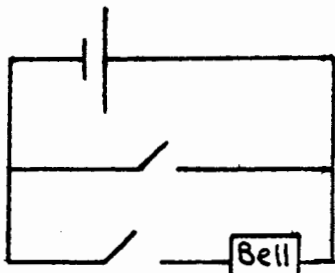
(a)



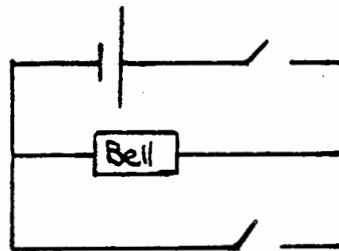
(b)



(c)



(d)



(e)

9. Plant and animal cells contain various parts. Which of the following is NOT found in plant cells?

- (a) cytoplasm
- (b) nucleus
- (c) cell wall
- (d) chloroplast
- (e) none of these

10. A small piece of a cactus is cut off and planted, it grows and produces a new plant. However we cannot do this with most animals because:

- (a) animals must move to find food.
- (b) plant cells are more specialised than animal cells.
- (c) plants make their own food.
- (d) animal cells are more specialised than plant cells
- (e) all the blood will run out.

11. Cellulose:

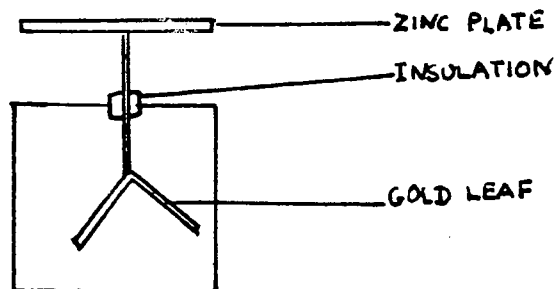
- (a) is used to make cellotape.
- (b) is a loosely packed tissue of cells
- (c) traps sunlight for photosynthesis
- (d) is a complex starch/carbohydrate
- (e) contains a green chemical pigment

12. A function of the root hairs is:
- to find food for the plant
 - to find mineral salts only for the plant
 - to store water for the plant
 - to absorb water from the soil
 - to anchor the plant in the soil
13. Which of the following statements is true?
- Monocotyledons; the radicle is replaced by adventitious roots.
 - The stems of monocotyledons contain hard wood, and bark with lenticels.
 - Monocotyledons have sessile, strap-like leaves.
- I only
 - I and II only
 - I and III only
 - I and II only
 - I, II and III
14. Compound leaves:
- have complex venation
 - are made up of many leaves
 - have one axillary bud
 - have several axillary buds
 - have been chemically changed for photosynthesis.
15. Meristematic means:
- cells elongating to form vacuoles
 - cell walls growing faster than the cytoplasm
 - the cells produce growth hormones
 - root hairs are developed in the regions
 - cells dividing to form new cells.

TOTAL SECTION A: [45]

SECTION B

- 1.1 Give two uses of an electroscope. (4)
- 1.2 The electroscope shown is charged.

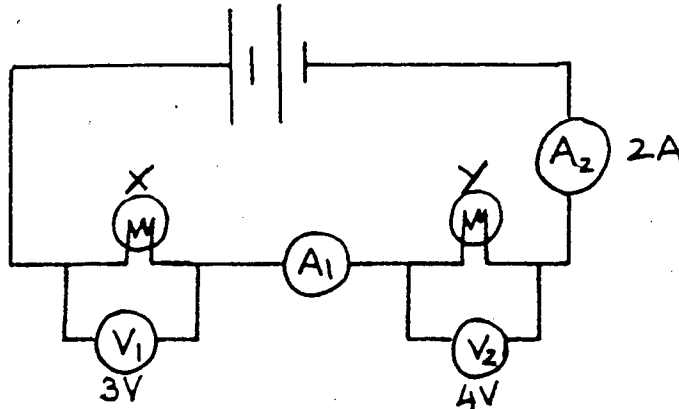


Explain very carefully with diagrams how you would determine the charge present on the electroscope.

(8)

1.3 Define conventional current.

(2)



1.4 In the circuit shown the ammeter A_2 reads 2A. The voltmeters V_1 and V_2 read 3V and 4V respectively. Find:

- 1.4.1 The potential difference of the battery. (2)
 1.4.2 The reading on A_1 (2)
 1.4.3 The resistance of bulb X (4)
 1.4.4 The total resistance of the circuit (5)
 1.4.5 The charge that passes through A_2 in 3 minutes (4)

1.5 In a household wiring system:

- 1.5.1 What colour is an earth wire? (2)
 1.5.2 What colour is the "live" wire? (2)
 1.5.3 On what wire will a fuse be situated - give reason (4)
 1.5.4 Are wall plugs and lights placed in the same parallel circuit? Explain your answer. (5)
 1.5.5 What method of connection is used in the wall plug circuitry. (2)
 1.5.6 Outline the working of a two way hall switch. (5)

2.1 On the moon a woman can easily lift a 60kg mass but is unable to repeat this feat on the earth. Explain why this is so. (5)

2.2 A crane is able to lift a 300kg mass through 8m in 10 seconds. Calculate:

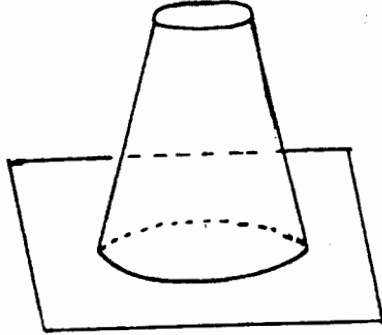
- 2.2.1 The weight of the object lifted (3)
 2.2.2 The work done by the crane (4)
 2.2.3 The energy gained by the 300kg mass (2)
 2.2.4 The power of the crane. (4)

2.3 Assuming a unit of electricity to cost 9c, calculate the cost of running:

- 2.3.1 a 60W light bulb for 7 hours (4)
 2.3.2 a 3000W heater for 3 hours per day for the month of June. (5)

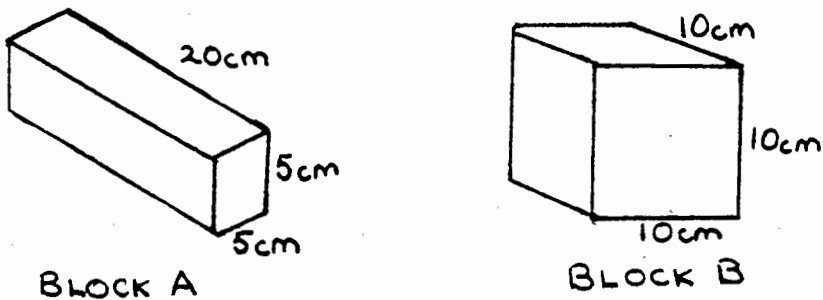
3.1 Define pressure and give the unit of measurement. (4)

- 3.2 Explain why it is possible to invert a full glass of water with a piece of paper covering the mouth, and holding it in the position shown in the diagram without the water falling out.



(5)

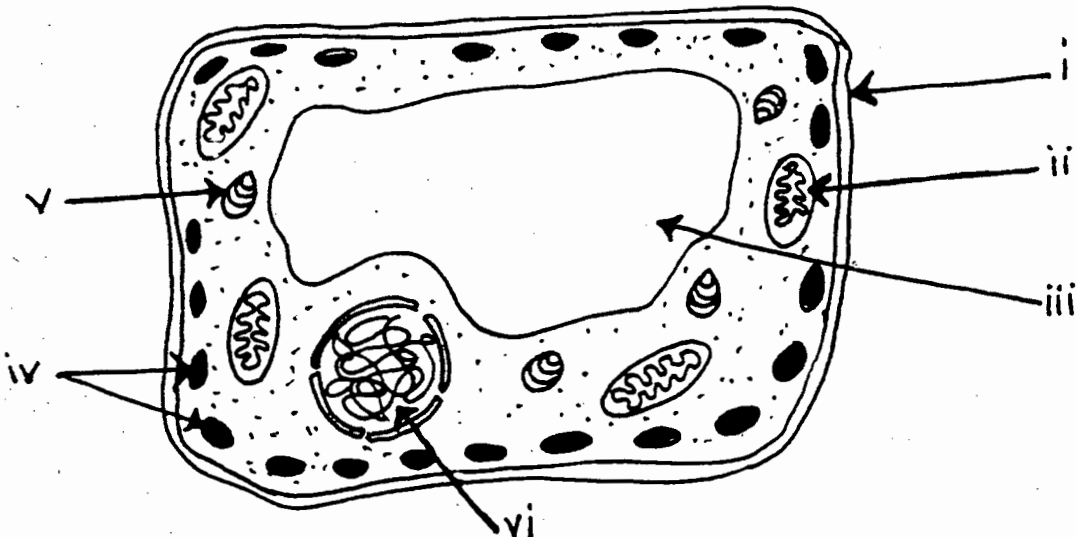
- 3.3 The two blocks have the same mass of 9kg. By calculation determine which block exerts the least pressure?



(6)

- 4.1. Tabulate three important differences between a plant and animal cell.

(6)

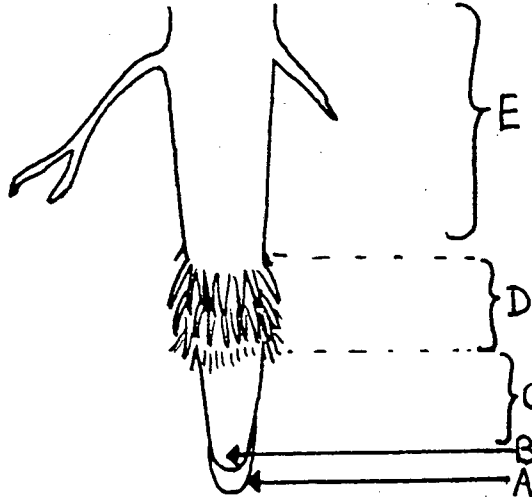


- 4.2. A diagram of a cell is shown above.

4.2.2 Name the structures I to VI and give one function of each structure. (18)

4.2.3 Is the cell that of a plant or animal? Give reasons for your answer. (4)

5.1 Use the diagram below to briefly outline the external structure and function of a root paying special attention to region B and D.



(12)

5.2 What type of root develops from stem cuttings? (2)

5.3 What type of root system is found in monocotyledenous plants? (2)

5.4 What is an epiphyte? Give a named example. (3)

5.5 Define haustoria. (2)

6.1 Give ways in which woody and herbaceous stems differ. (6)

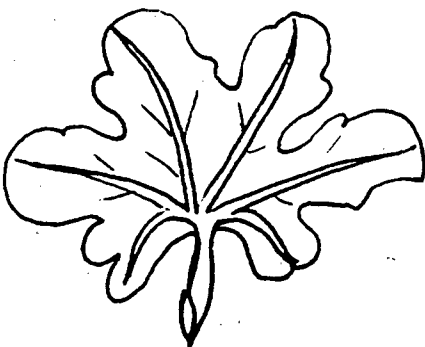
6.2 Name one type of stem modified for:

6.2.1 Propagation only.

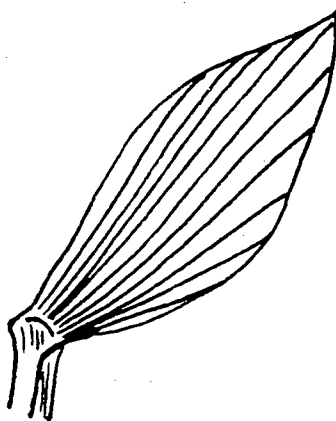
6.2.2 Support only.

6.2.3 Protection only. (6)

7.1 Name the types of venation illustrated.



A



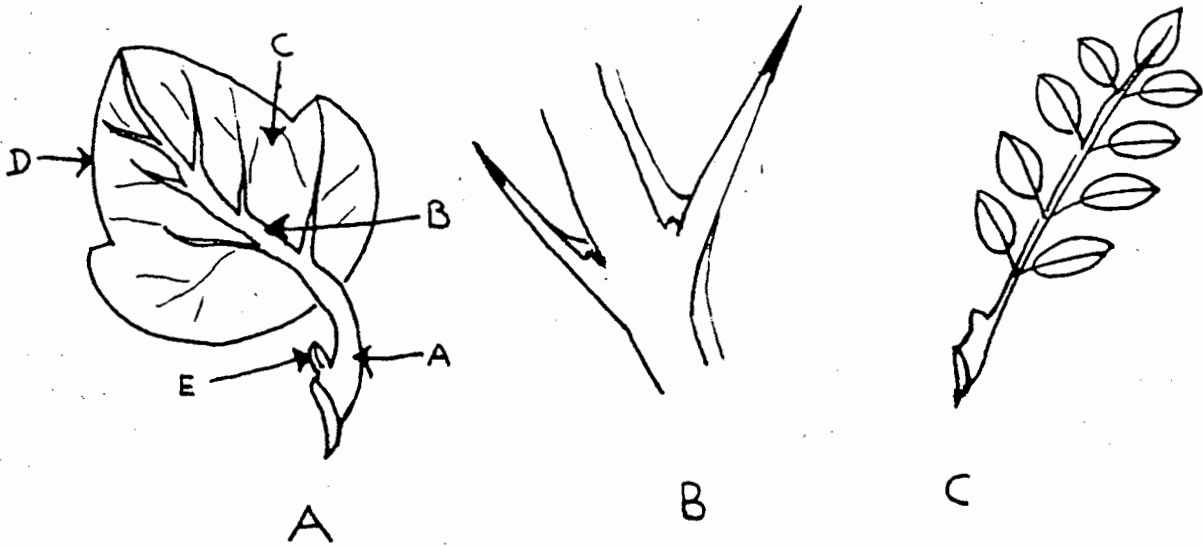
B



C

(3)

7.2 The diagrams show three types of leaves.



- 7.2.1 Classify the leaf types shown (Do not describe) (6)
- 7.2.2 Suggest what sort of climate each leaf type might be found in and give reason for your deductions. (6)
- 7.2.3 Name the parts A to E on diagram A. (5)
- 7.2.4 Give 3 functions of part B on diagram A. (3)

TOTAL SECTION B:

[177]