

RESUME OF CHIEF EXAMINERS' REPORTS FOR THE SCIENCE SUBJECTS

1. STANDARD OF THE PAPERS

All the Chief Examiners reported that the standard of the papers compared favourably with that of the previous years.

The questions were said to cover almost the entire spectrum of the syllabuses and were also clear.

2. CANDIDATES' PERFORMANCE

The reports on the performance of candidates varied.

The performance of candidates was reported to be good for Physics 2, General Agriculture 1 and 2, Fisheries 1 and 2, Crop Husbandry and Horticulture 1 and 2 and Animal Husbandry 1 and 2.

Candidates' performance for Integrated Science 1 and 2 was reported to be the same as that of the previous year.

Average performance was reported for Physics 1 and Biology 1.

In the view of the Chief Examiners, candidates performed poorly in Chemistry 1 and 2 and Biology 2.

3. A SUMMARY OF CANDIDATES' STRENGTHS

The Chief Examiners stated some commendable features in the responses of candidates. These include the following:

(1) Mastery of the Subject-matter

The Chief Examiners for Physics 1 and 2 and Animal Husbandry 1 reported that most candidates displayed mastery of the subject-matter.

(2) Good Answering Skills

The Chief Examiners reported that many candidates for Physics 2, Biology 1, Integrated Science 2, General Agriculture 1 and 2, Fisheries 2, Crop Husbandry and Horticulture 1 and 2 and Animal Husbandry 1 exhibited good answering skills in the responses.

(3) Improvement in English Language Usage

This commendable feature was noticed in the scripts of candidates for Biology 2, Integrated Science 1 and 2, Crop Husbandry and Horticulture 2 and Animal Husbandry 2.

(4) Improved Practical Skills

The Chief Examiners reported that there was improvement in the practical skills of candidates for Physics 1, Chemistry 1 and 2 and Biology 1.

- (5) Good Handwriting
Candidates for Biology 2 and Crop Husbandry and Horticulture 2 were reported to have exhibited good handwriting.
- (6) Adherence to rubrics
Most candidates were reported to have adhered to the rubrics of the papers. This was observed in Chemistry 1, Integrated Science 1 and 2, General Agriculture 2, Fisheries 1 and 2, Crop Husbandry 1 and 2 and Animal Husbandry 2.

4. **A SUMMARY OF CANDIDATES' WEAKNESSES**

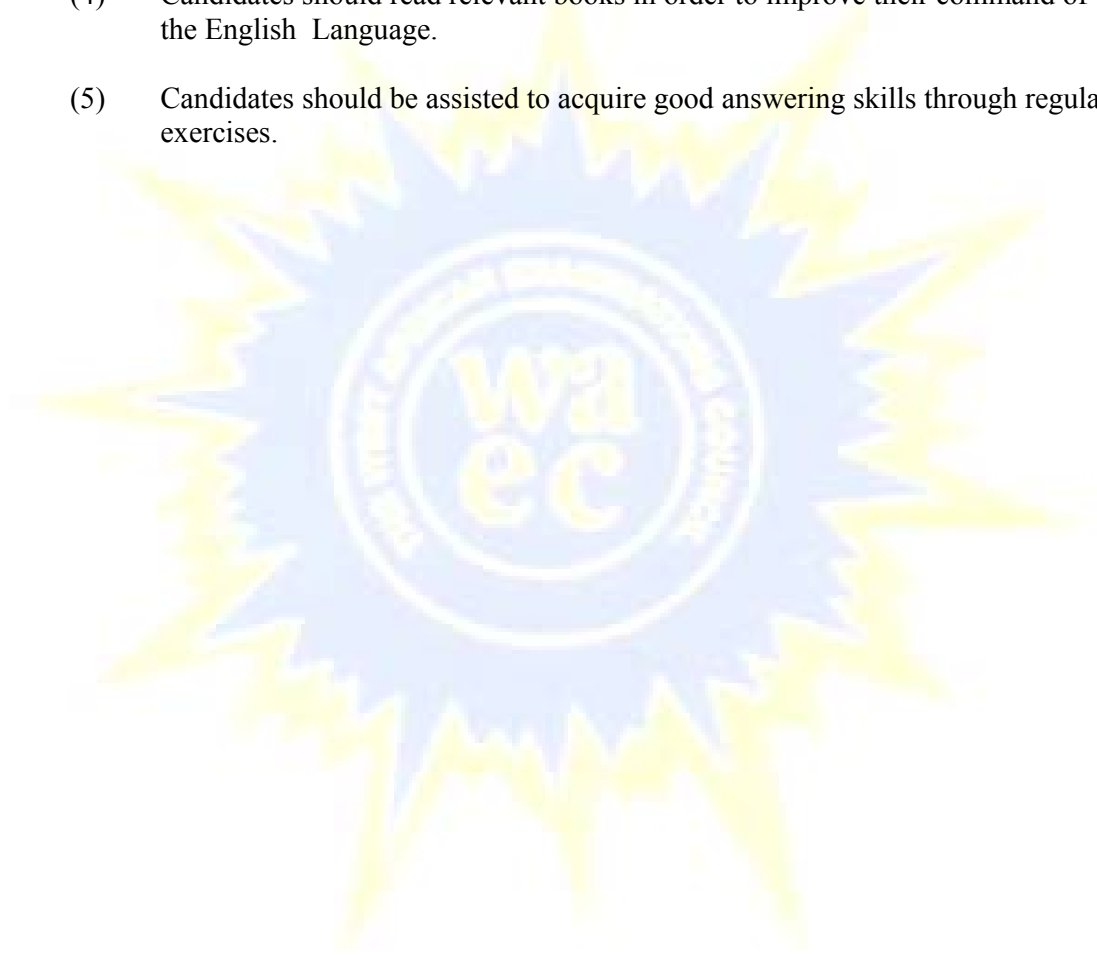
Weaknesses identified by Chief Examiners in the responses of candidates include the following:

- (1) Poor Expression and Inappropriate Use of the English Language.
These features were observed in the scripts of candidates for Biology 1 and Animal Husbandry 1.
- (2) Inadequate Preparation
The Chief Examiners for Physics 1, Chemistry 1 and 2 and Integrated Science 2 reported that the responses of candidates showed that they were ill-prepared for the examination.
- (3) Lack of Understanding of Questions
The reports of the Chief Examiners indicated that this unfortunate trait was exhibited by some candidates for Physics 1, and 2, Chemistry 2, Biology 1, Integrated Science 1, General Agriculture 1 and Fisheries 2.
- (4) Lack of Answering Skills
Candidates for Chemistry 1, Integrated Science 1, and 2, General Agriculture 2, Fisheries 1, Crop Husbandry and Horticulture 1 and Animal Husbandry 1 and 2 presented poorly organized work and wrong numbering.
- (5) Lack of Computational Skills
This feature was exhibited by candidates for General Agriculture 1.
- (6) Poor Handwriting
Candidates for General Agriculture 1, Crop Husbandry and Horticulture and Animal Husbandry 1 and 2 were reported to have exhibited poor handwriting.
- (7) Inability to Adhere to Rubrics
This feature was observed in the scripts of candidates for Biology 2 and General Agriculture 1.

(5) **RECOMMENDATIONS**

The Chief Examiners made the following recommendations in order to overcome the weaknesses:

- (1) The teaching and learning processes should be improved in the schools.
- (2) Candidates should make the effort to understand questions clearly before attempting them.
- (3) Candidates should be well-prepared for examinations.
- (4) Candidates should read relevant books in order to improve their command of the English Language.
- (5) Candidates should be assisted to acquire good answering skills through regular exercises.



ANIMAL HUSBANDRY 1

PRACTICAL

1. GENERAL COMMENTS

The general standard of the paper was maintained.
The general performance of the candidates is better than that of previous years.

2. A SUMMARY OF CANDIDATES' STRENGTHS

- (1) The majority of candidates were able to give the correct scientific names.
- (2) Most of them left appropriate spaces between sub- questions.
- (3) There was general improvement in the presentation of answers to questions.

3. A SUMMARY OF CANDIDATES' WEAKNESSES

- (1) The handwriting of some candidates was bad.
- (2) Candidates' observation of specimen was inaccurate in certain instances.
- (3) Most of them drew diagrams from memory.

4. SUGGESTED REMEDIES

- (1) Candidates should be advised to read questions well.
- (2) They should constantly look at the specimens to make sure of what they have done.
- (3) Supervisors should insist on the candidates writing their index numbers on their answer booklets.

5. DETAILED COMMENTS

SPECIMEN LIST

- A. Tick (preserved/live)**
- B. Maize weevils**
- C. Guinea grass**
- D. Spear grass**
- E. Saw dust**
- F. Dried straw**
- G. Leg of chicken (below knee)**
- H. Wing of chicken (dressed)**

Question 1

- (a) Identify each of specimens A and B.**

- (b) What kind of pest is specimen B?**
- (c) State four effects of the activities of each of specimens A and B on an animal farm.**
- (d) State two ways of controlling each of specimens A and B.**

Candidates were expected to identify specimen B as maize weevil, but they wrongly identified it simply as “weevil”. Also they wrongly identified specimen B as ectoparasite.

A large number of candidates answered that ticks are controlled by using insecticides. They mentioned some banned chemicals for controlling pests e.g. (DDT, Gamatox).

Question 2

- (a) Identify each of specimens C and D by both the common and scientific names.**
- (b) State five characteristics of specimen C that make it a good pasture plant.**
- (c) Give two uses of specimen D on an animal farm.**
- (d) Explain two disadvantages of having specimen D on a pasture.**

A few candidates could not write the scientific names of the specimens C and D as underlined the genus and species names separately, while using capital letter to start the species name.

A large number of the candidates were able to list the characteristics of guinea grass as a good pasture plant as well as the uses of spear grass. However, a few could not provide the disadvantages of having spear grass on a pasture. Some mentioned that spear grass was used as mulch.

Question 3

- (a) Identify each of specimens E and F.**
- (b) Give three reasons why specimen E is not suitable as litter material.**
- (c) Give two reasons why specimen F could be used as litter material.**
- (d) State three ways of ensuring that litter is kept dry.**

The general performance here was just satisfactory.

A few candidates identified specimen D as wood shavings instead of saw dust. Many candidates could not differentiate between the words Choke and “Chock” and digestive “track”. A good number also mentioned that gas produced by wet litter “wets” the litter.

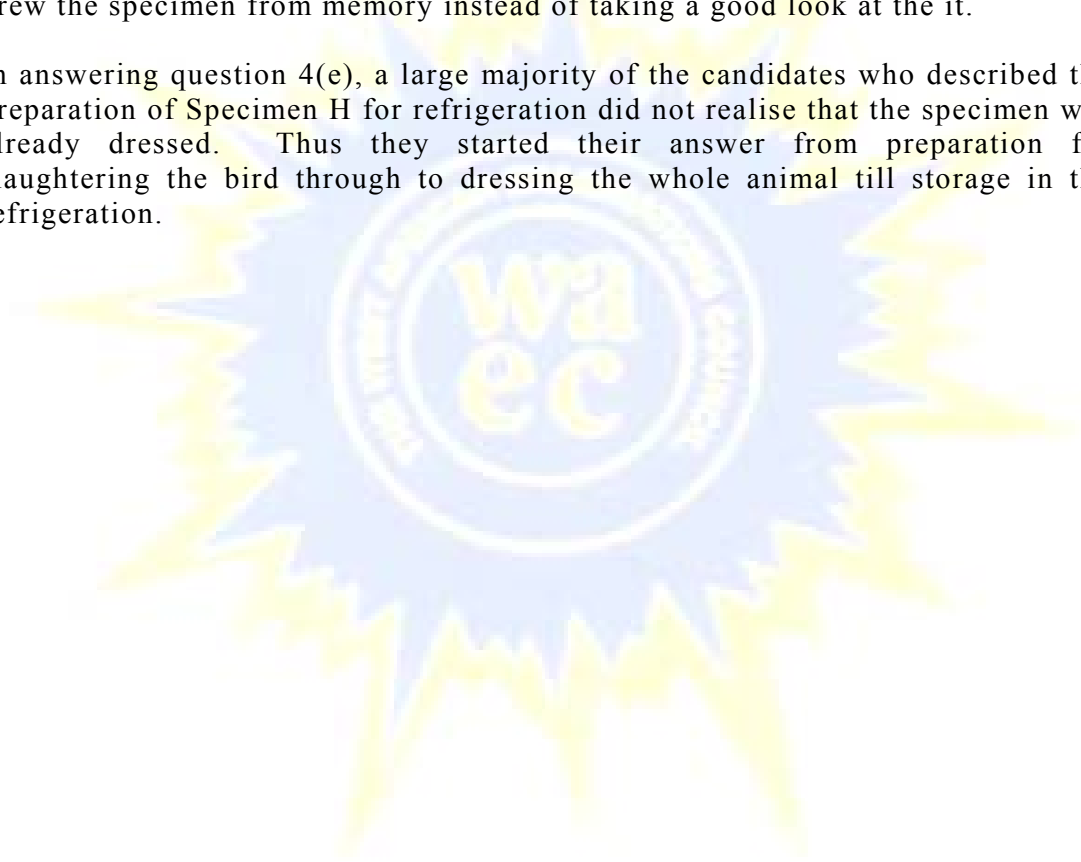
Question 4

- (a) Identify each of specimens G and H.**
- (b) State two functions of specimen G in a live animal.**
- (c) Draw and label specimen G.**
- (d) Name three bones that could be found in specimen H.**
- (e) Describe briefly how specimen H could be prepared for refrigeration.**

Candidates were to be presented with “dressed chicken wings and legs as specimens. Some candidates identified specimen G as either the “shank” or the “foot”.

Surprisingly, most of the candidates were able to write the names of the bones in the wings of the chicken. For a change, it was good that candidates were asked to draw and label Specimen G. Unfortunately, most of the candidates apparently drew the specimen from memory instead of taking a good look at the it.

In answering question 4(e), a large majority of the candidates who described the preparation of Specimen H for refrigeration did not realise that the specimen was already dressed. Thus they started their answer from preparation for slaughtering the bird through to dressing the whole animal till storage in the refrigeration.



ANIMAL HUSBANDRY 2

1. GENERAL COMMENTS

The Standard of the paper compares favourably with those of previous years.

The performance of candidates was better than that of the last year.

2. A SUMMARY OF CANDIDATES' STRENGTHS

- (1) Candidates demonstrated knowledge of the subject.
- (2) Candidates presented their answers in an orderly manner.

3. A SUMMARY OF CANDIDATES' WEAKNESSES

- (1) Poor language and poorly constructed sentences.
- (2) Poor spellings by candidates.
- (3) Words not legible/poor handwriting.

4. SUGGESTED REMEDIES

- (1) Candidates must read a lot of good books to improve on their vocabulary and expressions as well as spellings.
- (2) Spelling tests should be done to ensure an improvement in their spellings.
- (3) Teachers must encourage students to write legibly.

5. DETAILED COMMENTS

Question 1

- (a) **List three sources of animal protein for formulating poultry ration.**
 - (b) **State five symptoms of protein deficiency in farm animals.**
 - (c) **Discuss briefly, four problems associated with feeding of non-ruminant farm animals.**
- (a) Some candidate to mentioned bone meal, groundnut cake, wheat bran as sources of animal protein. The correct sources are fish meal, meat meal, blood meal, feather meal, maggot meal, milk and milk by-products.
 - (b) The symptoms of protein deficiency is quite a common question that candidates could have dealt with easily. Candidates were able to give answers such as stunted growth, loss of weight, anaemia, low productivity, low resistance to diseases.
 - (c) Candidates found this sub-question difficult since it demanded thinking and application.

The answers provided were sketchy.

It appears candidates did not generally understand the questions and therefore provided wrong answers like malnutrition, health status of animal, type of animal, digestibility, palatability of feed, age and sex of animal, temperature, pests and diseases.

- (i) scarcity and seasonality of feed ingredients mainly cereals;
- (ii) inadequate facilities for storage and preservation of feedstuffs resulting in losses and spoilage;
- (iii) High cost of ingredients/feed due to market forces, storage, preservation;
- (iv) Competition between non-ruminants and man for ingredients since they have similar digestive system;
- (v) Inadequate funds to purchase ingredients;
- (vi) Inadequate knowledge and skills to formulate and administer feed.

Question 2

- (a) **State two ways in which each of the following practices is important in animal production:**
 - (i) **culling;**
 - (ii) **debeaking;**
 - (iii) **dehorning;**
 - (iv) **hoof trimming.**
- (b) **Explain six objectives of animal improvement through breeding.**

This question was popular with candidates but the performance was average.

- (a) Some candidates explained/defined these terms without indicating the importance. Some candidates also defined the terms before providing the correct answers, which generally is a waste of time.
 - (i) It is quite common for students to state that culling helps farmers to know/identify productive animals etc. Candidates could have stated that very aggressive old and less productive animals should be removed and then followed with reasons such as to save the other animals from being bullied, to save feed, to create more space for the productive ones.
 - (ii) Candidates mentioned reduction in cannibalism/vent pecking and prevention of egg pecking/eating as correct answers. However, many of them were not conversant with reduction in injury to handlers and feed wastage.
 - (iii) Candidates did well in this sub-question. It should, however, be noted that dehorning does not reduce space in the kraal but rather creates more space. The practice also leads to the provision of good quality hide/skin and prevents animals getting entangled by their horns.
 - (iv) This sub-question was poorly answered. Hoof trimming prevents entanglement and infection and it also enables animals to walk comfortably.
- (b) This is a common question which one would expect candidates to answer easily. However, answers provided by some candidates implied that candidates did not understand the question. It is surprising that some candidates stated the importance of

agriculture, and others gave management practices instead of objectives of animal improvement through breeding.

A few of the correct answers include:

- To produce animals that can produce high quality products such as low backfat thickness
in pigs, yolk size etc
- To produce animals with high feed conversion efficiency.
- To produce animals which can adapt to climatic/environmental conditions.
- To produce animals with high reproductive potential .

Question 3

(a) State two functions of each of the following organs in farm animals:

- (i) gizzard;**
- (ii) caecum;**
- (iii) fallopian tube;**
- (iv) pancreas;**
- (v) stomach.**

(b) Suggest five ways of improving the productivity of local breeds of poultry.

This was not a popular question. The general performance was average.

- (a)
- (i) The gizzard does not digest food as some candidates stated but it rather grinds feed and churns it.
 - (ii) The caecum also does not digest cellulose or store faeces. It is the microbes in the caecum that are responsible for digestion. Absorption and amino acid synthesis occur in the caecum.
 - (iii) It is wrong for candidates to state that the fallopian tube
 - stores ovaries and feed
 - allows passage of ovary, feed to the young and passage of baby during parturition
 - serves as site for maturation of zygote.

Fertilization takes place in the fallopian tube not at the external part of the fallopian tube as some candidates indicated.

- (iv) The pancreas performs two general functions
 - secretion of insulin for sugar metabolism and
 - secretion of pancreatic juice containing enzymes for digestion.

The pancreas does not secrete ptyalin or bile. It secretes enzymes such as amylase, trypsin for digestion.

- (v) Candidates were generally comfortable with this sub-question. Many of them correctly mentioned storage of food, secretion of enzymes and hydrochloric acid.

Some of the expected answers were not give by candidates eg production of mucus, site for micro-organism as in ruminants.

The question did not ask for the benefits to be derived from improving local breeds of poultry or factors of production as some candidates intimated.

Some of the expected answers are as follows,

- Supplementary/improved feeding/balanced diet
- Effective disease/pest prevention and control
- Improved housing;
- Crossing with exotic breeds;
- Improved male to female ratio;
- Regular provision of fresh, clean water.

Question 4

- (a) **What is a pet?**
- (b) **Explain four reasons for keeping pets.**
- (c) **Discuss the management of cats under each of the following headings:**
- (i) **feeding;**
 - (ii) **sleeping place.**

It was a popular question. Candidates generally performed better in (a) and (b) than in (c).

- (a) This sub-question was well answered by most candidates. The important points that candidates should notice are as follows: pets are tamed/domesticated; pets are kept as companions; pets are treated with care and affection.
- (b) Many candidates were able to give reasons, for keeping pets such as, companionship, hunting, security at home, messengers, recreation/entertainment/sports, control of pests, guide to physically handicapped people, source of income. Candidates should be taught that pets are not to be kept for meat, neither are they kept for social security in homes.
- (c) (i) Candidates were expected to state the kinds of feed provided (eg raw meat, milk), provision of good drinking water, cleanliness of feeding plate, provision of balanced diet, breed etc. This subquestion was poorly answered.
- (ii) With regard to the sleeping place of cats, a comfortable bed, free of pests/parasites could be provided in a dark, warm, dry, well-ventilated and clean place. The practice of allowing cats to sleep on the owner's bed should be discouraged.

Question 5

- (a) (i) **Mention four factors that could affect ovulation rate in pigs.**
- (ii) **Explain briefly, how each of the factors you have mentioned in (a) (i) above affects ovulation rate in pigs.**
- (b) **Describe four features of the semi-intensive system of keeping pigs.**

This question was unpopular with candidates because it was quite technical. On the whole the performance of candidates was below average.

- (a) (i) The factors that affect ovulation rate in pigs were mentioned by candidates, particularly, diseases, pests, high temperature and nutrition. Only a few candidates mentioned the breed, age of sow and water intake.
- (ii) As to how the factors in a (i) affect ovulation, many of the candidates were at a loss. Their explanations were sketchy and poor.

Most of them simply said that the factor would affect ovulation without stating whether it will increase/decrease the rate of ovulation.

For instance

- good nutrition/flushing induces the release of many ova while poor nutrition results in the release of few ova
 - high temperature leads to low ovulation rate as animals are under stress.
- (b) This sub-question was poorly answered. The features of the semi-intensive system of keeping pigs include the following:
- the nature of the house: permanent house with solid wall/dwarf wall provided with wire meshing, and having concrete/non-concrete floor, roof made of thatch or aluminium sheets;
 - presence of wallows and a run with pasture
 - provision of feeding and water troughs.

Question 6

- (a) **State six characteristics of West African Dwarf Sheep.**
- (b) **Mention two ways in which sheep is of social importance in Ghana.**
- (c) (i) **List four stages of processing sheep.**
(ii) **Explain what happens at each of the stages of processing you have listed in (c) (i) above.**

This was not a popular question. The general performance was average.

- (a) Candidates had difficulty answering this-subquestion. They could provide only a few correct answers such as the small size, prolificacy, good milk producer, presence of short thin tail, short fine hair, adapted to humid climate, ram has mane and curved/crescent-shaped face.
- (b) Candidates were able to mention correctly the following answers: dowries, status symbol, religious festivals/feasts, pacification of goods.
- (c) (i) Candidates were able to list the stages in the processing of sheep such as slaughtering, flaying/singeing/washing, evisceration etc. but the stages were generally not sequential leading to the loss of mark.
- (ii) Candidates did not have problem explaining the stages in the processing of sheep. Sometimes, however, important points were omitted. For instance, to state that slaughtering means killing the animal is not enough. How was it killed?

BIOLOGY 1 **PRACTICAL**

1. GENERAL COMMENTS

The standard of the paper compared favourably with that of previous years. The general performance of the candidates was average.

2. A SUMMARY OF CANDIDATES' STRENGTHS

- (1) Ability to classify the specimens provided into their respective phyla and classes;
- (2) Improvement in biological drawing especially labelling;
- (3) Plotting the graph accurately with well-labelled axes.

3. A SUMMARY OF CANDIDATES' WEAKNESSES

- (1) Poor grammatical construction made it difficult for examiners to interpret what candidates wanted to write;
- (2) Wrong spelling of scientific terms;
- (3) Failure to understand the demands of the questions.

4. SUGGESTED REMEDIES

- (1) There is the need for students to take their English language lessons seriously;
- (2) Students should be encouraged to learn the spelling of all scientific terms they come across;
- (3) Teachers should take their students through a lot of tutorials on how to answer questions.

5. DETAILED COMMENTS

Question 1

- (a) **Name the developmental stages of specimen B.**
- (b) **List**
 - (i) **two structural similarities;**
 - (ii) **two structural differences between specimens A and B.**
- (c) **(i) Classify specimens A, B and C into their phyla and classes.**
(ii) State the economic importance of specimen C and how it can be controlled.
- (d) **Study specimen B carefully with the aid of a hand lens.**

Make a drawing 8 - 10 cm long of the lateral view of the specimen and label fully.

This question was well-attempted by most candidates and their performance was encouraging. The structural similarities and differences was a popular question as almost all candidates scored four full marks.

However, some candidates used internal features to answer the question. Candidates were expected to use features such as the fins, shape, sensory organs or any other observable structures as basis for the differences and similarities. For the differences candidates were not expected to use negative comparisons except where it cannot be avoided, for instance the presence of overlapping scales in fish which could not be found in tadpole. In this example, candidates were expected to write “the body of tilapia is covered with overlapping scales while that of the tadpole is smooth”. This is a better way of presenting the difference than writing “scale is present in fish and scale is absent in tadpole” in a tabular form which the question did not ask for. Candidates were also expected to write “Tilapia has paired fins while tadpole has unpaired fins”. If a candidate writes “Tilapia has paired fins but tadpole has no unpaired fins” he or she loses marks because he or she is using negative comparison.

The classification question was answered by many candidates.

However, most of them lost marks due the neglect of biological conventions. Names of both phyla and classes should begin with an upper case letters but some candidates used lower case letters. Another problem was poor spelling by candidates. For example, most candidates could not spell the class “Osteichthyes” of specimen A (Tilapia). Also, some candidates could not spell Arthropoda and insecta correctly. Arthropoda was spelt as “Anthropoda” and insecta was spelt as “insector”.

The economic importance of the mosquito larvae also posed problem to students. The majority of candidates wrote on economic importance of the mosquito which was wrong because the specimen presented was not a mosquito but the larvae of mosquito. Also most candidates understood economic importance to mean financial loss. Expected answers are:

- (i) source of food to aquatic fishes eg tilapia and
- (ii) develops into adult mosquito which is a vector of malaria. Candidates lost marks when they wrote “because mosquitoes do not cause malaria but they are vectors or transmit or spread the disease. The control measures include pouring kerosene or oil on stagnant water surfaces to suffocate larvae, drainage of stagnant waters, spraying with larvicides/insecticides or use of predatory fishes eg, tilapia.

Answers like” pouring of oil on water surface is incomplete”.

Drawing of the tadpole was a straightforward question and candidates were not expected to have

problems. However, serious mistakes were committed by candidates.

These include not drawing to the size given in the question, no title or wrong title, no

magnification or poor calculation of magnification, poor details especially in the presentation of head to tail ratio (HT), V-shape tail muscles (VM) and streamline shape (SL). Candidates also wrongly labelled tail fin as tail.

Question 2

- (a) **In order to estimate the population of different weeds in a farmland that measured fifty (50) metres (length) by twelve (12) metres (width). A 1m² quadrat was thrown ten (10) times. The results obtained were recorded in the table below.**

| Weed type | Frequency |
|------------------|------------------|
| <i>Tridax</i> | 33 |
| <i>Commelina</i> | 30 |
| <i>Desmodium</i> | 18 |
| <i>Ipomea</i> | 16 |
| <i>Imperata</i> | 10 |
| <i>Talinum</i> | 13 |

Use the results in the table to answer the questions below.

- (i) **Draw a bar chart to show the distribution of weeds in the farmland.**
- (ii) **Which weed occurred most frequently?**
- (iii) **Which weed occurred least frequently?**
- (iv) **Calculate the population density of tridax.**
- (v) **Calculate the population size of tridax.**
- (b) **Name one other method each for estimating a population of:**
- (i) **plants;**
- (ii) **animals.**
- (c) **List four factors that can affect population size of the weeds.**

Candidates took advantage of the calculations and scored very high marks while the majority of them found it difficult to do computation as well as plotting of the graph accurately. Examiners expected the candidates to give a precise title to the graph which most candidates did not do. The expected title of the graph is “Distribution of weeds in a farmland or estimation of population of different weed types in a farmland” Candidates also found it difficult choosing a correct scale for the graph.

Candidates who chose a scale of 2cm to 5 units on the y-axis had all the bars correct. Those who chose 2cm to 3 units could score for only types with frequencies divisible by 3, thus they scored only for *Tridax* (33), *Commelina* (30) and *Desmodium* (18). With this scale it was difficult to plot 0.33 on the graph. Other candidates also chose a scale of 2cm to 4 units. Although examiners expected a bar chart, most candidates drew histogram but they were not penalized.

The calculation of population density and size of *Tridax* posed problems to the majority of candidates. The formulae were wrongly quoted by most candidates. The formula for population density is Average No. of *Tridax*/unit area.

Candidates therefore had to calculate the average number of *Tridax* before finding the population density.

Candidates also confused the unit area of quadrat with the total area of the farmland, thereby leading to wrong answers.

Population size is given by population density multiplied by total area. In both calculations most candidates lost marks because they did not state the units.

The other methods for estimating the population also posed a challenge to some candidates. These are line or belt transects for plants and capture-mark-recapture for animals. The spelling of transect was also difficult for some candidates.

Over 80% of the candidates got the factors that affect the population of weeds correctly. The expected answers are water, light/sunlight, food availability, rainfall, temperature. Competition alone cannot be a factor that affects the population of weeds.

Competing for light, or nutrients is appropriate. Interestingly, most candidates wrote factors that affect the population of animals such as immigration, emigration, birth rate and mortality which were all wrong.

Question 3

Fill a measuring cylinder or beaker with specimen D which is garden soil up to one-third of it. Pour water into the cylinder until it is two-thirds full. Cover the measuring cylinder or beaker with a glass jar cover or petri dish and shake it properly. Let it stand on the table for a few minutes.

- (a) (i) **How many layers can you observe?**
(ii) **State two characteristics of each layer.**
- (b) (i) **Make a drawing 8-10 cm long of the experimental set-up and label fully.**
(ii) **Suggest an aim for the experiment.**

Candidates attempted the question from theoretical point, thereby, leading to huge loss of marks especially the description of the characteristics of the different layers. Candidates were expected to use observable features such as colour, particle size and texture to state the characteristics.

Candidates rather used nutrient content which cannot be seen.

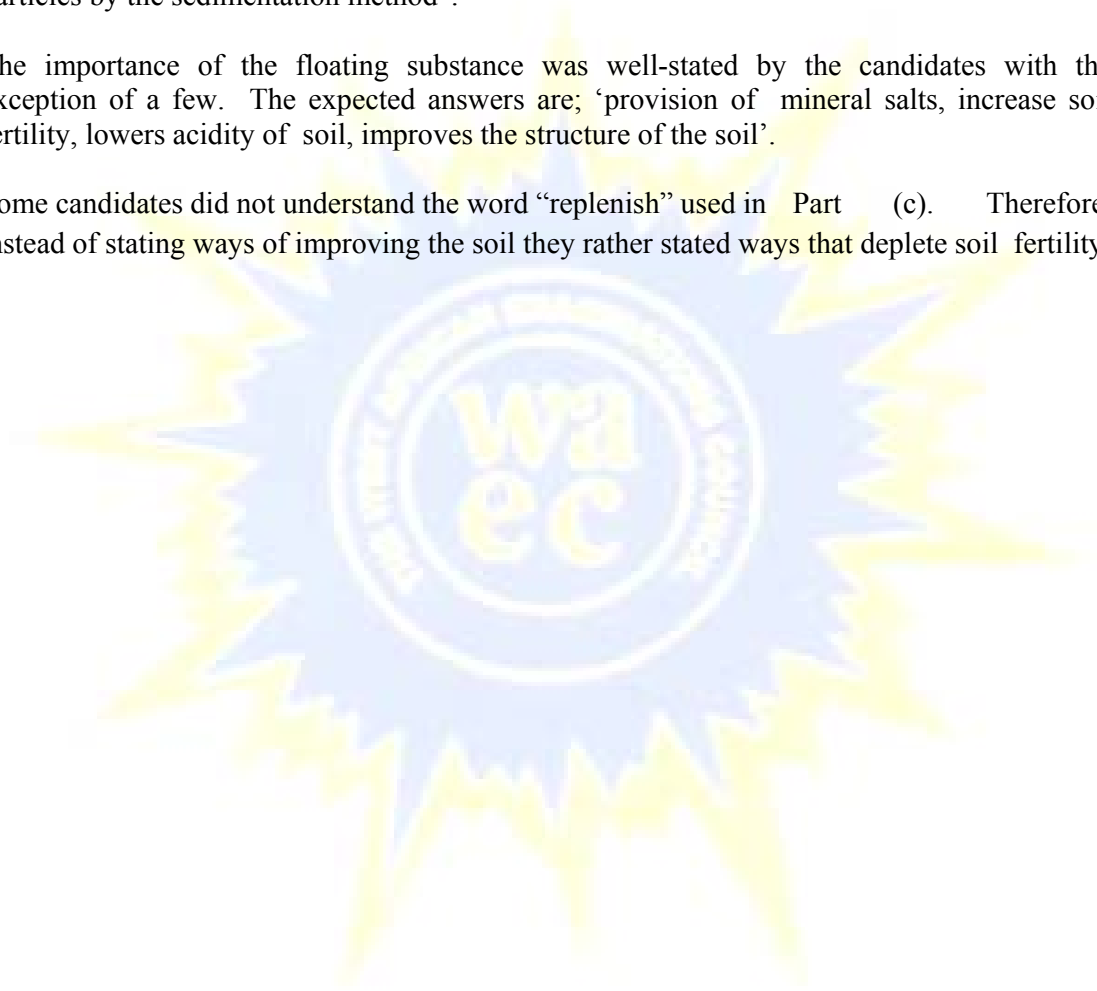
Strangely enough, some candidates could not relate the number of layers they had stated to the drawing. For example, a candidate may state that the number of layers is five but draw seven layers.

Candidates did not find it difficult drawing the layers but marks were lost due to inaccurate labelling. Most of the guidelines for the layers ended on the measuring cylinder instead of the layers. Another problem was the candidates' inability to draw according to instructions. While some candidates drew below 8 cm others drew more than 10cm-size diagram.

Candidates also were not able to aim correctly. The expected aim is "to separate soil particles by the sedimentation method".

The importance of the floating substance was well-stated by the candidates with the exception of a few. The expected answers are; 'provision of mineral salts, increase soil fertility, lowers acidity of soil, improves the structure of the soil'.

Some candidates did not understand the word "replenish" used in Part (c). Therefore, instead of stating ways of improving the soil they rather stated ways that deplete soil fertility.



BIOLOGY 2

1. GENERAL COMMENTS

The standard of the paper compared favourably with that of previous years. The general performance of candidates however, was not impressive. Only a few candidates performed satisfactorily.

2. A SUMMARY OF CANDIDATES' STRENGTHS

- (1) Many candidates' were able to match corresponding points in a tabular form;
- (2) Some candidates showed much improvement in expressing themselves well in English Language;
- (3) The handwriting of candidates was on the whole legible and must be kept up.

3. A SUMMARY OF CANDIDATES' WEAKNESSES

- (1) Spelling mistakes were many in the answers of candidates;
- (2) Most candidates failed to obey the rubrics regarding biological drawings;
- (3) Few candidates failed to read all instructions thereby answering questions they were not supposed to answer;
- (4) Many candidates failed to define/explain biological terminologies.

4. SUGGESTED REMEDIES

- (1) Candidates should read all instructions to the paper and follow them to the latter;
- (2) Tutors are to ensure that candidates know and understand the rubrics of the subject;
- (3) Tutors should ensure that they teach candidates acceptable definitions and explanations of biological terminologies;

- (4) Tutors should lay emphasis on the teaching of grammar and ensure correct spelling of biological vocabularies.

5. DETAILED COMMENTS

Question 1

- (a) Explain the following terms:
- (i) imbibition;
 - (ii) turgidity;
 - (iii) flaccidity;
 - (iv) plasmolysis.
- (b) (i) Define osmosis
(ii) List two factors that affect osmosis.
- (c) State two ways each in which osmosis is important to
- (i) human;
 - (ii) plants.

Most candidates attempted this question, but failed to define and explain the biological terms correctly.

The appropriate explanations are as follows:

- (i) Imbibition: is the tendency of a seed to absorb water and swell.
- (ii) Turgidity: when the osmotic potential of a cell sap is higher than that of the surrounding water medium/hypotonic, water molecules pass into the cell by osmosis as the plant cell absorbs more water cell vacuole and protoplasm increase in volume. The protoplasm presses against the cell wall in all directions causing it to be firm/rigid.
- (iii) Flaccidity: when osmotic potential of the surrounding water medium is higher/hypertonic than that of the cell sap; water diffuses out of the cell, the cell then loses its firmness and becomes flabby.
- (iv) Plasmolysis: when the osmotic potential of the surrounding water medium is higher/hypertonic than that of the cell, the cell loses water to the medium, as more water leaves the cell the vacuole collapses and the cytoplasm shrinks away from the cell wall.
- (v) Osmosis: is the movement of water molecules from a region of higher concentration of water to a region of lower concentration of water across a semi-permeable/partially permeable membrane or is the movement of water molecules from a dilute solution to a concentrated solution across a semi-permeable/partially permeable membrane.

Most candidates were able to list the factors that affect Osmosis in Part (b).

Candidates were able to state the ways in which osmosis is important to humans and plants respectively in Part (c).

Question 2

- (a) **With the aid of a diagram 8 - 10 cm long, describe how oxygen is given out as a by-product of photosynthesis.**

This question was avoided by most candidates, and the few who attempted it had average scores. The question requested candidates to present an experiment to show how oxygen is given out as a by-product of photosynthesis with regard to the diagram. Candidates could not apply the rubrics of biological drawings. The quality of diagram required was one with stated size 8 to 10 cm long; clarity of lines (ie diagram outlines not woolly and not broken; neatness of labels (ie ruled guidelines and horizontal labels). These were however, violated by candidates.

Details of the experiment showing an aquatic plant/*Elodea*/*Spirogyra* in inverted funnel, water levels in beaker and inverted test tube over the funnel stem, a small vacuum/space at the top of the test tube occupied by gas, and gas bubbles shown in the test tube water were not accurately shown. The labels were correctly spelt. The experiment could be described as follows: water plant/*Elodea*/*Spirogyra* is placed in a beaker of water covered with a funnel and a test tube filled with water is turned upside down/inverted over the funnel stem; the experimental set-up is placed in sunlight for about 3 hours/few hours while an identical control experiment is set up and placed in a dark cupboard for about 3hours/few hours to prevent photosynthesis taking place. Bubbles of gas were observed in the test tube of the experimental set up while no gas bubbles were observed in the control. The gas was tested with glowing splint which was rekindled/burst into flames, showing that oxygen gas is produced during photosynthesis.

Question 3

- (a) **Copy and complete the table below:**

| Disease | Causative Organism | Part of the body affected |
|-----------------------|---------------------------|----------------------------------|
| Malaria | | |
| Whooping Cough | | |
| Poliomyelitis | | |

It is worth noting in Part (b) that Plasmodium is transmitted when Female Anopheles mosquito bites an infected person and then bites a healthy person. Bordetella pertussis is transmitted when an infected person coughs and a healthy person inhales the infested air droplets.

Polio virus is transmitted through the intake of contaminated water or food and the discharge of the virus from the mouth, nose/faeces of patient to a healthy person.

- (i) Poliomyelitis can be controlled through the provision of clean water/food supply, hygienic food preparation and vaccination/immunization.
- (ii) Guinea worm is controlled by boiling/filtering contaminated water, and avoidance of washing/bathing/drinking contaminated water.

Question 4

- (a) **Explain the following terms:**
 - (i) **diploid;**
 - (ii) **polygenic inheritance.**
- (b) (i) **Explain the differences between sex linkage and autosomal linkage**
(ii) **Give two examples of a sex-linked characters.**
- (c) **Mr. John who does not have the sickle-cell anaemia trait is married to Mary who is a sickler, yet he claims the sicker child born to them is not his child. Determine by aid of a genetic diagram whether his claim is true.**

This question was avoided by candidates, but the few who attempted it performed fairly well.

Candidates could not adequately explained the biological terminologies. For instance;

- (a) (i) Diploid - is a nucleus/cell of an organism with two sets of chromosomes present with one set derived from the female parent and the other one derived from the male parent.
 - (ii) Polygenic Inheritance - in the determination of a character/ trait controlled by many genes each having an effect on the phenotype and such character shows continuous variation.
- The differences between sex linkage and autosomal linkage in Part (b) could be presented as follows: in sex linkage, the gene responsible for a trait is carried on the sex/x- chromosome while in a autosomal linkage, the genes occur on the autosomal chromosomes.

Candidates gave correct examples of sex-linked character as haemophilia, colour blindness, baldness.

Most candidates were able to deduce the genotypes of Mr. John who does not have a sickle-cell anaemia trait as AA, and Mary who is a sickler, SS, and further constructed the genetic diagram correctly in Part (c).

Question 5

- (a) **What is**
 - (i) **taxonomy**
 - (ii) **binomial nomenclature.**
- (b) (i) **Explain the importance of classifying living organisms.**
(ii) **Give three reasons why viruses cannot be classified as living organism.**

- (c) (i) **State five characteristic features of arthropods.**
(ii) **List five diseases of human associated with arthropods.**

Candidates provided satisfactory answers to a (i) - (iii); b (i) - (ii).

Few candidates found it difficult to state the characteristic features of arthropods, which were supposed to be: Skeleton is chitinous; body covered with hard exoskeleton; presence of jointed appendages; segmented body; bilaterally symmetrical; have three body layers/triploblastic etc.

Candidates satisfactorily listed the diseases of humans associated with arthropods such as malaria, yellow fever, typhoid fever, dengue fever, cholera, leprosy, elephantiasis, trypanosomiasis, onchocerciasis etc.

Question 6

- (a) (i) **What is RNA?**
(ii) **Outline the role of RNA in protein synthesis.**
- (b) **The continuous cultivation maize on a farmland for three consecutive years led to poor yield.**
(i) **State five possible reasons for the poor yield.**
(ii) **Suggest five possible ways by which the farmer can improve his yield.**

Few candidates fairly answered this question.

Candidates showed some level of understanding of Part (a) but had problems with sequential presentation outlining the role of RNA in protein synthesis in the nucleus by the DNA. It passes out through pores of nuclear membrane into cytoplasm and because attached to the ribosomes. The mRNA carries instruction for synthesis of specific proteins/CODONS. Each tRNA has triplet of bases/anti CODONS enabling it to become attached to definite part of the mRNA. The tRNA carries specific amino acids to the ribosomes/sites of protein synthesis and adjacent amino acids are linked together by peptide bonds. The rRNA moves along the ribosome adding more amino acids. Candidates performed satisfactorily in answering Part (b).

CHEMISTRY 1

1. GENERAL COMMENTS

The standard of each paper (Alt A, B or C) compared favourably with those of previous years. Apart from few candidates performance was not encouraging. Some of the difficulties are as follows:

- (1) Poor usage of Language. Limited vocabulary was identified as a major problem for many of the candidates where they had to explain or give reasons for answers.
- (2) Using different rubrics or no rubrics and failing to comply with instructions led to poor performance by some of the candidates.
- (3) Several cancellations by candidates of titre values.
- (4) Deliberate alteration of titre values often making it difficult to distinguish the new from the one cancelled.
- (5) Very poor handwriting, using wrong chemical formula, even for those stated in the question e.g. PbNO_3 instead of $\text{Pb}(\text{NO}_3)_2$

For each of the Alternatives, candidates performance was best in Question 1 and poorest in Q2

2. A SUMMARY OF CANDIDATES' STRENGTHS

- (1) Candidates demonstrated appreciable understanding in the use of mole concept.
- (2) Improvement was also noticed in the use of consistent titres.
- (3) No candidate put alkali in the burette.
- (4) There was decrease in arithmetic error ie in subtracting initial titres values from final titre values.
- (5) As a result of the commendable features mentioned, some of the candidates scored the maximum marks for Q1 in each of the alternatives A, B and C.

3. A SUMMARY OF CANDIDATES' WEAKNESSES

For the candidates whose performance was poor, the following weaknesses were noted (Alt A,B and C)

- (1)
 - Units were omitted or wrongly used.
 - Inconsistently reading burette to one decimal place.
 - Some candidates had difficulty with leaving their answers in correct significant figures

- (2)
 - Many students exhibited poor knowledge in reporting results of activities carried out as outlined in the format; Test, observation and inference.

 - Many candidates did not comply with rubrics and instructions.
 - Chemical terms were carelessly used e.g using 'ppt' when they meant 'residue.'
 - Precipitates were incorrectly described.
 - Under inference column, wrong charges were given to ions

- (3)
 - Candidates lost marks for wrong spelling of laboratory equipment, apparatus etc.
 - They also exhibited limited vocabulary in stating observation or explaining activities performed in laboratory.

4. SUGGESTED REMEDIES

- (1) Teachers must endeavour to engage students in more practical activities in order to give them the desired confidence.
This applied as well to other alternatives
- (2) Teachers must take note and correct the mistakes
- (3) Students attention must be drawn to correct description of precipitates during practical lessons

5. DETAIL COMMENTS

ALTERNATIVE A

Question 1

- (a) Cancellation of titre values/deliberate alteration of titre values to obtain supervisor's titre or close to it appeared to have increased.

- (b) Candidates were able to calculate the molar mass of HNO_3 as 63g mol^{-1} . But many missed or omitted the units. It is g mol^{-1} and not g or g gm^{-3} .
 - Marks were also lost by candidates for failing to leave evaluated values of concentration of A and B in correct significant figures (2 or 3) as in the scheme.
 - A good number of candidates demonstrated adequate knowledge of the concept of finding the value of x in $\text{Na}_2\text{CO}_3 \cdot x \text{H}_2\text{O}$. They however failed to correct their values to whole numbers.

Question 2

- (a) Some candidates showed no indication of addition of distilled water and carrying out filtration. In all the alternatives, many failed to report on what they did.
- (b) Precipitates were described wrongly. e.g. Filtrate + $\text{Pb}(\text{NO}_3)_2$ observation is 'white ppt and not white gelations ppt.'
- (c) (i) Performance of candidates to this sub-question was below average. They were expected to write "Residue + dil. HNO_3 ", but many wrote C+ dil. HNO_3
- (ii) The inference is ' Zn^{2+} or Al^{3+} ' and not ' Zn^{2+} and Al^{3+} '

Question 3

- (a) Students performance was good. A few who wanted to use the names of W,X and Y got the IUPAC names wrong.
- (b) Both colours must be mentioned. e.g. 'green colour changes to brown' instead of 'colour changes to brown.'

ALTERNATIVE B

Question 1

- (a) Please refer to Alt A.
- (b) Apparently, candidates were used to determine mole ratio of reactions from balanced equations. Some candidates got confused and assumed the mole ratio of acid to base was 1:1 though the question did not say D was a monobasic acid. Concept was difficult for such students and teachers must take note.
- The few who got to b(iii) failed to divide the mole ratio of acid to base by the smaller one in order to obtain the nearest whole number ratio.

Question 2

Sample G was also a mixture of two compounds.

- (a) Same issues as identified in Alternative B. In writing out tests, candidates failed to distinguish between the mixture, filtrate and residue when adding reagents.

As in Alt A, precipitates were described wrongly.

- (c) The observation should be 'blue-black colouration' and not 'blue-black ppt.'

Question 3

Performance was generally good.

ALTERNATIVE C

Question 1

- (a) Please refer to Alt A and B.
- (b) Students displayed adequate knowledge of the concept of finding the value of x.

Question 2

J was also a mixture of two compounds. Again, many candidates failed to differentiate between residue and resulting solution from the solid sample J.

Several candidates gave the correct inference i.e. $\text{NH}_3(\text{g})$ from NH_4^+ without performing. Many also failed to mention the white residue left after heating J strongly.

Question 3

Performance of candidates was good except for 3(d) where several candidates displayed ignorance of the activity i.e. Heating of $\text{Pb}(\text{NO}_3)_2$ strongly and allowing to cool. Teachers must try to demonstrate some of these activities required by the syllabus.

Clearly, performance of candidates in question 2 (Qualitative analysis) in all the alternatives (A,B and C) was not the best and gave a lot of concern. It was difficult to state whether it was lack of adequate practical work or candidates genuine weakness.

It is suggested that where the teacher is the problem, experienced teachers could be invited by schools to assist in this area.



CHEMISTRY 2

1. GENERAL COMMENTS

The paper was of the required standard, as it covered the entire syllabus. There was equal distribution of the questions in terms of recall, comprehension, application and some few analysis on the subject matter. The questions were arranged to allow flexibility in attempting them but this was not shown by most of the candidates. There was therefore a slight decline in the candidates performance compared with that of the previous year.

2. A SUMMARY OF CANDIDATES' STRENGTHS

Not much improvement was identified in the performance of the candidates, nonetheless they exhibited few skills in dealing with some items that need to be mentioned.

- (1) They were able to give exact definition for radioactivity, electron affinity and functional group as well as correct statements of Hess's Law of Constant Heat Summation and the Law of Summation and the Law of Conservation of matter.
- (2) They were able to write the electron configuration of Cr, Cr³⁺ and Cr⁶⁺ using the s, p, d notation.
- (3) They could also balance nuclear reactions.
- (4) They could determine order of reaction from given rate data.
- (5) Majority were able to give an outline of how the mass spectrometer operates.

3. A SUMMARY OF CANDIDATES' WEAKNESSES

The major weakness noted was the fact that the organic chemistry question was poorly answered by most of the candidates that attempted it.

Candidates seem not to understand that double indicator titration is used to analyse a mixture of bases (NaOH and Na₂CO₃). They could not explain the reactions occurring during the titration probably because they are not taught to understand but rather to just perform. No candidate was able to provide the answers for questions 5c(i), and 2 c(ii) as stated in the marking scheme.

4. SUGGESTED REMEDIES

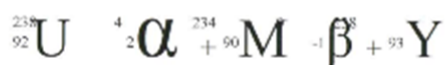
- (1) Efforts must be made by teachers to start the teaching of organic chemistry early and give candidates more exercises.
- (2) Teachers must be encouraged to do more laboratory demonstrations to enhance students understanding in Chemistry.
- (3) Students must be encouraged to read and do extra work on their own.
- (4) Teachers must be encouraged to upgrade themselves through workshops, seminars, symposia and short courses to enhance their teaching skills.
- (5) Chief Examiners report should be made available to teachers through the heads of institutions to help the teachers in delivering lessons.

5. DETAILED COMMENTS

Question 1

- (a) Give an outline of how the mass spectrometer operates.
- (b) (i) Write the electron configuration of each of the following species using s, p, d notation.
 - (α) Cr,
 - (β) Cr³⁺
 - (γ) Cr⁶⁺

[Cr = 24]
- (ii) Which of the species in (b) (i) above would have the highest magnetic moment?
Explain your answer.
- (c) (i) What is meant by radioactivity?
(ii) State two factors that determine the stability of a nuclide.
(iii) Balance the following reaction by supplying the missing atomic and mass numbers.



- (d) (i) Define electron affinity.
 (ii) Explain why the first ionization energy of sodium is lower than that of magnesium but the second ionization energy of magnesium is much lower than that of sodium.
 (iii) State two properties of transition metals which zinc does not exhibit.

- (a) - The sample to be analyzed is vapourised.
 - Positive ions are produced by bombardment with high velocity electrons and accelerated by an electric field.
 - Positive ions passed through magnetic field and are deflected according to m/e ratio onto a detector. Relative intensities or peak heights are measured and the relative atomic mass computed.

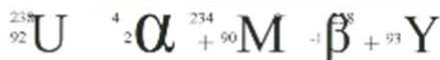
- (b) (i) (α) Cr - $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^1$
 (β) Cr^{3+} - $1s^2 2s^2 2p^6 3s^2 3p^6 3d^3$
 (γ) Cr^{6+} - $1s^2 2s^2 2p^6 3s^2 3p^6$

- (ii) Cr would have the highest magnetic moment because it has the highest number of unpaired electrons.

- (c) (i) Radioactivity is the spontaneous disintegration of the nucleus of a nuclide with the emission of radiation.

- (ii) - Neutron/proton ratio
 - total (neutron + proton)/nucleon number
 - binding energy per nucleon.

(iii)



- (d) (i) Electron Affinity is the energy released when gaseous atom gains electron/the energy change that occurs when one mole of electron is accepted by one mole of atom in the gaseous state.
 (ii) Sodium and magnesium belong to same period. Nuclear charge increases across the period, hence magnesium with a higher nuclear charge has higher first ionization energy.

In the second ionization, Na^+ has an octet configuration/stable electron configuration while Mg^+ does not. Hence. It is easier to remove an electron from Mg^+ than Na^+ .

- (iii) - Variable oxidation state
 - Coloured compounds/ions
 - Catalytic abilities
 - Formation of complexes

- Paramagnetism

Majority of the candidates who answered this question scored high marks. Sections (a), (c), d(i) and d(iii) were well answered. However b(i) and d(ii) was poorly answered.

Most candidates could not relate the number of unpaired electron configurations to the species having the highest magnetic moment in b(ii).

In c(iii) most candidates identified γ as gamma rays.

Question 2

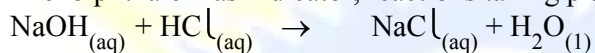
- (a) (i) What is a functional group?
(ii) Why are organic compounds classified on the basis of functional groups?
- (b) (i) Identify the functional group in each of the following compounds:
(α) $\text{CH}_3\text{CH}_2\text{COOH}$;
(β) CH_3CONH_2 ;
(γ) $\text{CH}_3\text{C}(\text{CH}_3)_2\text{OH}$.
- (ii) Give the major product(s) formed in each of the following reactions:
(α) ethene and acidified water at high temperatures;
(β) ethanol and iodine in the presence of $\text{NaOH}_{(\text{aq})}$ at high temperatures.
- (c) A solution containing a mixture of sodium hydroxide and sodium trioxocarbonate (IV) was titrated against hydrochloric acid.
(i) Name the indicator that should be used for the titration.
(ii) Explain briefly the reaction(s) occurring during the titration.
- (d) An organic compound Y contains carbon, hydrogen and oxygen only. On combustion, 0.463 g of Y gave 1.10 g CO_2 and 0.563 g of H_2O .
If the relative molecular mass of Y is 74, determine the;
(i) percentage composition of Y,
(ii) molecular formula of Y.
[H = 1.0, C = 12.0, O = 16.0]
- (a) (i) A functional group is an atom or a group of bonded atoms that are responsible for the chemical behaviour of an organic compound.
(ii) Classification allows for:
- easy identification
- study of the characteristic properties of the members of a particular group.
- (b) (i) (α) - COOH /alkanoic acid/carboxylic acid group
(β) - CONH_2 /amide group

- (ii) (γ) - OH/alkanol group
 (α) - CH₃CH₂OH/ethanol
 (β) - HCOONa/sodium methanoate CHI₃/triiodomethane
- (c) (i) Phenolphthalein and methyl orange
 (ii) Phenolphthalein is required to indicate the end point of the formation of NaHCO₃ which gives alkaline medium since phenolphthalein changes colour in the basic region.

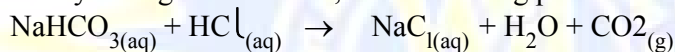
Methyl orange is needed to indicate the end-point of the overall reaction because the medium is acidic since methyl orange changes colour in the acidic region.

Alternative solution to c(i) and c(ii)

Phenolphthalein as indicator, reactions taking place are



Methyl orange as indicator, reaction taking place is



- (d) (i) Mass of Carbon = $\frac{12}{44} \times 1.1\text{g} = 0.3\text{g}$
 % Carbon = $\frac{0.3}{0.463} \times 100 = 64.79\%$
 Mass of Hydrogen = $\frac{2}{18} \times 0.563 = 0.0626\text{g}$
 % Hydrogen = $\frac{0.0626}{0.463} \times 100 = 13.52\%$
 % Oxygen = $100 - (64.79 + 13.54) = 21.69\%$

| | | | |
|------|--------------|--------------|---------------|
| (ii) | <u>C</u> | <u>H</u> | <u>O</u> |
| | <u>64.79</u> | <u>13.52</u> | <u>21.69</u> |
| | 12 | 1 | 16 |
| | <u>5.399</u> | <u>13.52</u> | <u>1.3556</u> |
| | 1.3556 | 1.3556 | 1.3556 |
| | 4 | 10 | 1 |

Empirical formula of compound is C₄H₁₀O

$$(\text{C}_4\text{H}_{10})_n = 74$$

$$48n + 10n + 16n = 74$$

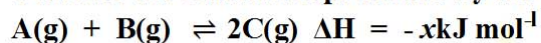
$$74n = 74 \quad n = 1$$

Molecular formula of compound = $C_4H_{10}O$.

Most of the candidates failed to attempt this question. Those who answered the question did it poorly and only a few scored high marks. Sections a(ii), b(ii) and c were poorly answered. Those attempted were unable to calculate the percentage compositions from the given masses of CO_2 and H_2O .

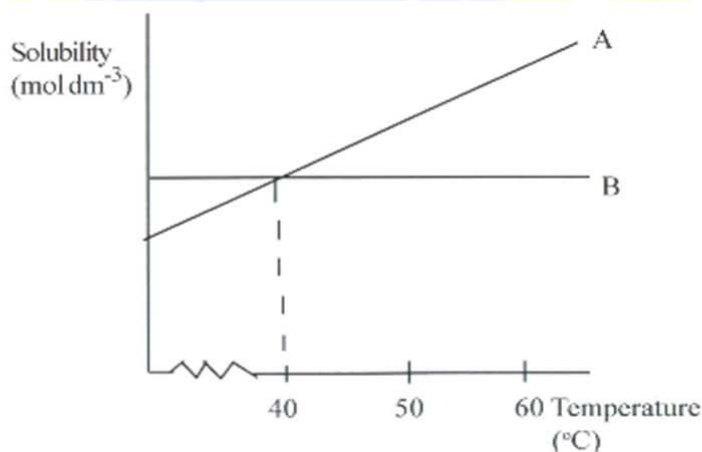
Question 3

(a) Consider the reaction represented by the following equation:



- (i) What type of reaction is represented by the equation?
- (ii) What is meant by $\Delta H = -xkJ \text{ mol}^{-1}$?
- (iii) What would be the effect of:
 - (a) an increase in pressure on the system;
 - (b) the addition of a reagent that would react with C?

(b) The diagram below represents the solubility curves for compounds A, B, and C.



- (i) Which compound,
 - (a) is most soluble at 50°C ;
 - (b) has its solubility least affected by temperature?
- (ii) Name the process by which a mixture of A and B could be separated.

- (c) Give three differences between the solubilities of solids in liquids and gases in liquids.
- (d) A piece of metal X was put in a trough containing water. The metal floated on the water and melted into a silvery ball which darted about on the surface on the water, giving off a gas Y. The resulting solution in the trough felt soapy to touch.
- Identify X and Y.
 - What will be the effect of the resulting solution on litmus paper?
 - Suggest a name for the resulting solution.
- (e) During the purification of a sample of gold, a solution containing gold ions was electrolysed using gold electrodes. A current of 0.20 A was passed for 60 minutes and at the end of the experiment the cathode gained a mass of 0.492g.

Calculate the,

- quantity of electricity passed;
 - mass of gold deposited by 1 faraday of electricity;
 - number of faradays required to deposit 1.0 mole of gold.
 - From the experiment in (e) above, deduce the charge on the gold ion.
[Au = 197, 1 Faraday = 96500 C mol⁻¹]
- (a)
- Equilibrium/Combination/Exothermic/Reversible reaction.
 - The term $\Delta H = -x\text{kJ mol}^{-1}$ means x kilojoules of heat per mole is given off to the surroundings during the reaction.
 - Increase in pressure would shift equilibrium position to the forward direction/product side hence more of C will be formed.
 - The product C will be removed from the mixture. Therefore, equilibrium will shift to the right side making more of A and B to react/more of C is formed.
- (b)
- A
 - B
 - Fractional crystallization.
- (c)
- The solubilities of gases in liquids decrease with increasing temperature while those of most solids increase with increasing temperature.
 - The solubilities of gases in liquid in liquid increase with increasing pressure while those of solids are not affected by pressure.
- (d)
- X is Sodium (Na)/Potassium (K)
Y is Hydrogen (H₂)
 - It will turn red litmus paper blue.
 - Sodium hydroxide/Potassium hydroxide.
- (e)
- Quantity of electricity passed , $Q = It$
 $Q = 0.20 \times 60 \times 60$
 $= 720\text{C}.$
 - 720 coulombs will deposit = 0.492g of gold
96500C will deposit = $\frac{96500 \times 0.492}{720}$

$$= 65.94 \text{ g of gold}$$

$$\begin{aligned} \text{(iii) } 65.94 \text{ g of gold was deposited by } 1F \\ 197 \text{ g of gold (1 mole)} &= \frac{1}{197} \times 197F \\ &= \frac{65.94}{197} \times 197F \\ &= 2.98 \text{ Faraday.} \\ &\approx 3.0 \text{ Faraday.} \end{aligned}$$

- (iv) The number of Faraday required to deposit one mole of an element during electrolysis is equivalent to the charge on the element.

Since gold requires 3 Faradays, it follows that the charge on gold is +3.

Majority of the candidates answered this question but failed to answer a(ii), c, e(ii), (iii) and (iv). Those who attempted this question did it poorly and very low marks were scored.

Most candidates could not give the correct answer to the meaning of $\Delta H = -x \text{ kJ mol}^{-1}$. They showed poor understanding of the concept of solubility.

Question 4

- (a) (i) What is standard enthalpy of formation?
- (ii) Write a chemical equation for the standard enthalpy of formation of methane.
- (iii) Use the following data to calculate a value for the enthalpy of formation of methane:
- $$\begin{aligned} \text{C}_{(s)} + \text{O}_{2(g)} &\rightarrow \text{CO}_{2(g)}, \\ \Delta H &= -394 \text{ kJ mol}^{-1}; \\ \text{H}_{2(g)} + \frac{1}{2}\text{O}_{2(g)} &\rightarrow \text{H}_2\text{O}_{(g)}, \\ \Delta H &= -242 \text{ kJ mol}^{-1}; \\ \text{CH}_{4(g)} + 2\text{O}_{2(g)} &\rightarrow \text{CO}_{2(g)} + 2\text{H}_2\text{O}_{(g)}, \\ \Delta H &= -802 \text{ kJ mol}^{-1}. \end{aligned}$$

- (b) Consider the following table:

| <i>Liquid</i> | H_2O | CHCl_3 | Ar |
|---------------------------|----------------------|-----------------|------|
| <i>Boiling point (°C)</i> | 100 | 62 | -186 |

Suggest reasons for the differences in boiling points of water, trichloromethane and argon.

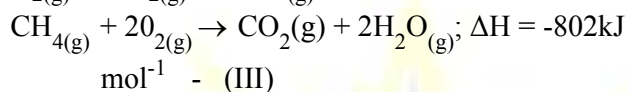
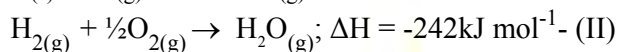
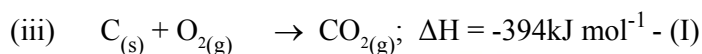
- (c) (i) What is meant by allotropy?
- (ii) Name two substances that exhibit allotropy.

(iii) Give three differences between the two crystalline allotropes of sulphur.

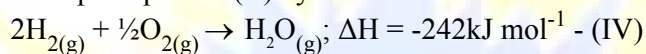
(d) State the law of conservation of matter.

(a) (i) The Standard Enthalpy of formation is the enthalpy change that takes place when

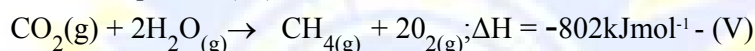
one mole of a compound in its standard state is formed from its constituent elements in their standard states.



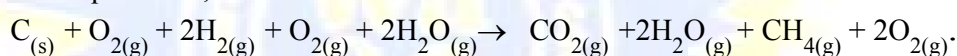
Multiple equation (II) by 2



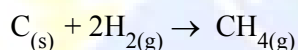
Reverse equation (III)



Add equations I, IV and V



$$\Delta H = [(-394 + -484) + 802] kJ \\ = - 76kJ$$



(b) The differences in the boiling points are due to strength of the intermolecular forces in each of the liquids.

In water, it is hydrogen bond and in $CHCl_3$, it is dipole-dipole.

In Ar it is induced -dipole induced-dipole/vander Waal's forces.

Hydrogen bond > dipole-dipole interaction > Van der Waal's forces.

(c) (i) Allotropy is the existence of two or more forms of element in the same physical state.

(ii) Carbon, Sulphur, Tin, Oxygen, Phosphorus, etc.

(iii) Rhombic Sulphur Monoclinic Sulphur

- | | |
|---------------------------|-------------------------------|
| - It is bright yellow | - It is amber |
| - It is stable below 96°C | - Stable between 96°C - 119°C |
| - It is octahedral | - Has needle-shaped |
| - Has density of 2.08 | - Has density of 1.98 |
| - Melting point of 113°C | - Has melting point of 119°C. |

(d) The law states that for a system undergoing chemical change, the total mass of the substances involved remain constant.

Majority of the candidates answered this question and scored high marks.

Question 5

- (a) (i) **Name one metal that is extracted by:**
(α) **electrolysis;**
(β) **reduction with carbon.**
- (ii) **State one use of each of the metal you have named in (a) (i) above.**
- (iii) **Name one ore of each of the metals in (a) (i).**
- (b) **Outline the method of extracting aluminium from its ore.**
- (c) (i) **Explain why a piece of zinc attached to a piece of iron protects the iron from rusting.**
- (ii) **Give one reason why the lead-acid battery is preferred to the Leclanché dry cell.**
- (d) (i) **Mention the states of matter.**
- (ii) **Arrange the states of matter in decreasing order of**
(α) **kinetic energy of particles;**
(β) **disorderliness between particles;**
(γ) **forces of cohesion between particles.**
- (iii) **A pure sample of a substance melts at 35°C and boils at 100°C. Sketch a graph to show the heating curve.**
- (a) (i) (α) Aluminium/Sodium/Calcium/Potassium/Magnesium (β)Iron/tin/zinc
(ii) Aluminium - for roofing sheets/cooking utensils/high tension cables/louvre frame/paints etc.

Sodium - for manufacturing of $\text{Na}_2\text{O}_2/\text{NaNH}_2/\text{NaCN}$ /in sodium vapour lamps/coolant in nuclear reactors/as sodium amalgam/as reducing agent in organic reactions.

Calcium - in extraction of uranium/as deoxidant in steel castings/manufacture of $\text{CaF}_2/\text{CaH}_2$ /used as dehydrating agent in preparation of pure ethanol etc.

Magnesium - in alloys (e.g. duralumin, magnalium) in photorographic flash light/fireworks/as deoxidant in metallurgy/in extraction of Uranium and titanium, etc.

Iron - for nails/iron rods/iron doors/roofing sheets/bridges/ railways, etc.

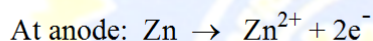
Tin - Coating iron to prevent corrosion/making sheet glass/making alloys (bronze, solder)

Zinc - galvanizing iron to protect corrosion/making dry cells/foil for packaging/lithographic plates/roofing sheets/manufacture of medicinal ointment/making alloys (e.g. brass).

| | | | |
|-------|-----------|---|-------------------------------------|
| (iii) | Aluminium | - | bauxite/kaolin |
| | Sodium | - | common salt |
| | Calcium | - | limestone/gypsum |
| | Magnesium | - | dolomite |
| | Potassium | - | saltpetre |
| | Iron | - | Haematite/magnetite/siderite/pyrite |
| | Tin | - | cassiterite |
| | Zinc | - | calamine/zinc blend. |

(b) Extraction of Aluminium Powdered ore dissolved under pressure in hot concentrated NaOH to form aluminate. The aluminate is sieved/filtered to remove impurities and then seeded to precipitate aluminium hydroxide. The aluminium hydroxide is filtered, washed, dried and heated to give pure alumina. The alumina is mixed with molten cryolite and electrolyzed to obtain aluminium.

(c) (i) Zinc attached to iron becomes the negative electrode and thus more readily oxidized than iron.



while iron becomes the positive electrode and is preserved.

(ii) The Lead acid battery is rechargeable whereas the dry cell is not rechargeable.

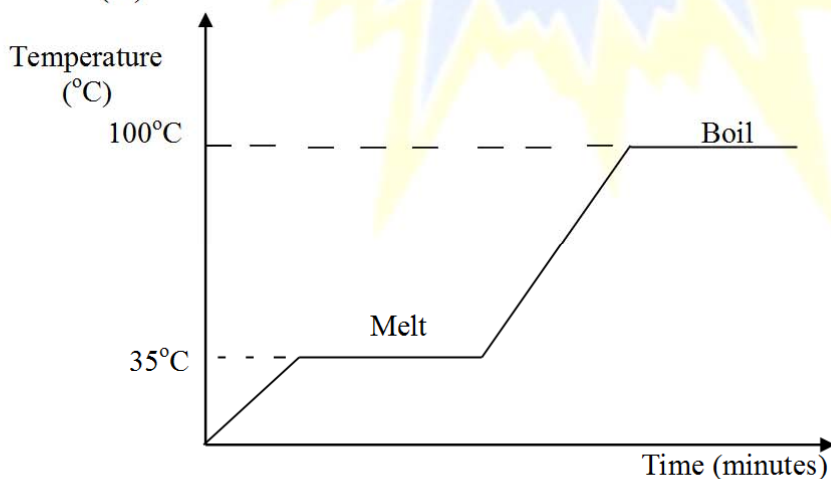
(d) (i) Solid, Liquid, Gas.

(ii) (α) Gas > Liquid > Solid

(β) Gas > Liquid > Solid

(γ) Solid > Liquid > Gas

(iii)



The candidates that attempted this question were few. They were able to answer sections a, b, c(ii) and d(i) well, scoring high mark in them. However, only very few candidates could explain why zinc attached to iron protects it. The plot of heating curve could not be plotted by the candidates.

Question 6

- (a) State Hess's law of constant heat summation.
- (b) The following table shows the results obtained for the reaction:
 $A + B \rightarrow E + D$

| Experiment | Initial conc. of A (mol dm ⁻³) | Initial conc. of B (mol dm ⁻³) | Initial rate (mol dm ⁻³ s ⁻¹) |
|------------|--|--|--|
| 1 | 0.01 | 0.02 | 0.0005 |
| 2 | 0.02 | 0.02 | 0.0010 |
| 3 | 0.01 | 0.04 | 0.0020 |

- B.
- (i) Study the table and determine the order of reaction with respect to A and B.
- (ii) State the overall order of the reaction.
- (iii) Calculate the rate constant using results of the experiment.
- (iv) Write the rate equation using results of the experiment.
- (v) Calculate the rate of the reaction if $[A] = [B] = 0.03 \text{ mol dm}^{-3}$.
- (c) $\text{CuCl}_2(\text{aq})$ reacted with $\text{NaOH}(\text{aq})$ to form a precipitate.
- (i) Write a balanced equation for the reaction.
- (ii) Calculate the mass of CuCl_2 that would react with 0.80 moles of NaOH .
[Cu = 64.0, Cl = 35.5, Na = 23.0, O = 16.0, H = 1.0]
- (d) (i) State the source of each of the following atmospheric air pollutants:
(α) SO_2 ;
(β) CH_4 ;
(γ) CO .
- (ii) What is the effect of each pollutant in (d) (i) above on the environment?
- (a) Hess's Law of constant heat summation states that the total enthalpy change of a chemical reaction is constant regardless of route by which the chemical change occurs provided the final and initial conditions are the same.
- (b) (i) $R = K[A]^a [B]^b$
From the experimental data,
$$\frac{R_2}{R_1} = \frac{0.0010}{0.0005} = \frac{0.02^a}{[0.01]^a}$$
$$2 = 2^a$$

Order with respect to A = 1

$$\frac{R_3}{R_1} = \frac{0.0010}{0.0005} = \frac{0.04^b}{0.02}$$

$$4 = 2^b \text{ i.e. } 2^2 = 2^b$$

Order with respect to B = 2.

Alternative

From experiments (1) and (2), [B] is constant. As [A] doubles, initial rate also doubles. Order with respect to A is 1.

From experiment (1) and (3), [A] is constant. As [B] doubles, initial rate quadruples. Order with respect to [B] is 2.

(ii) Overall order of reaction = 1 + 3 = 3

(iii) From experiment 3

$$R = K[A][B]^2$$
$$K = \frac{R}{[A][B]^2} = \frac{0.0020}{(0.01)(0.04)^2}$$
$$= 125 \text{ mol}^{-2} \text{ dm}^6 \text{ s}^{-1}$$

(iv) $R = 125 [A][B]^2$

(v) $R = 125 [A][B]^2$
 $125 \times 0.03 \times (0.03)^2$
 $= 0.0034 \text{ mol dm}^{-3} \text{ s}^{-1}$



(ii) From the equation of reaction;

1 mole CuCl_2 reacted with 2 moles NaOH

$$0.80 \text{ mole NaOH} = \frac{0.80}{2} \times 1 \text{ mole CuCl}_2$$

$$= 0.40 \text{ mole CuCl}_2$$

$$\text{Molar Mass of CuCl}_2 = 64 + 35.5 \times 2$$

$$= 135 \text{ gmol}^{-1}$$

$$\text{Mass of CuCl}_2 = 0.40 \times 135$$

$$= 54 \text{ g}$$

(d) (i) (α) SO_2 - from power station/fossil/motor vehicles etc.

(β) CH_4 - from the decomposition of sewage/vegetation etc.

(γ) CO - incomplete combustion in car/other engines etc.

Effects

(ii) (α) SO_2 - acid rain etc.

(β) CH_4 - green house effect/global warming

(γ) CO - poisonous when inhaled.

Almost all the candidates answered this question and had high scores. The only problem was their inability to give the effects of SO₂, CH₄ and CO on the environment.



CROP HUSBANDRY AND HORTICULTURE 1 **PRACTICAL**

1. GENERAL COMMENTS

The Crop Husbandry and Horticulture I was a standard paper. All the questions set were based on the examination syllabus.

The standard of the paper was not different from that of the previous year.

Candidates performed better this year.

2. A SUMMARY OF CANDIDATES' STRENGTHS

The major strengths of the candidates was as follows:

- (i) Most of them gave straight-forward answers to the questions directly without engaging in lengthy sentences;

- (ii) Most of the candidates attempted all the questions;
- (iii) The handwritings were clear enough which made the marking go on smoothly.

3 A SUMMARY OF CANDIDATES' WEAKNESSES

The main weakness of the candidates were as follows:

- (i) Candidates failure to critically observe the external features of specimens and using them to answer the questions;
- (ii) The non-adherence of the candidates to the basic rules of biological drawing.

4. SUGGESTED REMEDIES

- (i) Candidates should be taught to take their time to read and understand the questions before attempting to answer.
- (ii) The candidates should be taught that drawings in Crop Husbandry and Horticulture are similar to what is expected of students in biological drawings.

5. DETAILED COMMENTS

SPECIMEN LIST

- A. Agushie (melon) seeds**
- B. Tomato seeds (dried)**
- C. Okro fruit (fresh)**
- D. Cowpea seeds**
- E. Sorghum seeds**
- F. Carpet grass**
- G. Branch of croton**
- H. Trowel**

Question 1

- (a) Identify each of specimens A and B.**
- (b) Give three characteristics of each of specimens A and B.**
- (c) Give two uses of specimen A.**
- (d) State three methods for sorting specimen B to keep it viable.**
- (e) State two factors that could make specimen B lose its viability.**

The candidates answered this question fairly well except that they failed to bring out the external characteristics of the specimens which the question required them to do, and as a result most of the marks were lost by the students.

Question 2

- (a) (i) **Identify specimen C.**
(ii) **Give the botanical name and family name of the plant from which specimen C was obtained.**
- (b) (i) **List three pests of the plant from which specimen C was obtained.**
(ii) **Name two diseases of the plant from which specimen C was obtained.**
- (c) **Draw and label the longitudinal section of specimen C.**

The second part of the question was poorly answered by majority of the candidates. Most of the candidates chose to present an artistic impression of the specimen instead of presenting a biological drawing of the specimen. The rules of biological drawing were not observed by the candidates and as a result most of them lost marks.

Labelling of the parts of specimen C was poorly done and in most cases the drawing of the specimen did not look like a longitudinal section of an okro fruit. Wrong spellings of the labelling was also a major problem of the candidates.

Question 3

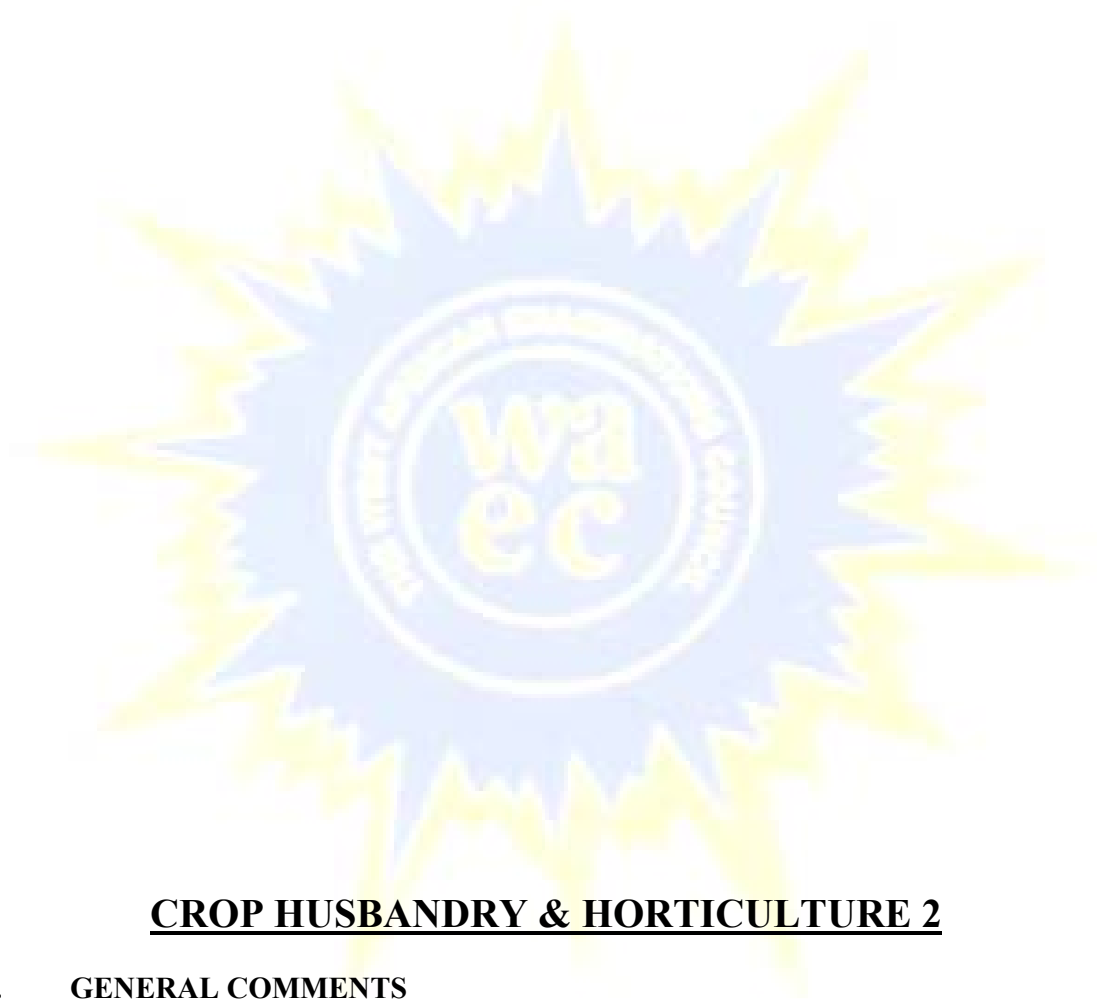
- (a) **Give three observable differences between specimen D and E.**
- (b) **Mention four industrial uses of specimen E.**
- (c) **State the planting depth and the number of seeds per hole for the cultivation of each of specimens D and E.**
- (d) **Mention one way of avoiding loss of specimen D on the field.**

This question was fairly well answered except that the question on the comparison was not well handled by the candidates. They should have compared by matching the characteristics e.g shape of the specimen D and E. They should also have compared features that they observed on the specimen.

Question 4

- (a) **Identify each of specimens F and G by the common name and botanical name.**
- (b) **Explain three ways of using specimen H in the cultivation of specimen G.**
- (c) **Give two reasons why specimen G is used in landscaping.**
- (d) **Mention one way of preventing the common diseases that affect specimen F during its cultivation.**

This question was on landscaping and it was well answered. The candidates scored their highest marks on this question and is very commendable. However, there were problems with the spelling of the botanical name of carpet grass and croton. On the whole, this was the question most of the candidates handled very well.



CROP HUSBANDRY & HORTICULTURE 2

1. GENERAL COMMENTS

The standard of the paper was comparable to those of previous years. The performance of candidates was below that of last year.

2. A SUMMARY OF CANDIDATES' STRENGTHS

- (1) The standard of English used in answering the questions was average although a few candidates were exceptionally good as they could expressed themselves well.
- (2) Adherence to the rubrics of the paper.

3. A SUMMARY OF CANDIDATES' WEAKNESSES

- (1) Candidates handwriting was poor;
- (2) Proper expression by candidates.

4. SUGGESTED REMEDIES

- (1) They should as much as possible try to read over their answers just to make sure that they themselves understand what they have written.
- (2) Schools should take the trouble or improve upon candidates whose handwriting is very poor.

5. DETAILED COMMENTS

Question 1

- (a) **What are edaphic factors?**
- (b) **Explain the effects of each of the following factors on crop production:**
 - (i) **wind;**
 - (ii) **high temperature;**
 - (iii) **edaphic factors;**
 - (iv) **biotic factors.**
- (c) **Give two examples of aromatic crops.**

Candidates could not specifically indicate the effects of soil temperature, soil pH, soil texture and structure and soil organisms on crop growth. For example, soil texture affects drainage while soil pH will affect nutrient availability. Therefore, for mentioning these factors, candidates should have gone ahead to explain how the factors affect crop growth. Biotic factors involve both micro and macro soil organisms. For example, some soil microbes cause diseases but others decompose organic materials and therefore add nutrients to the soil. Candidates could not differentiate aromatic crops from spices, garnishing, medicinal, herbs etc and therefore most candidates had the examples wrong.

Question 2

- (a)
 - (i) **What is a ridge?**
 - (ii) **Name two tools that could be used when making a ridge.**
- (b) **Explain two conditions under which it would be advisable to grow crops on ridges.**
- (c) **Discuss the importance of each of the following practices in crop production:**
 - (i) **planting at stake;**
 - (ii) **lining and pegging in tree crop production;**
 - (iii) **parboiling of paddy rice.**

It involved definition of a ridge and the tools used in making ridges. Tools are different from machines and equipment. Conditions under which ridges are made was also poorly answered.

A few candidates answered this question correctly by indicating that waterlogged or poorly drained soils require ridging. Plant parts that need loose soils such as roots, tubers and bulbs also require ridging. Some candidates could not differentiate planting at stake from staking of crops. These candidates were fundamentally wrong with their answers. Planting at stake has advantages and disadvantages and candidates were required to indicate some of these.

Lining and pegging also has advantages such as being simpler and cheaper. It is however labour intensive. Some of these answers were required.

The practice of parboiling of paddy rice should be known by all and again parboiling had advantages and disadvantages. For example parboiling reduces breakages of grains and gives high milling percentage but requires skilled labour and therefore increases cost of processing.

Question 3

- (a) Name three varieties of cassava that are cultivated in Ghana.**
- (b) Mention two products that could be manufactured from cassava starch.**
- (c) Discuss five problems associated with cassava production in Ghana.**

Varieties of cassava planted in Ghana are many and candidates were able to give appropriate answers. About 50% of candidates were able to give examples of products manufactured from cassava starch. Problems associated with cassava production were availability of planting materials, inadequate supply of superior varieties, problems with pests and diseases, marketing because of low prices, transportation especially poor road network.

Question 4

- (a) Discuss the cultivation of sweet orange under each of the following headings:**
 - (i) climatic requirements;**
 - (ii) land preparation;**
 - (iii) harvesting.**
- (b) Give four reasons why budding is done in citrus production.**

Candidates were required to discuss under climatic requirements, land preparation and harvesting in sweet orange cultivation. Under climatic requirements, rainfall and temperature ranges were required as well as climatic condition for ripening. Land preparation is a practical question which should not have posed problem for the candidates.

Harvesting of fruits was a simple question as sweet orange is normally harvested when ripe by. Reasons for budding is a propagation question and candidates had enough answers to choose from.

Question 5

- (a) What is a vegetable?**
- (b) Give two examples of each of the following types of vegetables:**
 - (i) fruit vegetables;**

- (ii) **floral vegetables;**
- (iii) **vegetables with fleshy storage structures.**
- (c) **Discuss four qualities of a vegetable that could make it marketable.**
- (d) **Mention three pests of cabbage.**

Most candidates answered this question. Most candidates defined vegetable correctly and were able to give correct answers to the examples of fruit vegetable and those with fleshy storage structures.

The difficulty was with examples of floral vegetables as was that they not common in Ghana. The cleanliness, freshness, colour, shape, size etc of the vegetable itself after harvesting were what was required for (c).

Question 6

- (a) **State two morphological features of the rose plant.**
- (b) **Name two diseases of lawn grasses.**
- (c) **Explain three ways of purifying seeds of ornamental plants collected for propagation.**
- (d) **Explain three ways in which ornamental plants perform each of the following functions:**
 - (i) **protection of property;**
 - (ii) **beautification of the environment.**

Probably, the word morphological was the problem, that is, how rose plant looks like outwardly. Diseases of lawn grasses were answered correctly but most candidates spelt 'spot' wrongly as 'sport' which means something different. There was a propagation question on purification of seeds.

The purification processes of seeds the same, that is, winnowing, handpicking sieving or pouring seeds in water to remove/separate chaff from the seeds.

Ornamental plants functions in the area of protection of property is by planting plants as windbreaks to slow down the speed of wind thereby minimizing damage to property. Again, plants check erosion by reducing the speed of run offs or by breaking the impact of raindrops on the soil. Ornamental plants also serve as fences to provide physical barrier for security. They also screen off property so that they are not exposed to outsiders and they provide shade from the sun.

On beautification of the environment, ornamental plants provide colourful flowers and foliage and also the arrangement of branches. Well maintained hedges and lawns provide beauty in the environment.



FISHERIES 1 **PRACTICAL**

1. GENERAL COMMENTS

The standard of the paper was at par with that of the previous years. Candidates performed better this year.

2. A SUMMARY OF CANDIDATES' STRENGTHS

There was an attempt by candidates to be sequential in the presentation of answers.

3. A SUMMARY OF CANDIDATES' WEAKNESSES

Candidates showed a weakness in the answering of the graphical question.

4. SUGGESTED REMEDIES FOR THE WEAKNESSES

- (1) Special attention must be paid by teachers to the answering of graphical questions, particularly the labelling of axes and the use of ruled lines to join the points.

5. DETAILED COMMENTS

SPECIMEN LIST

- A - Cast net
- B - Spear
- C - Hook
- D - Tilapia/fresh tilapia
- E - Crab
- F - Roe/mass of fish eggs

Question 1

A study was conducted on the environmental factors of a lagoon. The amounts of rainfall and the salinity of the lagoon water were measured over a period of six months. The data obtained are presented in the table below.

| Months | Amount of rainfall l(x 10 mm) | Salinity (part per thousand/ppt) |
|--------|-----------------------------------|-------------------------------------|
| 1 | 39 | 2 |
| 2 | 28 | 3 |
| 3 | 10 | 12 |
| 4 | 1 | 20 |
| 5 | 1 | 28 |
| 6 | 3 | 30 |

- (a) Present the data in a suitable graphical form on the same axes.**
- (b) Explain the results obtained from the study.**
- (c) How do fishes react to changes in the salinity of lagoon?**

(a) The graph was generally poorly done. Almost all candidates did not put a heading on their graphs.

The axes of the graphs were mostly correct, but the labels were wrongly done.

Candidates were expected to label the x-axis as: “time (months); and the vertical axes to be labelled as: amount of rainfall (x 10 m) and salinity (ppt)”.

When there are two graphs on the same graph sheet, there should be a differentiation of the graphs with different symbols and a key provided on the graph sheet. But most of candidates used the same symbols for both graphs and instead put labels on the graph sheets.

Almost all candidates used freehand to draw their graphs instead of joining the points with straight lines.

- (b) In the explanation, the candidates did not relate the rainfall to salinity as was required. Further, they failed to show the effect of rainfall on changes in salinity of the lagoon water.
- (c) Candidates failed to show how fishes react to changes in the salinity of lagoon water as far as physiology was concerned. They only stated that fishes gained or lost water by osmosis.

Question 2

- (a) Identify specimens A, B and C.**
- (b) Make a sketch of specimen A and label its parts.**
- (c) Name two materials each that could be used to construct specimens B and C.**
- (d) Describe how each of specimens A, B and C could be used to capture fish.**
- (e) Mention two limitations of using specimen B to capture fish.**

(a) The specimens provided were very well identified.

(b) The specimen (a cast net) was reasonably well sketched and labelled.

(c) The materials that could be used to construct a spear and a hook were satisfactorily named except that wood as an alternative material for the spear escaped the candidates.

(d) The description of the use of the spear was not accurate enough. Most stated that the spear was thrown to hit the fish.

For the cast net, most failed to state how it is cast to open before falling into the water.

Some of the descriptions were not sequential.

- (e) The limitations of using the spear to capture fish were not adequately stated. Most merely stated that it could not be used to catch many fish.

Question 3

- (a) **Identify specimens D, E and F.**
- (b) **Classify specimen D to the subclass level.**
- (c) **Describe how two features each of specimens D and E help them to adapt to their environment.**
- (d) **Outline one activity which could be carried out to extend the shelf life of specimen D.**
- (e) **Give the sequence of development of specimen F.**
- (a) The specimen were correctly, identified, except that the roe was sometimes identified as eggs instead of fish eggs.
- (b) Most candidates did not correctly classify under the taxons of phylum, class, subclass, but went straight to indicate that it belongs to a particular sub-class.
- (c) Most candidates only mentioned the feature, but failed to show the adaptation.
- (d) Most candidates only mentioned the activity which could be carried out to extend the self life of the specimen (Tilapia) without outlining how it is done.
- (e) The sequence of development of roe was well done, but some candidates even went on to describe the embryological sequence.

FISHERIES 2

1 GENERAL COMMENTS

The standard of the paper was at par with that of previous years. The performance of candidates was better than that years.

2 A SUMMARY OF CANDIDATES' STRENGTHS

- (1) The presentation of answers was good.
Candidates made effort to start each question on a separate sheet of paper;
- (2) Most candidates provided their answers in tabular form where instructed.

3 A SUMMARY OF CANDIDATES' WEAKNESSES

- (1) Candidates did not pay attention to details of the questions;
- (2) Many questions were answered in the context of aquaculture, even where the question was with a capture fisheries background.

4 SUGGESTED REMEDIES FOR THE WEAKNESSES

- (1) Candidates must read the questions well;
- (2) Candidates must pay attention to details of the questions.

5. DETAILED COMMENTS

Question 1

- (a) (i) **List four non-living factors that could adversely affect the growth of fish in ponds.**
- (ii) **Discuss two ways of minimizing the effects of each of the factors you have listed in (i) above.**

(b) **Describe four ways of improving sanitation at fish landing sites.**

- (a) Candidates ignored the details of the question. They were required to list NON-LIVING factors which ADVERSELY affect fish growth. Most candidates listed only factors. The requirement of adverse effects on growth of fish was ignored. They only mentioned ways of minimizing the effects.

Many candidates even ignored discussion on minimizing the effects, and only mentioned the effects of the factors.

Regarding (b), most candidates described sanitation around fish ponds, not fish landing sites.

Question 2

- (a) **State five characteristics of a good brood fish.**
- (b) **With the aid of a suitable diagram, describe a hook and line fishing gear.**
- (c) **Describe five ways in which the gill of a fish is adapted to its function.**

- (a) Most candidates wrote on the characteristics of fish suitable for culture, instead of a good BROOD fish.

- (b) The illustration of a hook and line fishing gear was satisfactory. However, in the description, most candidates described how it is used to fish.

- (c) Most candidates only mentioned the basic function of gills of a fish without describing how it is adapted to its functions.

Question 3

- (a) State five conditions that predisposes a fish to diseases.**
- (b) Outline four maintenance practices carried out on fishing gear.**
- (c) List five investment opportunities in the fishery industry.**
- (d) Discuss three factors which account for the importation of fish in Ghana.**

- (a) Most candidates were unable to state clearly the conditions which predispose fish to diseases. They dwelt mainly on feeding, and disposal of rubbish in the ponds.
- (b) Most candidates concentrated on fishing gear used in harvesting fish ponds. Some even mentioned the maintenance of fishing vessels.
- (c) This part of the question was confused with job opportunities in the fisheries sector.
- (d) Most candidates wrongly wrote about the benefits of fish importation.

Question 4

- (a) State one use of each of the following items in the fishery industry in Ghana.**
 - (i) basket;**
 - (ii) fertilizer;**
 - (iii) plastic bag;**
 - (iv) firewood.**
- (b) Tabulate three differences between fresh fish and spoiled fish.**
- (c) Describe the reproductive stages of a named fish.**

- (a)
 - (i) Most candidates mentioned baskets only as fishing gears.
 - (ii) Many indicated that fertilizers are used to fertilize ponds some even stated that they are used to fertilize the soil.
 - (iii) On the average this part was correctly answered, except that a number of candidates only said the plastic bag is used to transport fish instead of specifying fingerlings.
 - (iv) Most candidates correctly stated the use of firewood as being used for smoking or preservation.
- (b) In giving differences between fresh fish and spoiled fish, most tabulated as required, but a few did not. However, the differences did not match in the table.
- (c) Most candidates described the life cycle of a fish from eggs to larvae to fry to adult instead of the required courtship behaviour, spawning, fertilization etc.

Question 5

- (a) Explain the significance of each of the following practices in fishpond management:**
 - (i) supplementary feeding;**
 - (ii) fencing;**

- (iii) **sampling;**
- (iv) **weed control.**

(b) Describe six ways in which fishes adapt to aquatic environments.

- (a) (i) This was superficially answered. Most candidates only stated that it is the additional feed given to fish in a pond.
- (ii) Most candidates stated the use of fencing as preventing entry of predators, but very few realized the other use of preventing thieves.
- (iii) The practice of weed control was poorly explained.

Most candidates only described the clearing of weeds and stated that it prevents competition with fish for oxygen.

- (iv) Most candidates wrongly stated the use of sampling as grading fish into different sizes.
- (b) Quite a significant number of candidates only mentioned the adaptive features of fishes, but failed to add the adaptation. Otherwise, the sub-question was well answered.

Question 6

- (a) (i) **List three diseases of tropical freshwater fishes.**
- (ii) **Name the causative organisms of each of the diseases you have listed in (a)**
- (i) **above.**
- (iii) **Describe the symptoms of each of the diseases listed in (i).**

(b) Mention five life processes in fish.

(c) Discuss three traditional ways of controlling fishing in Ghanaian waters.

- (a) Many candidates listed fish diseases not covered or prescribed in the teaching or the examination syllabus.
- (b) Most candidates correctly answered this question.
- (c) Some candidates did not confine themselves to the traditional ways of controlling fishing in Ghanaian waters, but included ways such as mesh regulations, catch quotas, etc which are not traditional ways.

FORESTRY 1
(PRACTICAL)

1. GENERAL COMMENTS

The standard of the paper was comparable to those of previous years.
'Candidates performed better than the previous years.

2. A SUMMARY OF CANDIDATES' STRENGTHS

Excellence presentation of answers.
Good usage of technical terms.

3. A SUMMARY OF CANDIDATES' WEAKNESSES

- (1) Inadequate preparation by candidates.

4. SUGGESTED REMEDIES FOR THE WEAKNESSES

- (1) The candidates should pay serious attention to the practical teachings in the forestry.
- (2) Candidates should prepare well for examinations.

5. DETAILED COMMENTS

SPECIMEN LIST

A - Fruits of *piper, guineensis*

B - Fruit of *Capsicum frutescens*

C - Branch of whistling pine.

D - Branch of neem tree.

E - Fruit of mahogany

F - Plant of *Chromolaena odorata*.

Question 1

- (a) Identify each of specimens A and B.
- (b) State three ways in which specimens A is of economic importance.
- (c) Mention the method of propagation for each of specimens A and B.
- (d) State three external features of specimen A.
- (e) Give two reasons why specimen B is not commonly found nowadays.

- (a) Specimens A and B presented for identification were fruit of *Piper guinensis* and Fruit of *Capsicum frutescens* and almost all the candidates were able to identify them correctly.
- (b) The candidates were able to mention the economic importance of specimen A as food, medical, source of income and foreign exchange.
- (c) The method of propagation of each of specimens A and B were correctly given by many of candidates A - sexual/sexual/seed and B sexual (by birds).
- (d) The external features of specimen A was a difficult question to many candidates. The expected answers were as follows; brownish when ripe, pointed apex and lobbed fruit.
- (e) Reasons why specimen B is not commonly found nowadays was a favourable question to the candidates; rampant bush fires, climate change etc. are some of the answers.

Question 2

- (a) Identify each of the plants from which specimens C and D were obtained by the common name and scientific name.
- (b) Give four differences between specimens C and D.

- (c) **Describe how seeds of specimen D could be extracted for storage.**
- (a) The candidates were asked to identify specimens C and D by their common and scientific names. Majority of them were able to identify them correctly as C - branch of whistling pine, *Casuarina equisetifolia*, and D - branch of Neem, *Azadirachta indica*.
- (b) Many candidates were unable to tell the differences between specimens C and D. The correct answers are as follows:
specimen C has needle like leaves but specimen D has leaves with serrated margins. Specimen C has no well defined leaf stalk, but specimen D has well defined leaf stalk.

There is no arrangement of leaves in Specimen C, while there are definite arrangement of leaves in Specimen D. Specimen C has thorny fruits, but Specimen D has smooth fruit etc.

- (c) Description of extraction and storage of storage of specimen D was uneasy question to many candidates. The correct answers should be as follows; collect the ripe fruits, heap them. Allow fruits to ferment. Wash and take out the seeds from the fruit. Dry the seeds for two weeks. Store the seeds in cold dry place/containers.

Question 3

- (a) **Identify specimen E.**
- (b) (i) **Mention three tools that could be used in the preparation of a nursery bed for the propagation of specimen E.**
(ii) **State one use of each of the tools you have mentioned in (b)(i) during nursery bed preparation.**
- (c) **Mention four uses of the plant from which specimen E was obtained.**
- (d) (i) **Name two ecological zones in which the plant of specimen E could be found.**
(ii) **Name the average amount of rainfall that could be obtained annually in each of the zones you have mentioned in (d)(i) above.**
- (a) The question asked for the identification of the fruit of mahogany (E) and the candidates were able to do that.
- (b) (i) The question asked for the tools to raise the seedlings of specimen E in nursery, and the candidates were able to mention them correctly.
(ii) The question again asked for the uses of the tools named in 3(i), and the candidates were able to do so.
- (c) The question again demanded the uses of the tree of Specimen (E) and they were able to do that excellently.
- (d) (i) The candidates were asked to locate the ecological zones where specimen E could be found. The students could not tell the difference between the ecological zones and ecological types hence great confusion. The correct answers should be savanna zone, transitional zone/ecotone and forest zone.

- (ii) The candidates were unable to tell the average amount of rainfall of the ecological zones named in (3)(d)(i) as Savanna zone - 600-1, 200 mm; Transitional zone 18,00 mm per year and Forest zone 25,00 mm per year.

Question 4

- (a) **Identify specimen F**
- (b) **Give four reasons why specimen F should be controlled on a plantation.**
- (c) **Mention four methods of controlling specimen F**
- (d) **Give three characteristics of specimen F that help it to be invasive.**

- (a) The candidates were asked to identify specimen F as the plant of *Chromolana Odorata* and they were able to do that.
- (b) The candidates were able to give reasons why specimen F should be controlled in a plantation.
- (c) The methods of controlling specimen F were correctly mentioned.
- (d) The characteristics of specimen F were correctly given.

FORESTRY 2

1. GENERAL COMMENTS

The standard of the paper was equal to that of the previous years. There was great improvement in the performance of the candidates

2. A SUMMARY OF CANDIDATES' STRENGTHS

- (1) Many candidates were able to present answers straight to the point.
- (2) They were able to use the technical terms correctly.

- (3) Most of them were able to express themselves in the English Language.

3. A SUMMARY OF CANDIDATES' WEAKNESSES

- (1) Few candidates were not good at the English Language therefore they could not present their answers straight to the point.
- (2) Inadequate preparation by some candidates.

4. SUGGESTED REMEDIES

- (1) Candidates should enhance their control over the English Language;
- (2) Candidates should prepare well before the examinations.

5. DETAILED COMMENTS

Question 1

- (a) **What is deforestation?**
- (b) **Mention five causes of deforestation.**
- (c) **Explain five effects of deforestation.**
- (d) **Explain how education can be used to control deforestation.**

- (a) Majority of the candidates were able to answer the question excellently by stating deforestation is deliberate removal of natural forest by human action/the gradual loss of natural forest to less than 10% of forest.
- (b) Candidates performed well.
Cause of deforestation are intensive logging, bush fire, pollution etc.
- (c) Effects of deforestation are destruction of animal habitat, water pollution etc. These were provided by candidates.
- (d) Knowledge of usefulness of forest and forest, knowledge negative effects of deforestation and knowledge of laws as a result of education are some of the expected answers.

Question 2

- (a) **Explain each of the following terms as used in forestry;**
 - (i) **pollarding;**
 - (ii) **thinning;**
 - (iii) **underbrushing.**
- (b) **State two reasons for carrying out each of the following activities;**

- (i) **thinning;**
 - (ii) **underbrushing.**
- (c) **Name three trees found in the savanna zone.**
- (a) Candidates provided correct responses such as:
- (i) the cutting of shoots of trees at the sapling stage to allow profuse lateral branching.
 - (ii) the reduction of the numbers of trees growing in a space in which to develop.
 - (iii) the regular weeding of unwanted plants in a plantation so as to reduce competition from other plants.
- (b) Reasons for carrying out (i) thinning and (ii) under brushing were asked. Good answers were given.
- (c) This was a difficult question to many candidates. Shea tree, Acacia, Dawadawa, Anogeisus, Neem are some of the trees.

Question 3

- (a) **What is a forest reserve?**
 - (b) **Give three reasons for establishing a forest reserve.**
 - (c) **Explain five factors to be considered when proposing an area for a forest reserve.**
- (a) Many candidates were unable to tell what a forest reserve is as a tract of land covered with trees and undergrowth constituted and gazetted by forest ordinance/laws designated as production, protection or for research.
- (b) Many candidates were able to give reasons for establishing a forest resource such as supply wood, to protect the environment etc.
- (c) Factors to be considered when proposing an area for a forest reserve were well treated by many candidates these include name, topography, geology and soil, history, rights and privileges, fauna and flora composition and population pressure.

Question 4

- (a) **Name three bodies that own land in Ghana.**
 - (b) **State two effects of the land tenure system on land use.**
 - (c) **Describe the leasehold land tenure system.**
 - (d) **Explain three advantages and three disadvantages of the leasehold land tenure system.**
- (a) Many candidates were able to name those who own land in Ghana such as chiefs/stools/skin, individuals, government, families, communities.

- (b) The candidates were able to state the effects of land tenure such as fragmentation, litigation, high rent etc.
- (c) The leasehold land tenure system was fully explained by majority of the candidates as the land is held for a fixed period of time under agreed conditions which may include payment of cash, division of proceeds from the farm.
- (d) The advantages and disadvantages of tree leasehold system were correctly explained by many candidates.

Question 5

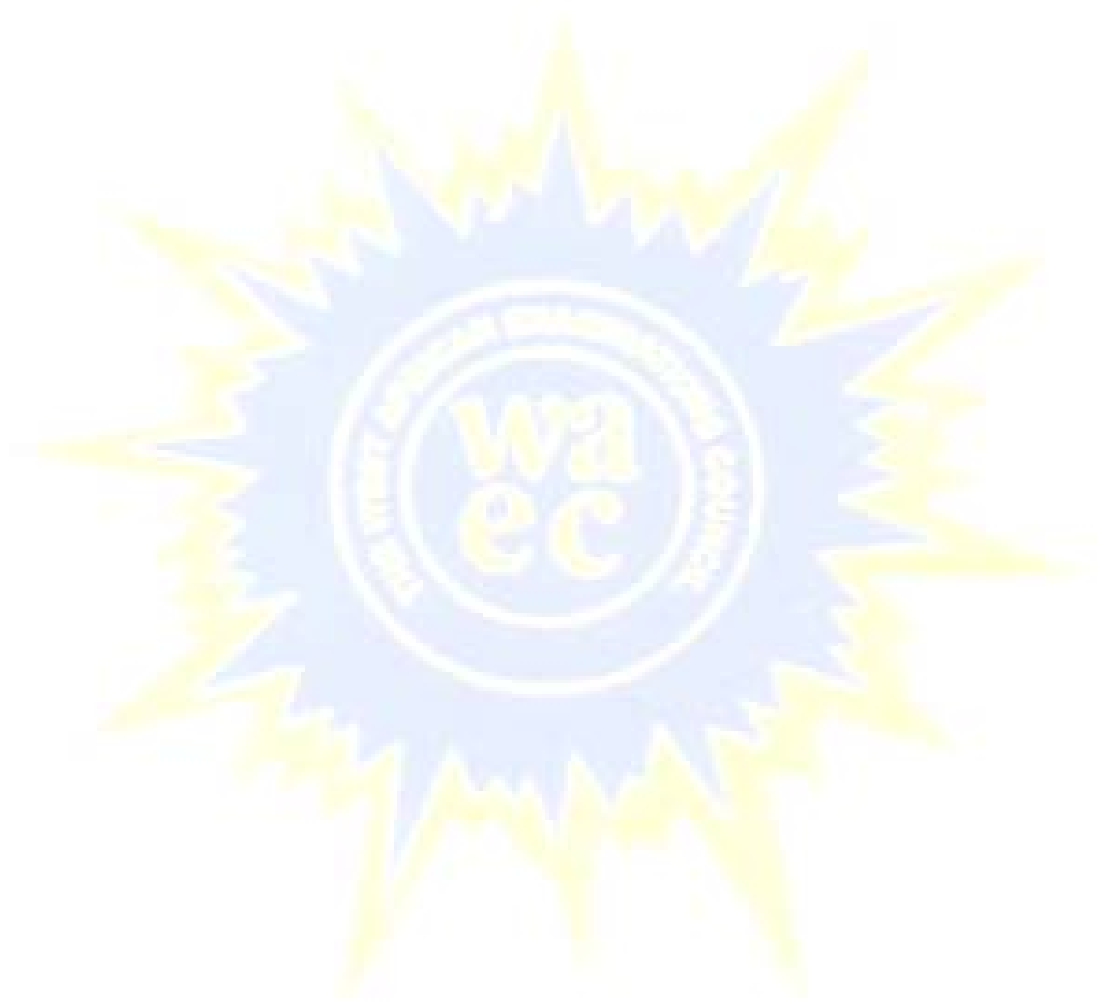
- (a) **Explain each of the following terms:**
 - (i) **woodlot;**
 - (ii) **taungya system.**
 - (b) **Give two reasons for promoting taungya in forestry.**
 - (c) **State eight factors to be considered when selecting tree species for afforestation programmes.**
 - (d) **Give two examples of trees that could be grown to produce tannins.**
- (a) Answers given to the explanation of woodlot and taungya system was not adequate. A vegetative cover raised for purposes of providing poles, firewood, rafter is woodlot and a forest consist of forest trees integrated with arablecropping is taungya system.
- (b) Reasons for promoting taungya in forestry were well answered.
- (c) Answers given to the factors to be considered when selecting tree species for afforestation programmes were good such as climate, availability of trees, drought resistance etc.
- (d) Acacia app and *cassia siamea* etc are good for tannins.

Question 6

- (a) **State four characteristics of mushroom.**
 - (b) **Mention four methods of cultivating mushroom.**
 - (c) **Give four reasons why it is important to cultivate mushrooms.**
 - (d) **Describe briefly how bees could be captured for a bee keeping project.**
- (a) Many students could not give characteristics of mushroom such as the hyphae , absorbs nutrient from substrate on which they grow, they do not have chloroplyll, they have a fruiting body, they produce quickly.
- (b) Methods of cultivating mushroom were correctly given by many candidates as high bed, low bed cocalpit and commercial/plastic bag.
- (c) Reason why it is important to cultivate mushroom is a popular question and candidates gave correct answers.

- (d) Majority of the candidates could not tell how bees could be captured for a bee keeping project. Correct answers are as follows:

Dress fully in bee suit and veil, light the smoker and obtain water which will be used to spray the bees to keep them calm. Wait for a while to allow all the bees to settle in swarm and cluster etc.



GENERAL AGRICULTURE 1 **PRACTICAL**

1. GENERAL COMMENTS

The standard of the paper was comparable to that of previous years.
The candidates performed better compared to previous years.

2. A SUMMARY OF CANDIDATES' STRENGTHS

The following strengths were noted:

- (1) Most of the candidates provided concise answers to the question;
- (2) They expressed themselves well in the English Language.

3. A SUMMARY OF CANDIDATES' WEAKNESSES

Some of the weaknesses are:

- (1) Non adherence to the rubrics of the paper;
- (2) Poor and unreadable handwritings ;
- (3.) Poor understanding of agricultural terminologies;
- (4) Poor mathematical skills.

4. SUGGESTED REMEDIES FOR THE WEAKNESSES

The Chief Examiner suggested that:

- (1) Teachers must let candidates appreciate the need to read examination instructions before providing answers.
- (2) Assignments involving calculations must be given frequently for the candidates to improve in the area of mathematics.

5. DETAILED COMMENTS

SPECIMEN LIST:

- A. Feather of a farm animal
- B. Horn of a farm animal
- C. Hand trowel
- D. Rake
- E. Poultry manure

Question 1

A commercial maize farmer selected two hundred seeds each from three different sources A, B and C.

Each batch of selected maize seeds were sown in seed boxes labelled A, B and C respectively. Each seed box was previously filled with equal quantity of the same moist soil.

After five days, the farmer counted the number of seeds that had germinated in each seed box. The results are shown in the table below.

| SOURCES OF SEED | NUMBER OF GERMINATED SEEDS |
|------------------------|-----------------------------------|
| A | 150 |
| B | 180 |

| | |
|---|----|
| C | 80 |
|---|----|

- (a) Calculate the germination percentage of seeds from each source.**
- (b) Which of the three sources would you recommend to the farmer?**
- (c) Give three benefits that the farmer would derive from using seeds from the recommended source.**

Feather is used for flight, protection and natural brooding whilst horn is used for defense, scratching the body and fighting. Industrial uses of horn include glue and button production, art and craft and jewellery.

This question required the candidates to use the values provided to calculate for germination percentage of seeds from three different sources and also give reasons to support the one they would recommend to a farmer.

Even though the question clearly stated the calculation of germination percentage, some of the students did not use 100 in their calculations, making their answers wrong.

Moreover, some of them did not also know the importance of germination percentage values and so had difficulty in answering sub questions b and c satisfactorily.

The recommended source is B(90%) because seeds will not be wasted, there will be good plant establishment, reduced cost of production etc.

Question 2

- (a) Identify specimens A and B .**
- (b) Name two farm animals each from which specimens A and B could be obtained.**
- (c) State two uses each of specimens A and B to the farm animals from which they were obtained.**
- (d) List three pests that could be found on the farm animal from which specimen A was obtained.**
- (e) Mention two industrial uses of specimen B.**

The requirements of the question were very simple. Most of the candidates had the identification correct even though some of them interchanged the specimens.

Sub-questions c and e were the areas where some of the candidates did not clearly understand.

The candidates found it difficult to distinguish between uses of the specimens to the animal and the industrial uses of the specimens.

Feather is used for flight, protection and natural brooding whilst horn is used for defense, scratching the body and fighting. Industrial uses of horn include glue and button

production, art and craft and jewellery.

Question 3

- (a) (i) **Identify specimens C and D.**
(ii) **Give three uses each of specimens C and D on the farm.**
- (b) (i) **State two uses of specimen E in agriculture.**
(ii) **Name two other materials that could be used in place of specimen E in agriculture.**
(iii) **State two problems associated with the use of specimen E in agriculture.**
(iv) **State one precaution that should be taken when using specimen E in crop production.**

This question was well answered. However some candidates had some difficulties. Hand trowel is used for mixing soil, mixing manure, transplanting seedlings and earthing-up vegetable crops on beds.

Rake is used for levelling of seed beds, breaking down of lumps of soil, covering of sown seeds and gathering rubbish.

Poultry manure is used to fertilize soil and fish ponds as well as source of fuel/energy. Cow dung, farmyard manure, compost and guano are some of the substitutes for poultry manure. Poultry manure is bulky, have offensive odour and could be source of pathogens.

Question 4

The following data were obtained from the record books of Akati Farms Limited on 31st December, 2009.

| S/N | Item | Amount (GH¢) |
|-----|---------------------------------|--------------|
| 1 | Drugs and vaccines in the store | 60.00 |
| 2 | Eggs collected | 80.00 |
| 3 | Incubator | 100.00 |
| 4 | Loans | 300.00 |
| 5 | Interest on Loans | 70.00 |
| 6 | Taxes | 50.00 |
| 7 | Poultry equipment | 80.00 |
| 8 | Poultry feed in store | 90.00 |
| 9 | Poultry house | 130.00 |
| 10 | Wages and salaries to be paid | 100.00 |

- (a) Use the data to prepare a balance sheet for Akati Farms Limited.
- (b) Give two reasons for preparing a balance sheet.
- (c) Name two other records that should be kept by Akati Farms Limited.

The question required candidates to prepare a balance sheet using the data provided. Candidates however, found it difficult to prepare the balance sheet. A good number of them rather prepared of profit and loss account.

The calculation of networth was also a problem to some of them.

Balance sheets are prepared because they give information on networth of farms, for tax purposes, for budgeting and planning and to compare performance of various farm enterprises.

GENERAL AGRICULTURE 2

1. GENERAL COMMENTS

The standard of the paper compares favorably with those of previous years. The performance of candidates was better than that of the previous year.

2. A SUMMARY OF CANDIDATES' STRENGTHS

A summary of candidates' strengths include the following:

- (1) Most candidates followed the rubrics;
- (2) Questions were properly numbered;
- (3) The handwritings of most candidates were legible;
- (4) Different question were answered on fresh pages.

3. A SUMMARY OF CANDIDATES' WEAKNESSES

The weaknesses of candidates include:

- (1) Poor expression and spellings;
- (2) Repetition of answers to questions;
- (3.) Poor understanding of agricultural terminologies.

4. SUGGESTED REMEDIES FOR THE WEAKNESSES

Suggested remedies are as follows:

- (1) More practical lessons should be organised by teachers;
- (2) The teaching of English Language should be strengthened;
- (3) Terminologies should be explained to students.

5. DETAILED COMMENTS

Question 1

- (a) **State four safety measures that should be observed when using machinery on the farm.**
- (b) **Outline the procedure for carrying out a farm survey.**
- (c) **Discuss three factors that hinder the development of agriculture in West Africa.**

- (a) Most candidates did not answer the question well. Instead of writing on machinery, they wrote on the maintenance of farm tools.

Candidates were expected to write the following:

wearing of protective gears, avoidance of smoking near inflammable material, using of eye and nostril guard etc.

- (b) A large number of candidates were not able to outline the procedure for carrying a farm survey. The procedure include reconnaissance, preliminary survey and preparation of maps.
- (c) This was a well answered question. The factors include land tenure system, inadequate social amenities, poor transportation system and low level of education.

Question 2

- (a) Distinguish between farm machinery and farm implement.**
- (b) State three roles played by each of the following occupations in agriculture:**
 - (i) agricultural engineering:**
 - (ii) agricultural research.**
- (c) Discuss the contributions of four non-timber products to national development.**

- (a) Most candidates were not able to distinguish between a farm machinery and farm implement. A farm machinery is a mechanical device which is capable of generating power to accomplish task on the farm whilst a farm implement is a complex farm tool which requires external power to perform farm operations.
- (b) Most of the candidates who attempted this question were unable to give three roles played by agricultural engineering and agricultural research. Most of them stated only two roles.
- (c) Candidates' performance was poor. Expected answers include game, herbs, spices, climbers and roofing materials.

Question 3

- (a) State two principles of crop rotation.**
 - (b) Explain three ways in which living organisms influence weathering of rocks.**
 - (c) Discuss four factors that influence fertilizer use by farmers.**
- (a) This question was well answered which showed that candidates knew the principles of crop rotation.
 - (b) This question was fairly well answered by candidates. The problem candidates had was explanation of how the living organisms influence weathering of rocks. Animals influence the weathering of rocks by their movement and burrowing actions.
 - (c) Most candidates were unable to discuss four factors as demanded. The factors required include social, economic, climatic and crop factors as well as type of fertilizer and government policies.

Question 4

- (a) **Explain the following terms as used in soil and water conservation:**
 - (i) **field capacity;**
 - (ii) **available water.**
- (b) **Outline two effects of the frequent use of ploughs on the soil.**
- (c) **Discuss four agronomic causes of decline in crop yields on a continuously cropped land.**

- (a) This was a poorly answered question. Most candidates were not able to explain the terms. Field capacity is the moisture level of the soil after gravitational water has drained out. Available water is the soil moisture content between field capacity and permanent wilting point.
- (b) This was also poorly answered. Effects of frequent use of ploughs on the soil include soil compaction, loss of structure, poor aeration and poor drainage.
- (c) Candidates found this question difficult and hence performed poorly. Decline in soil fertility, soil aeration; pH changes, pest and disease build up and destruction soil structure are some of the agronomic causes of decline in crop yields.

Question 5

- (a) (i) **List four types of agrochemicals used in crop production.**
(ii) **State one use of each type of agrochemicals you have listed in (a) (i) above.**
- (b) **Discuss four problems associated with cassava production in West Africa .**
- (a) This question was well answered. However, some candidates did not know that insecticide and rodenticide are pesticides so after stating insecticide and rodenticide they also added pesticide.
- (b) This question was fairly well answered. The question was demanding peculiar problems associated with cassava production such as difficult harvesting operations, bulky planting material, planting material deteriorates quickly and tubers cannot be stored for long. Some candidates wrote on problems associated with crop production in general.

Question 6

- (a) **Distinguish between a bed and a border in ornamental horticulture.**
- (b) **Outline four methods of cultural pest control in crop production.**
- (c) **Explain how three characteristics of weeds make them difficult to control on the farm.**
- (a) Most candidates were not able to distinguish between a bed and a border. In a bed, tallest trees are placed in the centre and can be viewed from all angles. In borders, tallest trees are placed near the obstacle and usually blocked at one/both sides by a wall/building.

- (b) Some candidates did not understand cultural method and therefore wrote on biological and chemical methods. Expected answers include crop rotation, good sanitation, weed control, tillage practices, use of catch crop and early harvesting.
- (c) Most candidates answered this question correctly. The characteristics of weeds include production of numerous seeds/fruits, long dormancy periods of seed, efficient means of dispersal and fast growth rate.

Question 7

- (a) **State two benefits each of the following practices in animal husbandry:**
- (i) **dehorning**
 - (ii) **identification;**
 - (iii) **culling;**
 - (i) **castration.**
 - (ii)
- (b) **Give two reasons why maintenance ration is important in animal nutrition.**
- (c) **Describe three methods of harvesting fish from a pond.**

- (a) Candidates were familiar with the practices and therefore provided correct responses.
- (b) Most candidates could not give reasons why maintenance ration is important in animal nutrition. They rather defined maintenance ration. Maintenance ration generally keeps animal alive and in normal health. It also ensures that animals develop properly and prevents malnutrition.
- (c) Though candidates were able to state the methods of harvesting fish from a pond, they could not describe these methods hence lost some marks.

Question 8

- (a) **Give three advantages of fostering in farm animals.**
- (b) **Outline five management practices that are carried out in a brooder house.**
- (c) **Explain four causes of low production of ruminants in Ghana.**
- (a) Only few candidates were able to provide correct responses to this question. Apparently they did not know what fostering was and therefore could not give its advantages. Some advantages of fostering are reduction in mortality of young animals, saves labour/cost and allows large number of young animals to be reared in a short time.
- (b) Responses to this question were quite good. Some of the management practices are provision of suitable feed and clean water, scheduled medication, regulation of brooder house temperature, changing of litter and control of diseases and pests.

- (c) Performance of candidates was quite good. Some candidates gave general responses instead of limiting them to ruminants. The correct answers include uneven availability of feed all year round, inferior quality of feed, poor health of animals, poor husbandry practices and poor housing facilities.

Question 9

- (a) **Give two examples each of the following extension teaching methods.**
(i) **mass method;**
(ii) **group method.**
- (b) **State four characteristics of small scale agribusinesses in West Africa.**
- (c) **Discuss four causes of instability of prices of agricultural produce.**

- (a) Candidates were able to answer this question well. Some examples of the mass method are use of posters, field days/agricultural shows, use of film shows and radio. The group method include lecture, demonstration, discussion, role play and field trip.
- (b) This question was fairly well answered. Some of the characteristics are sole proprietorship, partnership, limited initial investment, use of low level of technology and small market share.
- (c) Most candidates wrote on factors affecting demand and supply instead of causes of price instability.

Some of the causes of instability of prices of agricultural produce are inelastic supply, unpredictable natural factors, poor feeder road network, inadequate storage facilities and poor packaging.

Question 10

- (a) **List five agents of agricultural marketing.**
- (b) **Enumerate five characteristics of an effective extension system.**
- (c) **Explain three ways in which agricultural economics is important in farm management.**
- (a) Most candidates stated only retailers and wholesalers. Agents that were not stated include country buyer, commission agent, broker and auctioneer.
- (b) This question was fairly well answered. However, some candidates wrote on the characteristics of a good extension agent instead of effective extension system. Expected answers include good communication system, strong administrative support, adequate logistics and adequate financial support.
- (c) Candidates answered this question poorly. A few of them stated that it helps in decision marking and policy formulation but could not explain. Some of the correct responses are that it enables farmers to achieve production targets, ensures efficiency in farm budgeting and financing, and enhances price determination.

INTEGRATED SCIENCE 1

1. GENERAL COMMENTS

The paper as a whole covered sufficiently wide area of the syllabus and the standard was the same as those of previous years.

2. A SUMMARY OF CANDIDATES' STRENGTHS

Candidates can be commended on the following achievements:

- (1) Effort by most candidates to attempt to answer four questions required;
- (2) Answering of fresh questions on fresh pages;
- (3) Good expression in English language;
- (4) Orderly presentation of answers.

3. A SUMMARY OF CANDIDATES' WEAKNESSES

Weaknesses of candidates adversely affected their performance include the following:

- (1) Inability to show a clear understanding of scientific concepts;
- (2) Failure to spell correctly one-word answers.
- (3) Failure to show steps in questions involving calculations.

4. SUGGESTED REMEDIES

- (1) More exercises on the use of concepts to explain observations made By students from their own local environment is highly recommended. Teachers are also encouraged to guide students in applications of concepts to everyday life;
- (2) Vocabulary drill in scientific words at the beginning of each class lesson is highly recommended;
- (3) Teachers must guide their students on the need to show the steps when answering questions that involve calculations.

5. DETAILED COMMENTS

Question 1

- (a) Study the table below and use it to answer the questions that follow:

| Atom/Element | Atomic number | Mass number |
|--------------|---------------|-------------|
| V | 10 | 18 |
| W | 18 | 39 |
| X | 15 | 33 |
| Y | 10 | 20 |
| Z | 11 | 23 |

- (i) How many neutrons are there in atom X?
(ii) Which of the atoms will readily form an ion?
(iii) Which of the atoms will form an ion with a positive charge of +3 ?
- (β) Indicate the atoms that are isotopes.
(α) Explain your answer in (a) (iv) (α) above.
- (b) (i) What is a fertilizer?
(ii) State two effects of improper application of inorganic fertilizer.
- (c) (i) What is excretion?
(ii) Describe briefly how plants excrete each of the following substances:
(α) excess water
(α) oxygen.
- (d) (i) What is meant by mass of a body?
(ii) A room of area 12, m x 14 m has a height of 5 m.
If the density of air in the room is 1.32 kgm⁻³, calculate the mass of air in the room.

This question was answered by majority of the candidates and the performance was encouraging. In Part (a), there was a clear demonstration of the relationship between the atomic number and mass number of an atom/element. However, a few candidates failed to answer the question on isotopy.

Candidates must note that isotopes are elements of the same atomic numbers but different mass numbers.

Part (b) was well answered by majority of the candidates as they correctly explained the term fertilizer, and also stated correctly the effects of improper application of inorganic fertilizer.

Part (c) posed a difficulty for most candidates as they were unable to describe how plants excrete excess water and oxygen. Candidates must note that a description of excretion of excess water and oxygen from plants demands an understanding of the structure of the leaf, which is the main organ through which these substances are excreted.

Excess water diffuses in to the air spaces within the leaf, then through stomata (and in some cases through the lenticels) into the atmosphere as water vapour. Similarly the oxygen produced during photosynthesis diffuses out of the leaf cells, into the air spaces, through the stomata into the atmosphere.

Few candidates defined 'weight' instead of the "mass" of a body. The calculation of the mass of air in the room was correctly done by majority of the candidates.

Question 2

- (a) (i) **What is food preservation?**
(ii) **Explain the principles underlying each of the following methods of food preservation:**
(α) **salting;**
(β) **canning.**
- (b) (i) **What is a pathogen?**
(ii) **State three ways in which pathogens are transmitted from one person to another.**
- (c) (i) **What are x-rays?**
(ii) **State three dangers associated with over exposure to x-rays.**
- (d) **Write the structural formulae of each of the following chemical compounds:**
(i) **Ethanoic acid;**
(ii) **2, 2 - dimethylbutane;**
(iii) **3, methyl pent - 2 - ene;**
(iv) **2, methylbutan - 2 - ol.**

Few candidates attempted this question and their performance was not encouraging. Part (a) did not require the procedure involved in preserving food by salting and canning as stated by most candidates. Essentially the salt applied to the food absorbs water from the food and as a result microorganisms in the food are prevented from growing and carrying out their activities which causes the spoilage:

The salt does not kill the micro-organisms as wrongly stated by some candidates. On the other hand canning prevent the entry of micro-organisms and kills those already in the canned food and in their absence food is prevented from spoilage.

Part (b) was not well answered by most candidates as they failed to explain the term pathogen. There is the need for candidates to differentiate between a vector-an organism that transmits a disease and a pathogen-an organism that causes disease, the latter could be transmitted through a vector, contact with infected person, sharing infected material through droplet infection and through contaminated food.

Explanation of the term x-rays was correctly done by the majority of candidates in Part (c). Also, the candidates correctly stated the dangers associated with over exposure to x-rays.

In describing the structural formulae of chemical compounds in Part (d) it is important to show the bonds between all atoms. CH_3 and OH are not accepted as structural formulae.

Question 3

- (a) **Explain the mechanism by which the body of a mammal cools when the temperature rises.**
- (b) (i) **What is a direct current as used in electricity?**
(ii) **An electric furnace operating on 200 V, uses 3 kW of power.**

Calculate the current that flows.

- (c) (i) **Name the main ore from which aluminum is extracted.**
(ii) **State three properties that make aluminum suitable for use as cooking utensils.**
- (d) (i) **What is an ornamental plant?**
(ii) **State three maintenance practices to be adopted to ensure growth of ornamental plants.**

This question was attempted by majority of the candidates but their performance was average.

In Part (a) most candidates failed to explain the mechanism by which the body of a mammal cools when the temperature rises. Candidates need to understand that sweating occurs at all time and that when the body temperature rises the rate of sweat production increases. More blood carrying heat is carried to the skin as a result of the dilation of the blood capillaries of the skin. The heat is lost by radiation and as the rate of sweating increases, heat is also lost through latent heat of vapourization. Meanwhile less heat is produced by the cells under the circumstances as a result of reduction in metabolism.

Part (b) was not well answered by most candidates as they were unable to explain direct current. Candidates must note that the use of 'direct' in explaining 'Direct Current' an electric current which flows in one direction does not attract marks. Surprisingly in Part (c) many candidates could not spell 'Bauxite' correctly and lost a mark. However, most candidates stated correctly the properties that make aluminum suitable for use as cooking utensils Part (d) was well answered by most candidates as they correctly stated the maintenance practices that ensure the growth of ornamental plants.

Question 4

- (a) (i) **Explain the term frequency as applied to sound waves.**
(ii) **A wave of wavelength 0.3 m moves at a velocity of 400 ms^{-1} . Calculate the frequency of the wave.**
- (b) (i) **What is poultry?**
(ii) **State four reasons for keeping poultry.**
- (c) (i) **Explain the term population density.**

- (ii) **State three effects of high population density on the environment.**
- (d) **The engine of a car is left running in an enclosed garage. Explain why the fumes from the engine could lead to the death of a person in this enclosed garage.**

Majority of the candidates answered this question and their performance was average. Explanation of the term 'frequency' posed a difficulty to most candidates. They omitted the word 'complete' in their explanation. Frequency is the number of complete wave/oscillation/cycles per second is calculated from the formula $v = f \lambda$.

Some candidates could not make 'f' the subject of the formula as $f = \frac{v}{\lambda}$ and so ended up multiplying $0.3\text{m} \times 400\text{ms}^{-1}$ instead of $\frac{400\text{ms}^{-1}}{0.3\text{m}} = 1333.3\text{H}_2$.

In Part (b), most candidates explained correctly the term 'poultry' as well as stated correctly the reasons for keeping poultry.

Many candidates explained 'population' and not "population density" as demanded in Part (c). Candidates must note that the term 'population density' is the number of living organisms/people per unit area.

Candidates also failed to state the effects of high population density on the environment which include the following:

- depletion of natural resources
- sanitation problems
- destruction of natural environment
- destruction of the ozone layer
- pressure on lands
- etc.

Explanation of why fumes of the engine of car could lead to the death of a person in an enclosed garage posed a difficulty for most candidates. It is important for candidates to note that the death of a person locked up in an enclosed garage, does not result from shortage of oxygen in the garage.

It is rather the inability of haemoglobin in the person's blood to transport oxygen to the cells. This is because the carbon monoxide from the car engine when inhaled by the person combines with the haemoglobin to form carboxy-haemoglobin leaving no space for haemoglobin to carry oxygen. The person suffocates as a result and dies.

Question 5

- (a) (i) **Distinguish between normal salt and acid salt.**
(ii) **Give one example of each type of salt named in (a) (i) above.**
- (b) (i) **Explain the term drenching as applied to animal production.**
(ii) **State three ways in which drenching is important in animal production.**

- (c) (i) **Explain the following genetic terms:**
(α) **dominant character;**
(β) **genotype.**
- (ii) **The offspring of a black rabbit and white rabbit were all found to be black.**

With the aid of an appropriate crosses, illustrate the observation

- (d) **Explain this observation:**
A passenger sitting in a bus tends to fall backward when the bus moves suddenly.

Few candidates answered this question and their performance was not encouraging. In Part (a), most candidates were unable to differentiate clearly between normal salt and acid salt. The difference lies in the fact that the acid from which a normal salt is formed has its hydrogen atoms completely replaced by a metal/ammonium ion whereas the acid from which an acid salt is formed has its hydrogen atom partially or incompletely replaced by a metal. Examples of normal salt are NaCl , Na_2CO_3 , MgSO_4 and NaNO_3 and they do not contain ionisable hydrogen atom. NaHSO_4 , NaHCO_3 and $\text{Ca}(\text{HCO}_3)_2$ are examples of acid salt and they contain ionisable hydrogen atom.

Most candidates were able to explain correctly the term 'drenching' as well as state correctly the effects of drenching. The genetic cross in Part (c) is a monohybrid cross which can be explained by Mendel's first principle in which Black (B) is dominant and white (b) is recessive, in which case the black parent is represented by BB and produces (B) gamete whereas the white parent (bb) produces a (b) gamete and upon fertilization all the offsprings are black (Bb).

Most candidates were unable to explain the observation in Part (d). Candidates must note that the passenger tends to fall back when the bus moves suddenly because of the tendency of the person to remain at rest when the person and the bus move forward; this is the phenomenon of inertia which holds the passenger back.

Question 6

- (a) (i) **What is crop rotation?**
(ii) **State three advantages of crop rotation.**
- (b) **Name the kingdom to which each of the following organisms belong:**
(i) **Maize;**
(ii) **Bacterium;**
(iii) **Mushroom;**
(iv) **Lizard.**
- (c) (i) **What is a transistor?**
(ii) **Explain how a transistor behaves as a switch.**
- (d) **Magnesium ribbon of mass 4.0 g is placed in dilute hydrochloric acid contained in a beaker. Calculate the number of moles of hydrochloric acid that would be required to react completely with the ribbon.**

[Mg = 24, H = 1, Cl = 35.5]

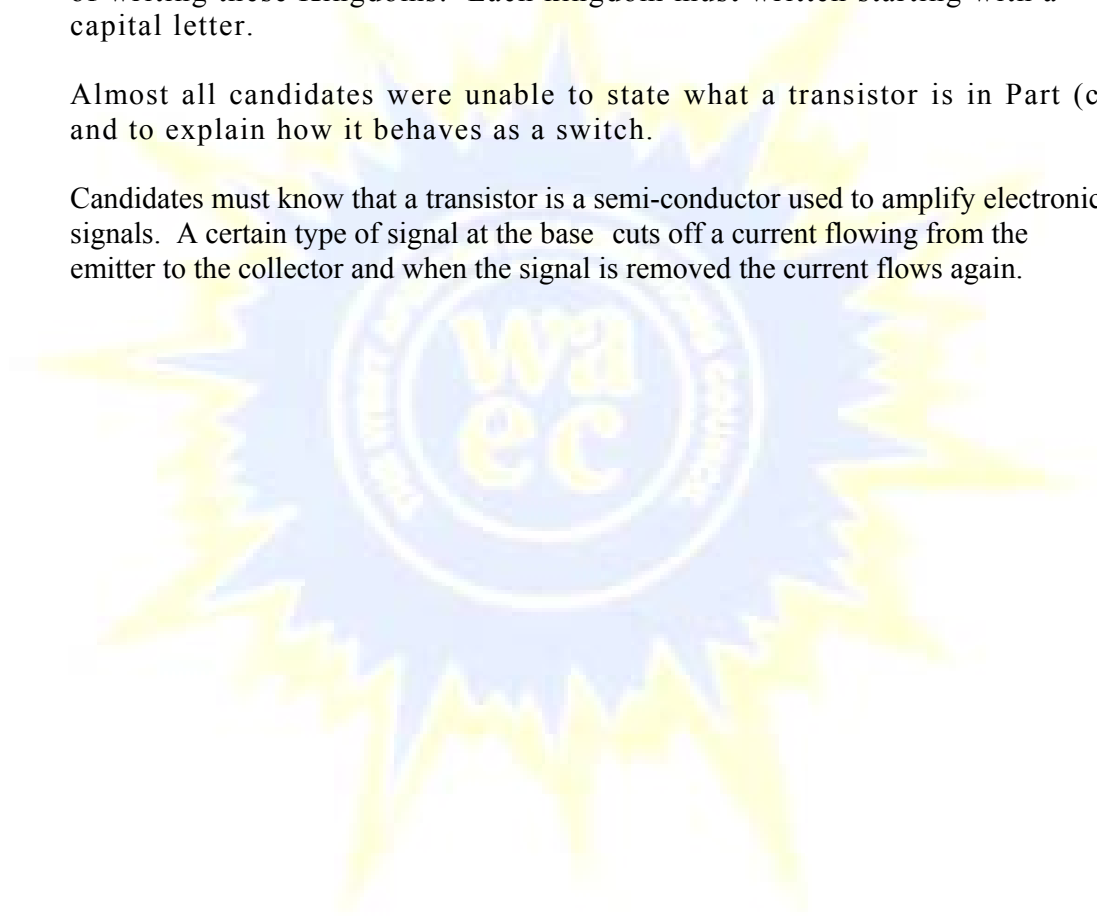
Majority of the candidates answered this question and their performance was good.

In Part (a) some candidates confused other farming system with crop rotation which involves different types of crops grown on the same piece of land in a definite order, for example, maize, beans and cassava in the first season and in the following season the order may be changed to cassava, maize and beans.

For Part (b), there is the need for candidates to know examples of the five kingdoms listed in their syllabus and must follow the convention of writing these Kingdoms. Each kingdom must be written starting with a capital letter.

Almost all candidates were unable to state what a transistor is in Part (c) and to explain how it behaves as a switch.

Candidates must know that a transistor is a semi-conductor used to amplify electronic signals. A certain type of signal at the base cuts off a current flowing from the emitter to the collector and when the signal is removed the current flows again.



INTEGRATED SCIENCE 2

1. GENERAL COMMENTS

The standard of the paper was comparable to that of previous years. The questions adequately covered wide aspects of the topics and skills required at the end of the programme. The performance of candidates as compared with that of previous years was good and highly commendable.

2. A SUMMARY OF CANDIDATES' STRENGTHS

- (1) Most candidates attempted all the four questions;
- (2) Most candidates presented their responses neatly and orderly;
- (3) Good usage of the English language made candidates responses easy to understand;
- (4) Many candidates understood the questions and gave precise and correct answers.

3. A SUMMARY OF CANDIDATES' WEAKNESSES

Weaknesses of candidates adversely affected their performance include the following:

- (1) Wrong spelling of scientific words especially for one-word answers;
- (2) Difficulty in writing down chemical equations and balancing them;
- (3) Reading values from instruments like stop watch is difficult for most candidates.

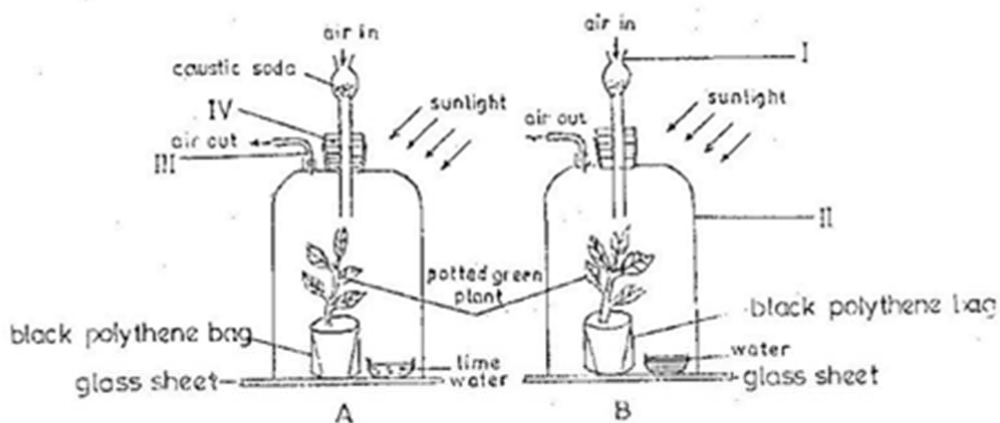
4. SUGGESTED REMEDIES

- (1) Teachers must insist on correct spelling of scientific and technical words;
- (2) Students should be taught how to write and balance chemical equations. Teachers must insist on correct reactants with corresponding products and correct balancing;
- (3) Teachers should teach their students how to record exact values on given instruments without approximations.

5. DETAILED COMMENTS

Question 1

Figure 1 below illustrates a set-up used for an experiment to demonstrate photosynthesis in green plants. Study the diagram carefully and use it to answer the questions that follow:



- (a) Name the parts labelled I, II, III and IV.
- (b) State one function of each of the following substances used in the experiment:
- (i) lime water;
 - (ii) caustic soda;
 - (iii) black polythene bag.
- (c) State the importance of the set-up B in this experiment.
- (d) (i) In which of the set-ups A and B, would the leaves show a positive test for starch?
(ii) Give one reason to support your answer in (d) (i).
- (e) State two precautions to be taken in setting up this experiment.
- (f) Suggest the aim of the experiment.

The answers provided by majority of the candidates to this question was unsatisfactory and as result their performance was low. In Part (a) majority of the candidates could not identify the labelled parts I and II.

Candidates identified labelled part I as thistle funnel instead of thistle funnel and labelled part II as glass jar/gas jar instead of 'Bell jar'. For Part (b) majority of the candidates stated correctly the functions of lime water and caustic soda but failed to state the function of the black polythene bag.

Candidates must know that the function of the black polythene bag is to prevent carbon dioxide from entering the bell jar. Majority of the candidates were able to state correctly that set-up B in the experiment serves as the control.

In Part (c) most of the candidates were able to identify set-up B as the one that shows positive test for starch. However, only a few candidates were able to support their answer.

Candidates must note that set-up B showed positive test for starch because all the conditions necessary for photosynthesis were supplied.

Part (e) was well answered by most candidates as they stated correctly the precautions to be taken in setting up the experiment. Suggesting the aim of the experiment in Part (f) was well answered by most candidates. They stated that the aim of experiment was to show that carbon dioxide is needed for photosynthesis.

Question 2

In an experiment to determine the velocity of a moving body, the displacements, $d = d_1, d_2, d_3, d_4,$ and d_5 of the body and the corresponding times, $t = t_1, t_2, t_3, t_4,$ and t_5 taken were determined.

Figure 2a represents the displacements, $d = d_1, d_2, d_3, d_4$ and d_5 , while Figure 2b represents the corresponding times, $t = t_1, t_2, t_3, t_4,$ and t_5 .

Study the figures carefully and answer the questions that follow:

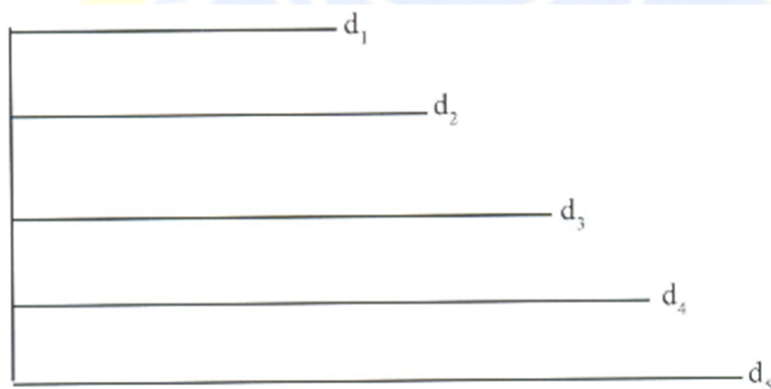


Fig. 2A Displacements, d , in centimetres

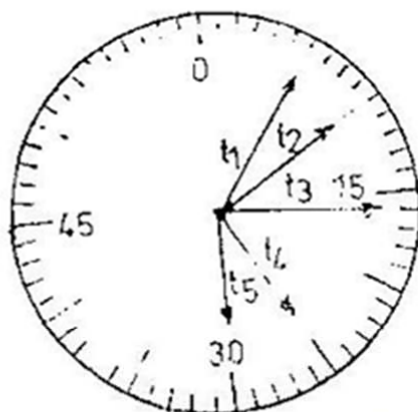


Fig. 2b. Stop clock showing time, t in seconds

- (a) (i) Measure and record the raw displacements, $d = d_1, d_2, d_3, d_4,$ and d_5 .
(ii) Read and record the times, $t = t_1, t_2, t_3, t_4$ and t_5 .
(iii) Convert the raw values of displacements recorded in (a) (i) to actual displacements, $D = D_1, D_2, D_3, D_4,$ and D_5 .
(iv) Tabulate your results obtained in (a) (i), (a) (ii), and (a) (iii) as shown below.

| t/s | t_1 | t_2 | t_3 | t_4 | t_5 |
|-----------------------|-------|-------|-------|-------|-------|
| Raw value of d/cm | | | | | |
| Actual value of D/m | | | | | |

- (b) Plot a graph with actual displacements D on the vertical axis and times, t on the horizontal axis.
- (c) (i) Determine the slope of the graph.
(ii) State the significance of the slope of the graph determined in (c) (i).

This is the most well answered question. Majority of the candidates scored very high marks. Candidates seem to be at home with how the Physics and mathematical aspects involved in this type of questions.

In Part (a) candidates measured the raw displacements and times correctly and tabulated them correctly as required. They also converted correctly the raw values into actual values. The choice of scale for the graph in Part (b) by most candidates was good and they were able to plot the points correctly.

Drawing of the line of best fit was correctly done by the candidates. In Part (c) most candidates were able to state the formula for calculating the slope and substitution were

accurately done. A few candidates could not state the formula as they inverted the formula, that is, $\frac{\Delta t}{X_2 - X_1}$

$$\Delta D = Y_2 - Y_1$$

Most candidates stated correctly the significance of the slope. They stated that the slope represented the velocity of the curve.

Question 3

Figure 3 illustrates three different methods of crop propagation. Study the figure carefully and answer the questions that follow.

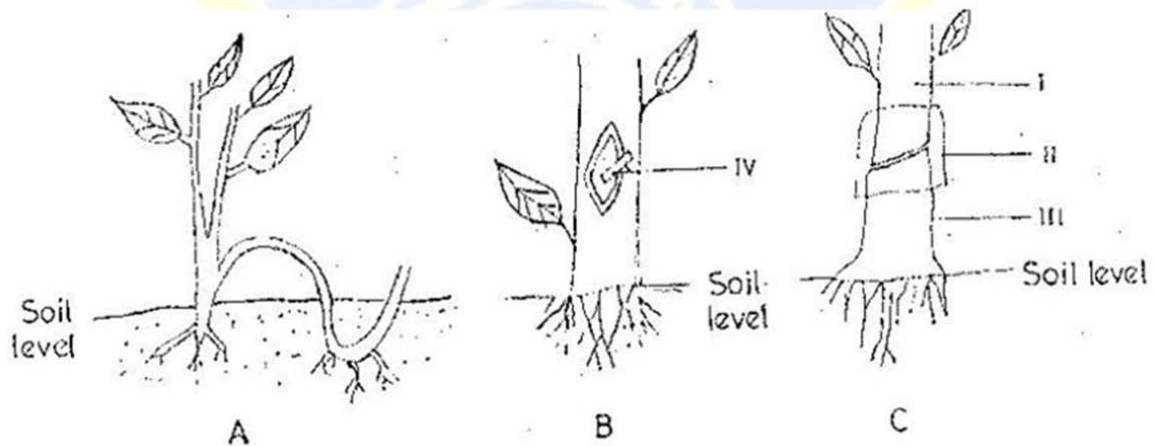


Fig. 3

- Name the parts labelled I, II, III and IV.
- Identify each of the methods of propagation in A, B, and C.
- Given a citrus seedling, a mature citrus plant, a knife and a wrapping tape, describe how the propagation method would be performed as illustrated in set-up B above.
- State three factors that influence the success of the method of propagation illustrated in C above.
- Name one ornamental plant propagated by the method illustrated in A.
- State four advantages of the methods of propagation illustrated above.

This question was poorly answered by most candidates.

Identification and naming of the labelled parts in Parts (a) and (b) were not accurately done by most candidates. Correct names of the labelled parts are as follows:

- I - Scion
- II - Grafting tape/wax/rubber/raffia
- III - Stock/root
- IV - (Dormant) bud

Methods of propagation identified are as follow:

- A - Layering
- B - Budding/Bud grafting
- C - Grafting

In Part (c) most candidates could not describe the operation in set-up B. The most popular answer was that part of the mature plant be cut and the whole seedling inserted instead of the bud. The expected answer was that a T-shaped cut be made on the bark of the matured plant and a bud or bud wood excised from the seedling inserted into the T-shaped cut.

Majority of the candidates failed to state correctly the factors that influence the success of the method of propagation in C in Part (d).

The expected answers include the following:

- The scion and the stock must be compatible
- The operator must be skillful
- Environmental conditions must be suitable
- Stock must be growing vigorously while scion is dormant.
- Stock and scion should be disease free

Part (f) was well answered by most candidates as they stated correctly the advantages of the methods of propagation.

Question 4

Figure 4 below illustrates a set-up for the titration of 0.2 M hydrochloric acid against 25.0 cm³ of a solution of sodium hydroxide.

Study the figure carefully and answer the questions that follow:

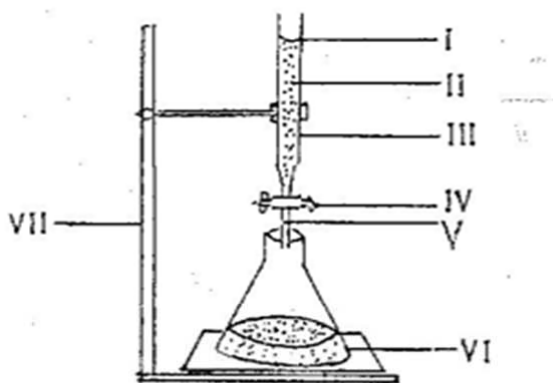


Fig. 4

- (a) (i) Name the parts labelled, I, II, III, IV, V and VII.
 (ii) State one function of each of the parts labelled III, IV and VII.
- (b) Write a balanced chemical equation for the reaction that takes place between the hydrochloric acid and the sodium hydroxide.
- (c) Assuming the volume of acid is 28.0 cm^3 , calculate the number of moles of sodium hydroxide in 100 cm^3 of the sodium hydroxide solution.
- (d) State two precautions to be taken when carrying out an experiment with the set-up illustrated above.

The performance of the candidates at this question was average.

In Part (a) most candidates were able to identify the labelled parts correctly. However, a few candidates failed to identify the part labelled V (Jet/Teat).

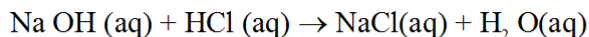
The functions of the labelled parts were correctly stated by most candidates.

Majority of the candidates could not write the chemical formulae of both reactants and products

correctly, for examples, "Na oH" instead of Na OH', and 'NaCL' instead of "NaCl". Those who wrote correct formulae balanced the equation correctly.

Part (c) posed a difficulty for most candidates as they were unable to calculate the number of moles of sodium hydroxide in 100 cm^3 of the sodium hydroxide solution. Candidates must note that the correct method of calculation is as follows:

$$\begin{aligned}
 1000\text{cm}^3 \text{ of HCl} &= 0.2 \text{ moles} \\
 28 \text{ cm}^3 &= \frac{28}{1000} \times 0.2 \text{ mole} \\
 &= 0.0056 \text{ moles}
 \end{aligned}$$



Molar ratio : 1 : 1

$$25 \text{ cm}^3 \text{ of Na OH} = 0.0056 \text{ moles}$$

$$\begin{aligned}\text{Therefore, } 100 \text{ cm}^3 &= \frac{100\text{cm}^3}{25\text{cm}^3} \times 0.0056 \text{ moles} \\ &= 0.0224 \text{ mol}\end{aligned}$$

With regard to the precautions to be taken during the experiment, most candidates stated general precautions taken during titration such as placing conical flask on a white background for easy observation.

The expected answers are as follows:

- Care should be taken not to splash acid because it is not corrosive.
- Care should be taken not to drop any part of the set-up because they are fragile.
- Clamp the burette gently to avoid cracking.
- The funnel must not be left on top of burette.
- Reading must be taken at the eye level.



PHYSICS 1
PRACTICAL A

1. GENERAL COMMENTS

The standard of the paper compared favourably with that of previous years.

Questions in all the Alternative question papers were within the scope of average candidates.

However performance of candidates was average.

2. A SUMMARY OF CANDIDATES' STRENGTHS

Commendable features observed in candidates' responses included:

- (1) Ability to read and record data correctly from the experiments;
- (2) Choice of large right-angled triangles in computing slope of graphs;

- (3) Ability to choose appropriate scales for graphs.
- (4) Presentation of results in the required composite table with appropriate headings and units;
- (5) Deductions from graphs were expertly done.

3. A SUMMARY OF CANDIDATES' WEAKNESSES

Some weaknesses observed in candidates' responses that adversely affected their performance included the following:

- (1) Inability to analyse experimental data
- (2) Interchanging of axes.
- (3) Over approximation of decimal values for plotting graphs;
- (4) Inaccurate lines of best fit;
- (5) Columns on tables had wrong/missing units;
- (6) Recording of experimental values with wrong/inconsistent number of significant figures;
- (7) Identifying points on graphs with large dots or asterisks instead of neat crosses.

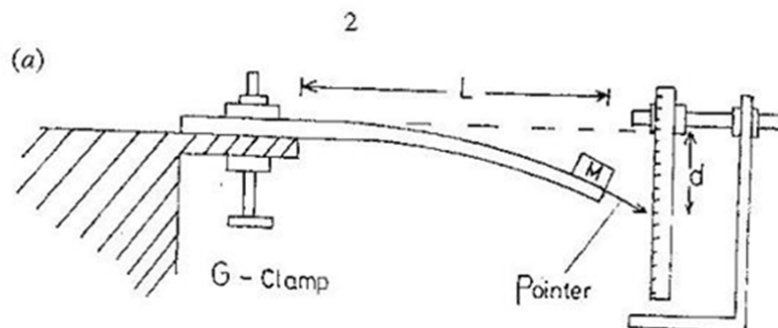
4. SUGGESTED REMEDIES

Some of the suggested remedies to address these lapses included:

- (1) Adequate practical work should be carried out by students which should be discussed with them;
- (2) Teaching and learning facilities should be improved in schools ;
- (3) Students should be taught practical skills.

5. DETAILED COMMENTS

Question 1



You are provided with two metre rules with their masses

You are provided with two metre rules with their masses written at their back, G-clamp, retort stand with clamp, mass M and other necessary apparatus.

- (i) Clamp one of the metre rules horizontally to the top edge of the bench, with its graduated face upwards such that a length $L = 90$ cm of it projects beyond the edge of the bench as illustrated in the diagram above.
- (ii) Clamp the second metre rule to serve as a vertical scale.
- (iii) Fix a pointer at the free end of the metre rule such that it can freely move over the vertical scale.
- (iv) Read and record the initial pointer position d_0 .
- (v) Attach the mass M to the free end of the metre rule and record the new pointer position d_i .
- (vi) Evaluate and record L^3 and $d = (d_i - d_0)$.
- (vii) Repeat the procedure for other values of $L = 80, 70, 60$ and 50 cm.
- (viii) Tabulate your readings.
- (ix) Plot a graph with d on the vertical axis and L^3 on the horizontal axis starting both axes from the origin (0,0).
- (x) Determine the slope, s , of the graph.
- (xi) Measure and record the width, w and thickness, t of the metre rule clamped horizontally.

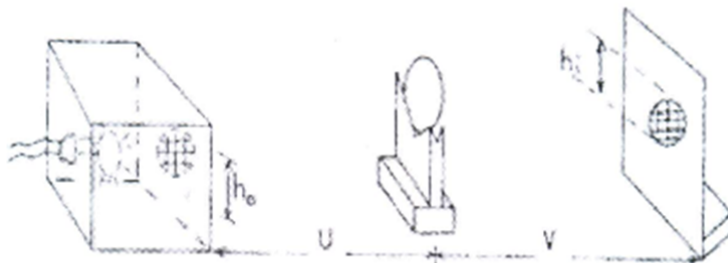
(xii) Evaluate $E = \frac{KM}{wt^2s}$

Give that $K = 39.2 \text{ cm}^{-2}$

- (xiii) State two precautions taken to ensure accurate results.
- (b)
 - (i) Using your graph, determine the value of L for which d is 2.5 cm.
 - (ii) Define Young's modulus.
- (a) This question was poorly handled. Candidates failed to record the values for L , d_0 , d_i , d and L^3 to the appropriate decimal places. Most candidates recorded the values of L as $80, 70, 60, 50 \dots$ instead of $80.0, 70.0, 60.0$ and $50.0 \dots$ to score for the graph, candidates were required to label both axes appropriately, choose easily readable scales and draw lines of best fit.
- (b) Some candidates stated Young's modulus as "stress/strain" instead of "tensile stress/tensile strain."

Question 2

(a)



You are provided with an illuminated object, a white screen, a converging lens and other necessary apparatus.

Using the diagram above as a guide, carry out the following instructions:

- (i) Measure and record the height h_0 of the illuminated object.
 - (ii) Place the object at a distance $u = 25$ cm from the lens and adjust the screen until a sharp image is formed.
 - (iii) Measure and record the height h_i of the image.
 - (iv) Measure and record the distance v between the lens and the screen.
 - (v) Evaluate and record $m = \frac{h_i}{h_0}$
 - (vi) Repeat the procedure for four other values of $u = 30, 35, 40$ and 45 cm.
 - (vii) Tabulate your readings.
 - (viii) Plot a graph with m on the vertical axis and v on the horizontal axis starting both axes from the origin $(0,0)$.
 - (ix) Determine the slope, s , of the graph and the intercept, c , on the vertical axis.
 - (x) Using your graph, determine the value of v when $m = 0$.
 - (xi) State two precautions taken to ensure accurate results.
- (b) (i) An object is placed at a distance u from a converging lens of focal length 20 cm. If the magnification of the real image formed by the lens is 4 , calculate the value of u .
- (ii) Draw a ray diagram showing how a concave mirror may be used to produce a virtual image.

- (a) In this ray box experiment, candidates were required to measure and record the height, h_0 of the object that was illuminated. For each specified value of object distance u , the image height, h_i and the image distance, v were measured.

The magnification, $m = \frac{h_i}{h_0}$ for each set of values were required.

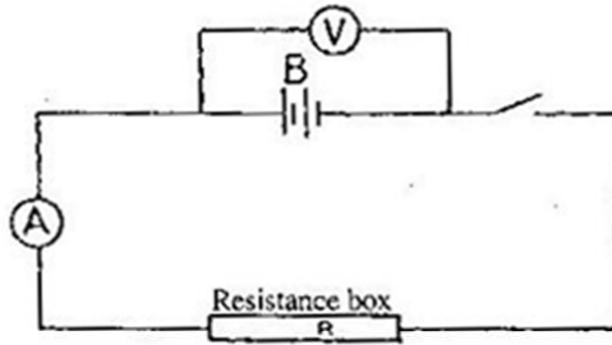
The trend expected was that as u increases, both v and h_i decreases.

Most candidates had the correct trend. The commonest error observed in candidates' answers was recording of the given values of u with no decimal points. Candidates drew good graphs with the correct intercept and gave the appropriate deductions.

- (b) (i) Candidates were able to substitute and obtained the appropriate answer for $u = 25$ cm.
- (ii) The appropriate ray diagram was drawn and the position of the virtual image was determined.

QUESTION 3

- (a)



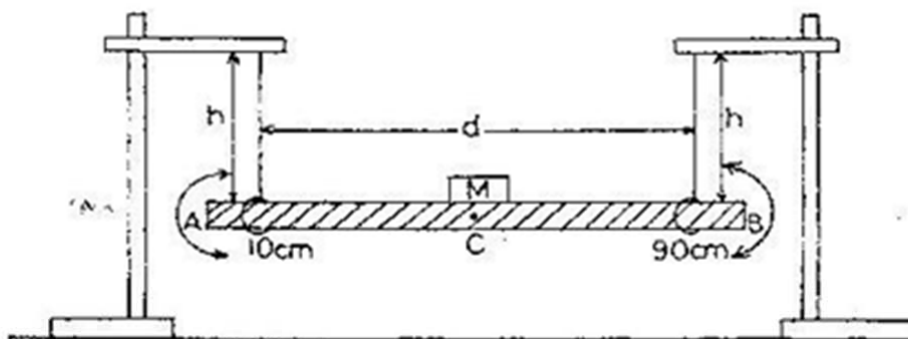
You are provided with an ammeter, A; a voltmeter, V; two chemical cells, B connected in series; a resistance box, R; a plug key and connecting wires.

- (i) Set up a circuit as shown in the diagram above.
 - (ii) With $R = 0$ and the key closed, read and record the ammeter reading, I_0 and the voltmeter reading V_0 .
 - (iii) Remove the key, set $R = 1 \Omega$ and close the key. Record the ammeter reading I and the voltmeter reading, V .
 - (iv) Evaluate and record $Z = V_0 - V$.
 - (v) Repeat the procedure for five other values of $R = 2, 3, 4, 5,$ and 6Ω .
 - (vi) Tabulate your readings.
 - (vii) Plot a graph with Z on the vertical axis and I on the horizontal axis.
 - (viii) Determine the slope, s , of the graph.
 - (ix) State two precautions taken to ensure accurate results.
- (b) (i) State Ohm's law.
- (ii) Name two electrical conductors that do not obey Ohm's law.
- (a) This question was unsatisfactorily answered. Candidates should have recorded the value of I_0 and V_0 to at least 1 decimal place with the correct unit. From the values obtained as R increases, V increases and $V > V_0$.
Graphs were correctly drawn and the slope determined.
- (b) (i) Ohm's law was correctly given with the conditions under which it holds.
- (ii) Electrical conductors that do not obey Ohm's law include:
- diode valve
 - junction diode
 - thermistor
 - electrolyte
 - semi conductor
 - thyristor
 - capacitor

ALTERNATIVE B

Question 1

- (a)



You are provided with two metre rules other necessary apparatus.

(i) Place one of the rules on a knife-edge and determine its centre of gravity C. Mark this position with a piece of chalk.

(ii) Read and record the mass M_R of the metre rule written on the reverse side of it.

(iii) Attach the mass $M = 100 \text{ g}$ firmly on the rule AB at C using sellotape.

(iv) Suspend the metre rule by two parallel threads of length $h = 40 \text{ cm}$ each at the 10 cm and 90 cm marks. Ensure that the graduated face of the metre rule is facing upwards.

(v) Set the rule AB into a small angular oscillation about the vertical axis through its centre of gravity.

(vi) Determine the time t for 20 complete oscillations. Evaluate the period T and T^2 .

(vii) Read and record the value of d in metres.

(viii) Keeping d constant throughout the experiment, repeat the procedure for other values of $h = 50, 60, 70$ and 80 cm .

(ix) Tabulate your readings.

(x) Plot a graph with T^2 on the vertical axis and h on the horizontal axis.

(xi) Determine the slope, s , of the graph and evaluate

$$k = \frac{s}{Q}$$

$$\text{where } Q = \frac{2}{25d^2}$$

(xii) State two precautions taken to ensure accurate results.

(b) (i) Define the term couple as it relates to rotational or oscillatory systems.

(ii) Give two practical applications of a couple in everyday life.

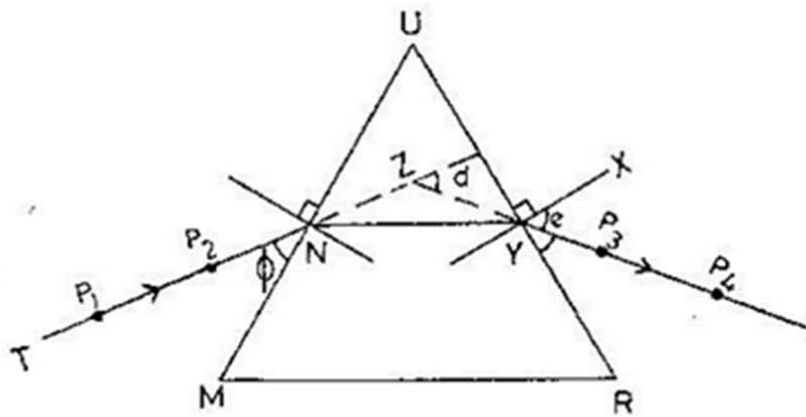
(a) Candidates were expected to read and record the values of c , M_R , d and t to at least 1 d.p and then evaluate and record values of T and T^2 to at least 2 and 3 d. p.

respectively. To score for evaluation of K, candidates were expected to substitute values of d and s in the formula $k = \frac{s}{Q} = \frac{25sd^2}{2}$ major weakness displayed by candidates was not recording the centre of gravity of the metre rule and also the mass of the metre rule determined but not recorded without any unit and appropriate decimal place.

- (b) (i) The term couple was poorly defined. Couple-Two parallel forces of equal magnitude acting in opposite directions and separated by a distance.
(ii) Actions of couple were well stated by candidates.

Question 2

(a)



You are provided with a triangular glass prism, four optical pins and other necessary materials.

- (i) Place the triangular glass prism on a drawing paper and draw its outline UMR. Remove the prism. Measure and record the value of the angle U.
Draw a normal to the line UM at N.
Also, draw another line TN to the normal such that $\phi = 60^\circ$. Fix two pins at P_1 and P_2 .
- (ii) Replace the prism and fix two other pins at P_3 and P_4 such that the pins appear to be in a straight line with the images of the pins at P_1 and P_2 when viewed from the side UR. Remove the prism.
- (iii) Join points P_3 and P_4 producing the line to meet TN produced at Z^3 . Draw the normal XY.
- (iv) Measure and record the angle of emergence, e, and that of deviation d.
- (v) Repeat the experiment with $\phi = 55^\circ, 50^\circ, 40^\circ$, and 35° . In each case measure and record the corresponding values of e and d.
- (vi) Tabulate your readings.
- (vii) Plot a graph with d on the vertical axis and e on the horizontal axis starting both axes from the origin (0,0). Join your points with a smooth curve.

(viii) From your graph, obtain the minimum deviation d_m and the corresponding angle of emergence e_m .

Hence, calculate the refractive index n of the prism using the formula

$$\sin \left[\frac{d_m + e_m}{2} \right]$$

$$\sin \left[\frac{A}{2} \right]$$

(ix) State two precautions taken to ensure accurate results.

[Attach your traces to your answer booklet.]

(b) (i) State the conditions necessary for total internal reflection of light to occur.

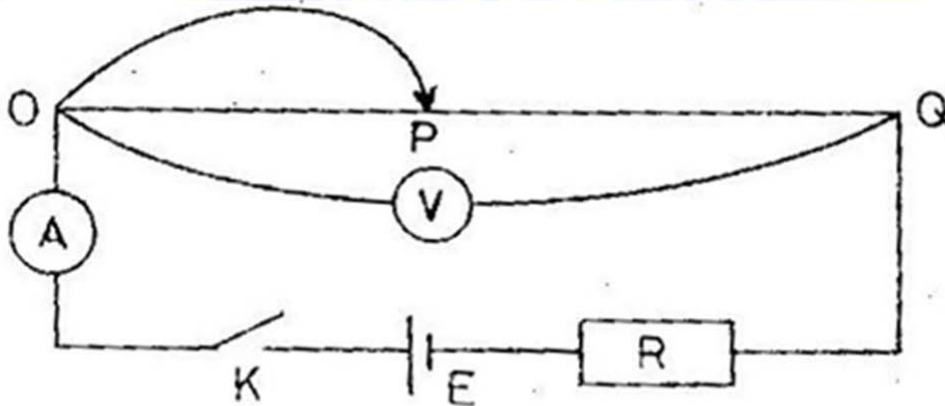
(ii) The critical angle for a transparent substance is 39° . Calculate the refractive index of the substance.

This question was satisfactorily answered by candidates. They were expected to show trace of the incident ray, the emergent ray and the angle of deviation, d . Values of the glancing angle ϕ and angle of emergence, e were to be correctly shown in the correct trend to score, (i.e. ϕ decreases as d increases). Also d decreases and later increases with decreasing ϕ .

Most candidates substituted correctly their values for u and d_m in calculating the value for n .

Question 3

(a)



You are provided with a potentiometer OQ, an ammeter A, a voltmeter V, a standard resistor R, and other necessary apparatus.

(i) Set up a circuit as illustrated in the diagram above.

(ii) Close the key, K.

(iii) Read and record the ammeter reading I_0 and the voltmeter

reading

V_0 when the jockey, J is not making contact with the potentiometer wire.

(iv) Using J, make contact with the potentiometer wire OQ at a point

P

such that $OP = 10$ cm.

(v) Read and record the current I and the corresponding value of V .

- and
- (vi) Repeat the procedure for other values of OP = 20, 30, 40, 50, 60 cm.
 - (vii) Tabulate your readings.
 - (viii) Plot a graph with V on the vertical axis and I on the horizontal axis starting both axes from the origin (0,0).
 - (ix) Determine the slope, s, of the graph.
 - (x) Determine the value of V when I = 0.
 - (xi) State two precautions taken to ensure accurate results.

- (b) (i) Explain how a moving-coil galvanometer may be converted into a voltmeter.
- (ii) A cell of e. m. f 2 V and internal resistance of 1Ω passes current through an external load of 9Ω . Calculate the potential drop across the cell.

(a) Candidates were expected to read and record the values of the emf of the accumulator, R, and I to at least one decimal place and I^{-1} recorded to at least 3 significant figures respectively.

Most candidates were able to do this correctly. Candidates were expected to plot a graph of R against I^{-1} starting both axes from the origin, O, for the intercept, C to be correctly read on the R-axis.

- (b) (i) To score, candidates were expected to state that the lead-acid accumulator has a low internal resistance and therefore supplies a higher current than a Leclanche cell. Apart from supplying a higher voltage, it is also rechargeable.

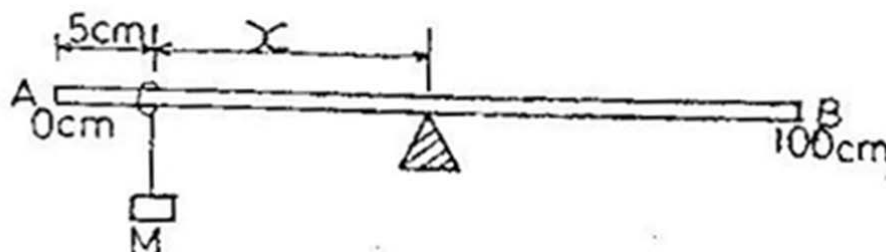
Most candidates were able to state these advantages.

- (ii) Candidates were expected to find the effective value of the parallel arrangement and add it to the resistance in series.
i.e. $R_T = \frac{R_1 R_2}{R_1 + R_2} + R_3$. Most candidates did this correctly.

ALTERNATIVE C

Question 1

(a)



You are provided with a uniform metre rule, AB, a knife-edge, a set of masses and a piece of thread.

- (i) Balance the metre rule horizontally on the knife-edge. Read and record the centre of gravity G, of the rule.
 - (ii) Suspend the body M of mass 30 g, by means of a thread at the 5.0 cm mark of the rule. Balance the loaded rule horizontally on the knife-edge as shown in the diagram above.
 - (iii) Determine and record x, the distance between the body and the knife-edge when the rule is in horizontal equilibrium.
 - (iv) Evaluate x^{-1} .
 - (v) Repeat the procedure for four other values of $M = 50, 70, 80$ and 100g .
 - (vi) Tabulate your readings.
 - (vii) Plot a graph with M on the vertical axis and x^{-1} on the horizontal axis, starting both axes from the origin (0,0).
 - (viii) Determine the slope, s, of the graph.
 - (ix) Determine the value of M for which $x^{-1} = 0$ and the value of x for which $M = 0$.
 - (x) State two precautions taken to ensure accurate results.
- (b) (i) State two conditions necessary to maintain the metre rule in equilibrium in the experiment above.
- (ii) Define moment of a force about a point.

(a) Candidates were required to measure and record values of C, M and x in cm to at least 1 d.p values of x^{-1} were to be recorded to at least 3 sig. fig s. Most candidates failed to do the latter.

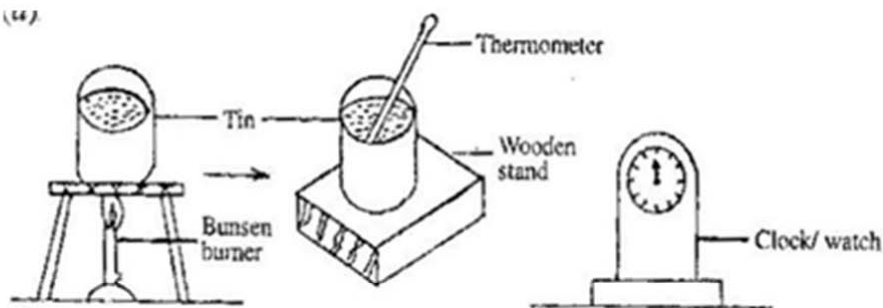
In plotting the graph of M against x^{-1} candidates were required to start both axes from the origin O to enable the values of x^{-1} and M to be determined when $x^{-1} = 0$ and $M = 0$ respectively.

- (b) (i) To score, candidates were required to state that moments are always taken about a point and that for a system in equilibrium, the sum of anti-clockwise moments about a point equals sum of anti-clockwise moments about the same point.
- (ii) The moment of a force about a point is the product of the force and the perpendicular distance of the line of action of the force from that point.

Question 2

(a)

(14)



You are provided with a measuring cylinder, two different tins labelled C and D, thermometer and other necessary materials.

- (i) Use the measuring cylinder provided to measure 120 cm^3 of water and pour it into the tin labelled C.
 - (ii) Heat the water in the tin almost to boiling (90°C).
 - (iii) Remove the tin and place it on a cork or wooden stand.
 - (iv) Insert the thermometer into the tin and record the temperature of the water every minute starting from 85°C until the temperature falls to 60°C .
 - (v) Repeat the experiment with the tin labelled D using exactly the same volume of water and temperature range.
 - (vi) Tabulate your readings.
 - (vii) On the same graph sheet and using the same axes and scales, plot two graphs of temperature on the vertical axis and time on the horizontal axis from the readings obtained using tins C and D.
 - (viii) Label the graphs appropriately as C and D to correspond with the tins used.
 - (ix) From each graph, read off the time taken to cool from 85°C to 65°C .
 - (x) State two precautions taken to ensure accurate results.
- (b) (i) Explain how heat losses by radiation and convection are minimized in a vacuum flask.
- (ii) State four factors which affect the rate of evaporation of a liquid in an open container.

- (a) Most candidates were able to read and record correctly the values of θ_c , θ_p and t in the correct trend. At t increases, θ_c and θ_p against t correctly plotted would enable candidates to read off times taken to cool from 85°C .

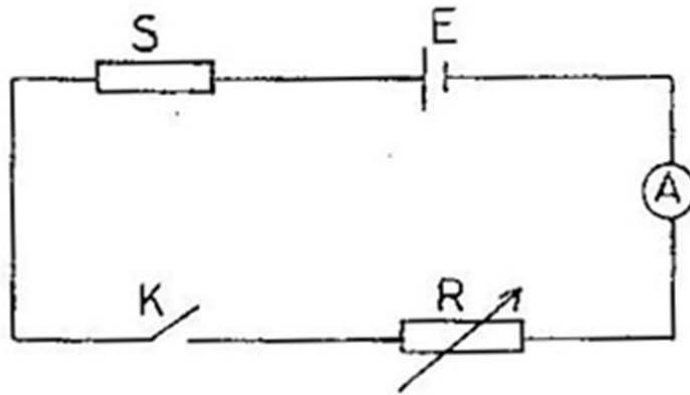
Most candidates approached this correctly.

- (b) (i) Most candidates stated correctly that for total internal reflection of light to occur;
- light must be moving from an optically dense medium to an optically less dense medium;
 - Angle of incidence i in the dense medium must be greater than the critical angle, c .

- (ii) Candidates substituted correctly in the formula $n = \frac{1}{\sin C}$.

Question 3

(a)



You are provided with a resistance box R , an ammeter A , a standard resistor S , a cell E , a key K , and connecting wires.

- (i) Measure and record the e.m.f of the accumulator.
 - (ii) Set up a circuit as illustrated in the diagram above.
 - (iii) Close the key K .
 - (iv) With $R = \Omega$ read and record the ammeter reading I .
 - (v) Evaluate and record $I-1$.
 - (vi) Repeat the procedure for $R = 1, 2, 3, 4$ and 5Ω .
 - (vii) Tabulate your readings.
 - (viii) Plot a graph with R on the vertical axis and $I-1$ on the horizontal axis, starting both axes from the origin $(0,0)$.
 - (ix) Determine the slope, s , of the graph and the intercept, c , on the vertical axis.
 - (x) State two precautions taken to ensure accurate results.
- (b)
- (i) State two advantages of a lead-acid accumulator over a leclanche cell.
 - (ii) A parallel combination of 6Ω and 4Ω resistors is connected in series with a resistor of 5Ω and a battery of negligible internal resistance. Calculate the effective resistance in the circuit.

- (a) Candidates were required to read and record values of I_0 and V_0 to at least 1 d.p and values of I and V in the correct trend and in the correct unit.

Most candidates had the correct trend. In plotting the graph of V against I , candidates were to start both axes from the origin O . This would enable candidates to read of the value of V when $I = 0$.

- (b)
- (i) To convert a moving coil galvanometer to a voltmeter, a high resistor is connected in series with the galvanometer.
 - (ii) Candidates were able to substitute correctly in the required formula to obtain the current, I and then the voltage V .

PHYSIC 2

1. GENERAL COMMENTS

The standard of the paper compared favourably with that of previous years. The questions were well selected from a wide spectrum of the syllabus and devoid of ambiguities.

The performance of candidates on the whole was good.

2. A SUMMARY OF CANDIDATES' STRENGTHS

Commendable strengths exhibited by candidates included;

- (1) Stating principles, theories and definitions as required;
- (2) Offering explanations to scientific occurrences ;
- (3) Evaluation of mathematical problems;
- (4) Applying stated laws to solve mathematical problems and applications;
- (5) Listing factors which determine given parameters.

3. A SUMMARY OF CANDIDATES' WEAKNESSES

Some weaknesses observed in candidates' responses which adversely affected their performance included the following:

- (1) Incorrect definition of scientific terms;
- (2) Making deductions from stated laws;
- (3) Quoting inappropriate formula to solve mathematical problems;
- (4) Choice of unsuitable scales for plotting graphs ;
- (5) Stating incorrect scientific laws.

4. SUGGESTED REMEDIES

- (1) Teaching and learning facilities should be improved in schools;
- (2) Students should be encouraged to put in much effort in doing extra work in the area of solving mathematical problems.

5. DETAILED COMMENTS

Question 1

The frequency f of a transverse wave in a stretched string depends on the length l , tension T and linear density m . Deduce the formula for f in terms of l , T and m using dimensional analysis.

This question was poorly done.

Candidates were required to use dimensional analysis to obtain the formula frequency, f , from the given parameters, length L , tension, T and linear density, m .

Most candidates failed to state $[m]$ correctly as ML^{-1} which was wrongly stated as ML^{-3} .

Question 2

Write down the complete truth table for a two-input.

- (a) **AND gate;**
- (b) **OR gate.**

Most of the candidates satisfactorily answered this question. It must be noted that the only time an:

- AND gate produces an output of 1 is when both inputs are 1, and any other input arrangement is 0.
- OR gate produces an output of 0 is when both inputs are 0; and any other arrangement produces 1.

Question 3

What is an equation of state for:

- (a) **n moles of an ideal gas;**
- (b) **one mole of a real gas assuming that, the intermolecular forces are significant but the volume of the molecules is negligible.**

Majority of candidates were able to attempt this question satisfactorily.

- (a) In this part, most candidates could not read that real gas is assumed to have significant intermolecular force but negligible molecular volume, has the same ideal volume, v hence $(P + a/v^2) = RT$ is the expected equation of state for one mole of such a special gas.

Some candidates wrongly stated the equation $(P + a/v^2)(v - b) = RT$ as though the molecular volume of each molecule is negligible in the ideal case before correction in the real gases.

Question 4

- (a) **State the principle of conservation of charge in a network.**
- (b) **Use the answer in (a) to deduce Kirchhoff's junction rule.**

The few candidates who attempted it used current I ; instead of charge of as though they were stating Kirchhoff's junction rule.

The principle states that the net charge, of Q at any junction is zero.

Question 5

A coil having 1000 turns and a length of 31.4 cm carries a current of 5 A. Calculate the:

- (a) **magneto motive force;**
- (b) **magnetizing force.**

- (a) Majority of candidates were unable to state that magnetomotive force = number of turns x current.
- (b) Magnetizing force = $\frac{\text{magnetomotive force (mmf)}}{\text{Length of coil}}$

Question 6

(a) **How is a single-stage amplifier biased to operate in the active mode?**

(b) **Why is a p-n-p transistor a bipolar device?**

This question was unsatisfactorily answered.

Candidates are to note that for a single-stage amplifier to operate in active mode, then

- (i) E - B junction is forward biased.
- (ii) C - B junction is reverse biased.

Question 7

(a) **State Newton's law of universal gravitation.**

(b) **State the conditions necessary for a satellite to be in motion in a circular orbit.**

The law was correctly stated by most candidates however, some candidates stated that force varies inversely with the distance instead of varies inversely with the square of distance.

Question 8

(a) **What is doping?**

(b) **Explain how doping improves the conductivity of a semiconductor.**

- (a) Majority of candidates answered this question satisfactorily.
- (b) Doping reduces the energy gap between the conduction band and the valence band so that charges of minimum energy can move into the conduction band which otherwise would not have been able to do so.

Question 9

A train moving, with a speed of 40 ms⁻¹ sounds its whistle as it approaches a stationary observer. If the frequency of the sound produced is 500 Hz, determine the frequency of the sound heard by the observer as the train approaches him.

[Speed of sound in air = 345 ms⁻¹]

This question was well answered by most candidates except few candidates who misquoted the formula which should have been $f_o = \frac{(v)f}{v-v_s}$.

Question 10

- (a) Define the term beat frequency:
- (b) State two uses of beats.
- (a) Majority of candidates defined the term ‘beat’ instead of “beat frequency”: i.e. the difference between two notes of nearly equal frequencies.
- (b) This question was well-answered by most candidates.

Question 11

- (a) List three facts about acceleration of free fall due to gravity.
- (b) List two objects each which may be considered as projectile in
- sports;
 - warfare.
- (c) A ball of mass 120 g was projected vertically upward from the earth surface with a speed of 25 ms^{-1} . The height of the ball was determined at regular intervals as shown in the table below.

| Height H/m | Time t/s |
|------------|----------|
| 11.25 | 0.5 |
| 20.00 | 1.0 |
| 26.25 | 1.5 |
| 30.00 | 2.0 |
| 31.25 | 2.5 |

- (i) Plot a graph with height H on the vertical axis and time t on the horizontal axis, starting both axes from the origin (0,0).
[Draw a smooth curve through the points]
- (ii) Using the graph determine the height of the ball at $t = 1.7 \text{ s}$.
- (d) The combined mass of a bicycle and its rider is 60 kg.
Calculate the magnitude of the forward force produced by the bicycle if its speed increases from 10 ms^{-1} to 15 ms^{-1} in 3.0 s .
[Neglect friction and air resistance]
- (a) Majority of candidates answered this question satisfactorily.
Few candidates could not realize that the value of $g = 9.8 \text{ ms}^{-2}$ is not universal.

Question 12

- (a) Explain why, in hot weather, water can be kept cool by storing it in a clay pot.
- (b) List two effects of heat on a substance.
- (c) The floor of a rectangular swimming pool 1.6 m deep, measure 10 m by 5 m. A heater rated 100kW is used to raise the temperature of the water in the pool from 12 °C to 30 °C. Assuming no heat loss, calculate the:
- mass of water in the pool;
 - pressure exerted on the floor of the pool;
 - quantity of energy supplied by the heater;
 - time, in hours taken to raise the temperature of the water from 12 °C to 30 °C.

[Density of water = 100 kgm^{-3} ; specific heat capacity of water = $4200 \text{ J kg}^{-1} \text{ K}^{-1}$;

- (d) List two factors that could change the cooling rate of the water in the pool when the heater is switched off.

- (a) The process by which water is kept cool in a clay pot is simply by the process of cooling by evaporation.
- (b) This question was well-answered by most candidates.
- (c) Most candidates could not realize that pressure exerted on the floor is in two parts, the atmospheric pressure and that due to the water. ie Pressure required = Patmospheric + Calculated pressure.

Some candidates could not express 100 kW in S. I unit as 100000 W before substituting to get the time.

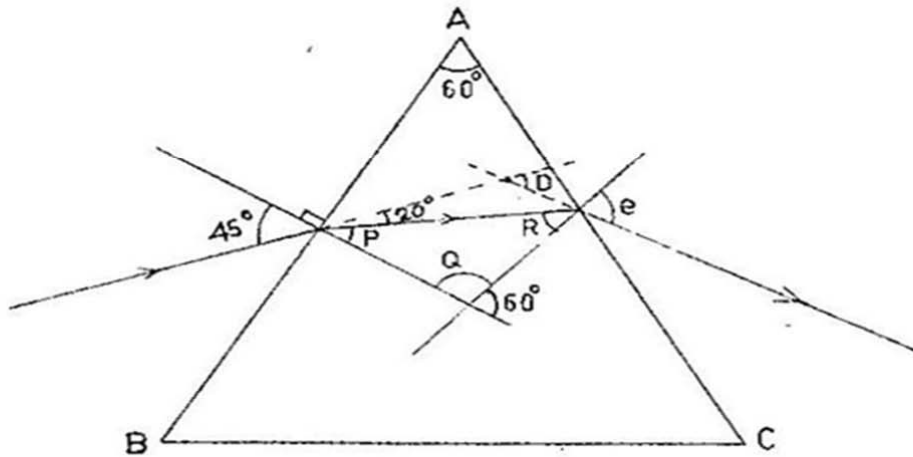
- (d) Factors that could change the cooling rate of the pool are not necessarily factors which affect cooling rates.

Mention of temperature is incorrect, it has to be surrounding temperature/atmospheric temperature.

Question 13

- (a) List two factors that determine the velocity of a wave.
- (b) State two:
- differences between a transparent medium and a translucent medium?
 - examples of each of the media.

(c)



Study the ray diagram above and use it to answer the questions that follow.

Calculate the:

- (i) values of angles P, Q and R;
 - (ii) refractive index n of the glass prism;
 - (iii) value of angle e ;
 - (iv) total deviation D .
- (d) The dipper of a ripple tank generates water ripples such that the distance between two successive crests is 5 cm. If the ripples cover a distance of 60 cm in 4 seconds, calculate the frequency of the vibrator.

(a) Candidates did not realize that factors that determine the velocity of waves do not include 'frequency' and 'wave length'. They are infact characteristics/properties.

- (b) Difference between transparent and translucent as required are:
- Light passes easily through transparent material but in translucent where the light may pass through with difficulty.
 - Objects can be seen through clearly in the case of transparent materials unlike translucent materials.
 - Quite a number of candidates could not answer this question satisfactorily.

- (c) (i) P, Q and R could be found easily from geometry. eg. $P + 20^\circ = 45^\circ$.
 (ii) Many candidates used the Snell's law correctly but could not substitute values

Correctly i.e.

$$n = \frac{\sin i}{\sin r} = \frac{\sin 45^\circ}{\sin P} = \frac{\sin 45^\circ}{\sin 25^\circ}$$

i.e. $n = 1.67$

of (iii) Some candidates could not remember to apply the principle of reversibility

light

$$\text{i.e. } n = \frac{\sin e}{\sin R}$$

$$1.67 = \frac{\sin e}{\sin 35^\circ}$$

from which e could be determined as 73.5°

(iv) The total deviation $D = 20^\circ + (e - R)^\circ$
 $D = 20^\circ + (73.5^\circ - 35^\circ)$
 $D = 58.3^\circ$

Majority of candidates could not work the problem correctly because they assumed minimum deviation was what occurred.

(d) The frequency, f of the vibration = $\frac{v}{\lambda}$

$$v = \frac{\text{distance}}{\text{time}} = \frac{60 \text{ cm}}{45 \text{ cm}} = 15 \text{ cm}^{-1} = 0.15 \text{ ms}^{-1}$$

Some candidates could not identify that $\lambda = \text{distance between two successive crests} = 5 \text{ cm}$
Hence were unable to compute $f = \frac{0.15 \text{ ms}^{-1}}{0.05 \text{ m}}$

$$\therefore f = 3 \text{ Hz}$$

Question 14

(a) State two ways in which the earth's magnetic field is beneficial to life on earth.

(b) A power plant generates 20 kV at 5 kA and this is fed to a transformer which steps the voltage up to 132 kV. The output of the transformer is connected to a transmission line of length 150 km.

(i) Why is the power not fed directly to the transmission line at 20 kV, 5 kA?

(ii) Calculate the:

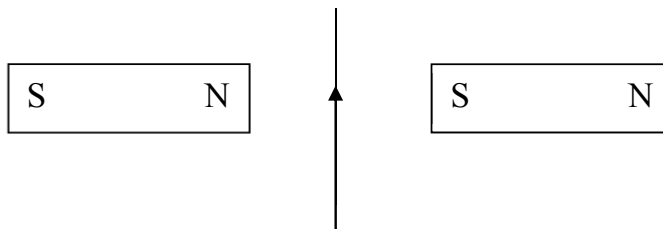
(α) turns ratio of primary to secondary coils in the transformer;

(β) current in the secondary coil of the transformer;

(γ) power loss in the transmission cable if the cable has a resistance of

0.3

$\Omega \text{ km}^{-1}$.
[Assume 100% efficiency]



- (c) A current carrying conductor is placed between the opposite poles of two magnets as illustrated in the diagram above.
- (i) State the two changes that are necessary to reverse the direction of motion of the conductor.
 - (ii) List two factors on which the magnitude of the force on the conductor depends.

Candidates were required to state benefits of earth's magnetic field as

- navigation by sailors
 - location in high sea
 - protection against harmful cosmic rays etc.
- (b) (i) Reasons why power is not directly fed to the transmission line is that most of the power would be wasted in form of heat ($I^2 R$) because of the distance (150km) on the transmission line.
- (ii) The calculation part was well tackled by most candidates.
- (c) (i) The changes necessary to reverse the direction of motion are:
- reversing the polarity of just one of the magnets
 - direction of current must be reversed
- (ii) Factors on which the magnitude of the force on conductor depends on are:
- length of conductor
 - magnetic field strength
 - magnetic of current through the conductor
 - angle of inclination of the conductor to the magnetic field.

Question 15

- (a) Define:
- (i) half-life;
 - (ii) decay constant.
- (b) State one factor in photoelectric emission, that determines the:
- (i) rate of emission of electrons;
 - (ii) speed of emitted electrons.
- (c) The radio-isotope is produced by bombarding the isotope with a deuteron (^2H). The isotope ^{24}Na disintegrates further by emitting a β - particle to form a new substance Y.
- A beta-particle counter installed near the radioactive isotope ^{24}Na records an initial reading of 243 pulses per minute and 80 pulses per minute a day after.
- (i) Write down balanced equation for the two nuclear reactions.
 - (ii) Calculate the half-life (T) of the radio-isotope

[Hint: $N = N_0 e^{-\lambda t}$]

- (a) This question was satisfactorily answered. Candidates were able to define half life and decay constant as required
- (b) Majority of candidates were able to state one the factor in photo electric emission that determines the rate of electrons as the wavelength/work function/threshold wavelength of the irradiated metal surface.
- (c) Majority of candidates answered this question satisfactorily. They were able to quote the appropriate formula and substituted to obtain the answer.

