RESUME OF SCIENCE SUBJECTS

1. STANDARD OF THE PAPERS

All the Chief Examiners reported that the standard of the papers of the various science subjects was appropriate and comparable to that of previous years.

2. CANDIDATES' PERFORMANCE

The Chief Examiners expressed varied views on the performance of candidates for the various science subjects. Performance in Fisheries, Forestry, General Agriculture, Crop Husbandry and Horticulture, Integrated Science, Physics and Chemistry was good. Candidates for Animal Husbandry and Biology were reported to have performed averagely.

3. A SUMMARY OF CANDIDATES' STRENGTHS

The Chief Examiners noted that candidates performed well in the following topics of the respective subjects.

Biology

Secondary sexual characteristics of males and females
Genetics
Classification of living things

General Agriculture

Ways of controlling tapeworm infestation in farm animals
Preparation of profit and loss account
Contribution of forest to national development

Crop Husbandry and Horticulture

Nutritional importance of vegetables to humans
Reasons for establishing ornamental plants on a school compound
Calculation of plant population

Chemistry

Recognition of types of energy changes from given thermochemical equations
Knowledge of periodic properties (electron affinity and electronegativity)
Faraday's constant, primary and secondary cells
Determination of empirical and molecular formulae for elemental data
Calculation of solubility and concentration in mol dm^{-3} and g dm^{-3}
Plotting of graph from a given set of data

Physics

Presentation of data in a composite table
Derivation of Newton's equation of motion
Use of large triangle in determining slope of graphs

Integrated Science

Definitions of compound and mixture
Environmental factors that affect the life cycle of crops
Plotting of points for the drawing of graphs

Animal Husbandry

Reasons why protein is important in the diet of farm animals
Ways in which egg breakage in poultry house could be reduced
Diseases transmitted by tick
Functions of gizzard, skin and kidney

Forestry

Income generating activities in forestry
Stakeholders of the Forestry Sector in Ghana
Weeds which grow in natural water bodies

Fisheries

Feed ingredients
Water quality parameters

In addition, the Chief Examiners for Integrated Science, Biology, Chemistry, General Agriculture, Crop Husbandry and Horticulture and Animal Husbandry reported that candidates adhered to the rubrics of the papers in addition to exhibiting legible handwritings.

Candidates for Biology, Chemistry, Physics, Animal Husbandry and Forestry were commended by the respective Chief Examiners for the orderly presentation of their responses.

Improvement in the spelling and usage of scientific terms was a noted feature in the responses of candidates for Integrated Science, General Agriculture and Fisheries.

4. A SUMMARY OF CANDIDATES' WEAKNESSES

The Chief Examiners noted that candidates performed woefully in the following topics of the respective subjects.

Biology

Components of the Nervous system
Candidates could not differentiate between structural features and physiological features

General Agriculture

Causes of mortality in broiler production
Steps involved in carrying out germination test on cowpea
Ways of controlling cotton stainer

Crop Husbandry and Horticulture

Explanation of the term monocropping, monoculture, crop rotation and relay intercropping
Differentiating between budding and grafting
Process of floral induction in pineapple production

Chemistry

Unable to distinguish between dehydrating agent and drying agent
The use of kinetic theory of matter to explain how solids change when heated
Elemental analysis of organic compounds
The formation of the dipolar ion (Zwitterion) by amino acids under acidic and alkaline conditions
Inability to state the correct observation of simple experiment (e.g. precipitates were incorrectly described, and inferences stated did not correspond to observations recorded)
Inability to outline how recrystallization is carried out in the laboratory

Physics

Use of odd scales
Failure to record values to the correct number of decimal places
Dimensional analysis
The concept of terminal velocity

Integrated Science

Concept of greenhouse effect and climate change
Functions and structural adaptations of the placenta
Failure to join adjacent points with straight lines on the graph

Animal Husbandry

Explanation of the terms, flushing and steaming up
Determining the number of ducks that could be kept in a given area of land
Sources of calcium and carbohydrates in poultry production
Differences between tick and weevil

Forestry

Uses of bark of a tree
Environmental conservation
Factors that determine the choice of species for forest plantation establishment

Fisheries

Diagrams were poorly drawn

Furthermore, the Chief Examiners lamented that the responses of candidates for some of the subjects showed that they were not adequately prepared for the examination. This feature was reported for Chemistry, Biology, Physics, General Agriculture and Animal Husbandry. Improper usage of the English Language negatively affected the performance of candidates for Biology, Crop Husbandry and Horticulture, General Agriculture and Integrated Science. Candidates were consequently unable to express themselves properly in their responses.

Candidates for Integrated Science, General Agriculture, Physics, Chemistry and Crop Husbandry and Horticulture seem not to have understood the demands of the question and therefore, provided inadequate answers.

Other notable weaknesses reported in the sciences include:

i. Poor drawing skills
ii. Inability to explain simple scientific occurrences
iii. Inability to assign proper units to figures
iv. Inability to draw and interpret graphs

5. SUGGESTED REMEDIES

The Chief Examiners for the science subjects generally recommended that candidates should be taken through many practical lessons to improve their performance. Candidates should be adequately prepared for the examination and also given the needed help to improve upon the usage of the English Language.

The Chief Examiners also made the following suggestions.
Candidates should:

i. be taken through calculation drills to improve upon their speed and accuracy;
ii. learn the conventions of writing scientific or technical terms;
iii. identify and understand the scientific principles underlying everyday occurrence;
iv. be allotted more time during practical lessons;
v. taught the procedure used in practical activities.

ANIMAL HUSBANDRY 2

1. **GENERAL COMMENTS**

   The standard of the paper was comparable to those of the previous years. However, performance of most of the candidates was not encouraging, as quite a number of them performed below average.

2. **SUMMARY OF CANDIDATES' STRENGTHS**

   (i) The candidates did well by answering questions in an orderly manner. A significantly high number of candidates answered different questions on different pages, as indicated in the instructions on the answer booklets. This is commendable, as it reduced the difficulty of marking the scripts.

   (ii) Candidates were quite impressive this year, as majority of them wrote the question numbers in the order in which they answered them on the front page of the answer booklets.

   (iii) Every candidate attempted to answer at least, some of the questions, even though some of them had no idea about the requirements of the questions.

   (iv) Candidates had very little difficulties answering the following questions:

   (a) Reasons why protein is important in the diet of farm animals

   (b) Activities that should be carried out to ensure high performance of improved breeds of sheep

   (c) Ways in which egg breakage in a poultry house could be reduced

   (d) Effects of delayed removal of litter on poultry production

   (e) Ways of controlling cannibalism in poultry production

3. **SUMMARY OF CANDIDATES' WEAKNESSES**

   (i) Some of the candidates had difficulties in understanding some of the questions, thus answers provided in some cases had nothing to do with the question under consideration.

   (ii) It appeared some candidates did not devote enough time to read over their answers to questions, to enable them to correct some omissions and wrongly spelt words. Some of such errors would have been avoided, if they had devoted time to read over their answers.

   (iii) Some candidates provided more answers to some questions, than were required of them. Some of them also answered more than the four questions they were expected to answer for the paper. This behaviour causes the candidates to waste time answering questions which would not contribute to their final grade. Such time could have been spent to improve answers provided for the four main questions.

   (iv) Some of the candidates spend so much time to answer questions, and later cancel them out, probably because they later realized those questions were not the easiest. These

could have been avoided if they spent about minutes to read all the questions at the start of the exams, and decision taken on which ones to attempt or not.

(v) Most of the candidates were unable to form correctly, simple sentences to make meaning to readers. These mostly end up bringing out different meanings from what the candidates intended to write.

(vi) Errors associated with spellings of technical words were very common this year, and this caused candidates to lose precious points.

(vii) Though this year's questions did not involve writing of scientific names, candidates who attempted to write the scientific names of some plant species, mostly the leguminous pasture species, did so without adhering to the rules of presenting scientific names.

(viii) Areas that posed much problems to the candidates include:

(a) Explanations of the terms, flushing in sows, and steaming up in sheep.
(b) Reasons why chicken production is popular than duck production in Ghana
(c) Explanations of the terms; pest, pathogen and zoonotic diseases
(d) Ways by which animals grazing in a hot weather maintain constant body temperatures
(e) Control measures for foot and mouth disease, and examples of animals that could be affected
(f) Determining the number of ducks that could be kept in a given area of land
(g) Sources of Calcium and Carbohydrates in poultry production

4. **SUGGESTED REMEDIES**

(i) Candidates need to improve their reading skills, to enable them to build more vocabularies for use under examination situations.

(ii) At the start of a paper, candidates are entreated to ***spend about five minutes of their time*** to read and understand all the questions, and also decide on questions to attempt before they start to provide answers to them.

(iii) Teachers need to emphasize the need for candidates to obey instructions during examinations. This will help them to spend good time to answer the right number of questions, rather than ***wasting time in providing additional answers*** to some questions.

(iv) Candidates should be advised to convince themselves on which questions they wish to answer, before starting to provide answers to them. This will help minimize the excessive cancellation of answers to a whole question, after wasting time to write all those answers.

5. DETAILED COMMENTS

Question 1

(a) Name three breeds of goats reared in Ghana.

(b) Explain each of the following practices as used in livestock management:

(i) disbudding in cattle;

(ii) flushing in sows;

(iii) steaming up in sheep.

(c) Give four

(i) advantages of the free-range system of rearing animals;

(ii) disadvantages of the free-range system of rearing animals.

(a) Quite a number of the candidates got this wrong, but a significant number of candidates were on point.

It was commonly observed that some of the candidates listed temperate breeds of goats as among those reared in Ghana. It is worth noting that some of these breeds of goats do not survive under tropical conditions, and thus not suitable for the climatic conditions in Ghana.

Some candidates just wrote "Sokoto" or "Sokoto Gudali" for "Sokoto red" goats. It should be noted that these are names of a town and a breed of cattle respectively, so did not earn any score. In addition, since answers expected for this question were names, candidates needed to have spelt them correctly to score. Consequently, a lot of them did not score due to wrong spellings of names.

The expected answers were:

- Saanen goat;
- West African dwarf;
- West African long legged / Sahel / Sahellian goat / Touareg;
- Sokoto Red;
- Kano Brown;
- Bornu white;
- Bornu Red;
- Boer goat;
- Alpine.

(b) In all, this was the most answered question among the lot. Quite a number of candidates attempted this question. Whiles a good number of candidates got them right,

others did not really understand what the terminologies meant. Teachers need to emphasize these terminologies to clarify them.

Some of the candidates did not seem to know the difference between ***disbudding*** and ***dehorning,*** so they were defining dehorning for disbudding.

Others defined weaning and artificial insemination for flushing and steaming up respectively. It was obvious such candidates did not know what those terminologies meant, hence the answers provided.

The following answers were expected:

(i) Disbudding in cattle

Disbudding is the removal of the horn producing bud of young calf using caustic soda stick / hot iron.

Reasons: It allows for easy handling of the animal / makes the animal gentle or calm, controls horn cancer, reduces injury to other animals and personnel, creates space in the pen.

(ii) Flushing in sows

Flushing is the provision of sufficient and nutritious feed to dams, two to three weeks before mating.

Reasons: It is done to induce ovulation and increase multiple birth

(iii) Steaming-up in sheep

This is the provision of additional concentrates of high nutritive value to pregnant-dam in the last two to three weeks preceeding lambing.

Reasons: It helps the dam build up enough energy for early lactation / boosts milk production, satisfies the nutritional requirement of the growing foetus / ensure delivery of healthy lambs, provides energy for parturition.

Majority of the candidates just defined the terminologies without indicating how they are performed, nor reasons behind their practice. It should be noted that candidates were asked to ***explain the practices***, and therefore, it was expected that they indicate ***what it was***, ***how it is done***, and ***at least a benefit of performing that exercise***; for a full score. Consequently, most of them earned partial scores for this question.

(c) This appeared to be one of the easy questions for the candidates. Almost everybody provided two or more correct responses for this question. Candidates were creative and practical with the responses provided for this question.

The only challenge observed was that, some of the candidates wrote the opposite of the advantages indicated earlier, as disadvantages; which were in most cases, incorrect.
In addition, candidates should take note that under the free-range system of livestock keeping, ***disease incidence is high*** due to the high probability of animals picking up pathogens from stray animals or decomposing feed materials, but ***disease spread is low*** under this system because animals do not live close together for a long period. Quite a number of the candidates interchanged these points, hence did not score.

Question 2

(a) Explain each of the following terms as used in animal nutrition;
- **(i) roughage;**
- **(ii) concentrate.**

(b) Give six reasons why protein is important in the diet of farm animals.

(c) (i) Define the term fodder crop.
- **(ii) Name two pasture legumes used to feed ruminants.**

(d) State four causes of feed contamination in animal production.

(a) This was the most popular question Quite a number of the candidates provided correct answers to the questions. However, a significant number did not score because they did not bring out the major distinguishing key words, thus, had partial scores. It should be noted that concentrates are feed materials which have ***low fibre content***, and with ***high levels of digestibility***. Roughages on the other hand have ***high levels of fibre*** and with ***low digestibility***.

(b) This question appeared not to have posed any challenge at all to the candidates. Majority of the candidates scored four or more points for this question. The only challenge encountered was that some of them listed points which were similar as separate points. E.g. Proteins build cells, build tissues and promote growth. It should be noted that all these points talk about growth, and therefore, a candidate who stated all those points scored for only 1, since all the points meant the same thing.

Other importance of proteins in animal's diet are:
- needed for formation of gametes;
- for production of anti-bodies;
- for repair of worn-out tissues;
- for production of enzymes;
- for production of hormones;
- for formation of exoskeleton such as hair, hooves;
- forms a significant component of blood;
- serves as a source of energy under stressful conditions;

- required for production of milk, eggs, muscles;
- promotes growth;
- help maintain fluid balance in the body.

(c) This question was also quite challenging to the candidates, as a number of them did not know the difference between ***forage*** and ***fodder***; hence most of them defined forage in place of fodder. Fodder crops are arable crops / plants which are established for the purpose of feeding ruminants and are fed in the form of cut and carry, silage or hay. For the examples of pasture legumes, most of the candidates ignored the "legume", and listed non-leguminous species instead, thus they did not score for those.

Examples of legumes include:

- Centrosema - Calopogonium
- Mucuna - Stylo / stylosanthes
- Moringa - Pueraria
- Leuceana - Alfalfa

In addition, though the question did not demand scientific names of those plant species, some of the candidates listed the scientific names but failed to either spell them correctly, underline them separately, or failed to start the genus name with a capital letter, and the species name with a small letter. It should be noted that for scientific names to score full marks, all these rules must be applied.

(d) Over here, candidates were expected to provide reasons why feed could get contaminated prior to feeding animals with it. However, some of them rather indicated causes of feed wastage, among others. It should be noted that once wholesome feed is offered to animals and they eat what they can, urine and faeces mixing with the rest is considered as wastage, but not contamination.

Causes of feed contamination include:

- inappropriate storage facility / high humidity or moisture;
- feaces and urine from pests;
- pest attack;
- using unwholesome ingredients / adulterated ingredients;
- use of contaminated equipment / tools / packaging materials;
- serving feed in contaminated containers / troughs;
- fungal infestation / mouldiness.

Question 3

(a) (i) Mention the four organs responsible for excretion in farm animals.

(ii) Name one substance excreted by each of the organs mentioned in (a)(i).

(b) State four functions of

(i) blood;

(ii) skin.

(c) State four activities that should be carried out to ensure high performance of improved breeds of sheep.

(a) This question was one of the simplest and as such, significant number of candidates were on point. However, some of the candidates listed *anus, nose* and the *male and female reproductive organs* as excretory organs.

The correct answers given by most candidates were:

- lungs;
- liver;
- skin;
- kidney.

In addition, majority of the candidates listed sweat and urine as substances that are excreted by the skin and kidney respectively. It should be noted that sweat and urine are products of excretion, and these consist of a number of substances. For instance, urine has substances such as water, salt, urea and ammonia. Sweat on the other hand contains substances such as urea, water and salt. These were what were expected of the candidates.

(b) (i) Similar to the earlier question, this was also quite simple, thus candidates did not struggle much to provide correct responses. However, it was observed that some of the candidates indicated that blood helps the body to survive, to function well, etc. These were not accepted because candidates were expected to state specific functions or roles of blood in the body such as:

- transports oxygen and carbon dioxide;
- distributes food nutrients;
- regulates body temperature;
- removes waste products from the body;
- transports hormones;
- protects body against diseases;
- regulates pH in the body.

Others also stated uses of blood in place of the roles, thus, for blood meal etc.

(ii) Considering the functions of the skin, some candidates listed several points which meant the same thing. For example, the skin protects the heart against injury, protects the kidney against injury, protects the bones against injury etc. It should be noted that all these points fall under protection of organs against injury, hence some candidates scored less than they should have, if the points were not related.

Functions of the skin include:

- for protection;
- for excretion of salts;
- synthesizes vitamin D;
- for temperature regulation;
- for secretion of sebum;
- acts as a sensory organ / sense of feel;
- responsible for pigmentation / skin colour.

Some of the candidates also listed products that are obtained from the skin, rather than roles played to the live animals. It should be noted that ***functions*** of the skin refer to benefits that the live organism derive from the skin, whiles ***uses*** of the skin refer to products obtained from the skin.

(c) This question did not pose much problems to the candidates. Majority of candidates were on point, regarding this question. There were no general issues with this question. Those who provided incorrect answers were those who had no idea about what the question meant.

Question 4

(a) Mention two sources of each of the following nutrients in poultry production:
- **(i) calcium;**
- **(ii) carbohydrate.**

(b) State four ways in which egg breakage in poultry house could be reduced.

(c) Give four reasons why chicken production is more popular in Ghana than duck production.

(d) The recommended stocking rate for ducks in a semi-intensive run 0.3 m2 per duck. If a community has a grass run of 0.2 hectares, how many ducks would be needed to fully stock the run?

(a) This question was straight forward and very simple, as a good number of candidates were on point. However, instead of sources of the nutrients, some of the candidates rather listed the roles of those nutrients in the diets of livestock. Such candidates probably didn't read to understand the questions before attempting to answer. Candidates are advised to take their time to read and understand questions before attempting to answer.

(b) Candidates understood the question and actually knew some of the answers to this question. The problem was with their inability to form correct and complete sentences to bring out facts. Some candidates also indicated that birds should be kept in a battery cage system to reduce egg breakage. This point was not accepted because candidates were asked what should be done in a poultry house, and it's worth noting that ***the battery cage is also a poultry house***, so though it reduces egg breakage compared with the deep litter system, candidates were expected to indicate what should be done to reduce egg breakage even if the battery cage was in use.

Ways of reducing egg breakage in a poultry house:

- remove broody hens from nesting area;
- avoid agitating the birds;
- avoid overcrowding in deep litter system;
- collect eggs regularly;
- provide sufficient calcium in the feed / balanced diet;
- avoid careless handling of eggs;
- prevent / control diseases;
- supply adequate feed and water;
- provide sufficient nests / nesting space;
- prevent attack of rodents and vermins;
- ensure gentle slope of cage;
- debeak the birds;
- use appropriate packaging material;
- provide sufficient floor litter;
- do not feed fresh egg shells to birds;
- cull egg-eating birds.

(c) This question was also quite problematic to the candidates. Quite a number of them did not get it right. Most of the points raised by the candidates were rather in favour of ducks, for instance, some said chicken grow faster than ducks, meat of chicken is more tender, chicken are more prolific than ducks etc. It is worth noting that ducks rather grow faster than chicken, are more prolific than chicken, and the fatty nature of their meat makes the meat tender and tastier than chicken.

In addition to these, some of the answers did not show comparison between duck and chicken. For example; an answer as "its meat is tasty", is confusing as one cannot tell which of the two (duck or chicken) the candidates were referring to.

The following answers were expected:

- chicken meat is preferred to duck meat;

- chicken eggs are preferred because of their acceptable taste and colour;
- chicken is easier to manage in an intensive system;
- chicken need less floor space;
- chicken crows for time alert;
- chicken has less fat content;
- chicken is more readily available;
- chicken does not need water body for rearing / lower water requirement;
- chicken eggs hatch earlier than duck eggs;
- market is readily available for chicken;
- ducks have the tendency of flying off and not coming back;
- chicken require less feed than ducks / lower cost of production.

(d) This question appeared to have been the most challenging among the lot. Majority of the candidates did not score even a single mark for this question.
The problems observed were in three folds:

Some of them could not correctly do the conversion of 0.2 ha to m^2. Consequently, answers obtained were incorrect. Others could not quote the formula correctly, hence could not get the correct answer. Others got the formula and the conversions right, but the final answers were incorrect because the candidates either left the answer in a decimal form or rounded them up to a higher whole number. The expected answer was 6,666 ducks. Those who left the answers with decimals were marked down because for live animals, there cannot be decimals (0.7 of an animal for instance); e.g. 6,666.7 ducks. Those who rounded-up to make the answer 6,667 were also marked down because keeping that number of ducks in the space provided would result in overstocking of the ducks. It should be noted that when it comes to stocking density, lower densities are better for improved stock performance, and the slightest overstocking could have adverse effects on the stock of animals.

The steps involved are:
Stocking rate - 0.3 m^2 / duck
Size of run - 0.2 ha
Area of run in m^2 = 0.2 x 10,000 m^2 / ha
= 2000 m^2

No. of ducks to stock run = $\frac{\text{Area of run}}{\text{Stocking rate}}$

= $\frac{2000\ m2}{0.3\ m2}$
= 6,666 ducks

Question 5

(a) (i) Explain each of the following terms as used in animal production:

(α) pest;

(β) pathogen;

(γ) zoonotic disease.

(ii) Give one example of each of the terms in (a)(i).

(b) Discuss foot and mouth disease under the following headings:

(i) causal agent;

(ii) two symptoms;

(iii) two control measures;

(iv) two animals that could be infected.

(c) Explain two factors that could increase parasite population on an animal farm.

(a) For the definition of pest, it was realized that most of the candidates misread it as "pets". This consequently adversely affected the examples given. This could probably be due to impatience on the side of the candidates, who failed to spend some time to carefully read and understand the questions.

Some candidates also defined pathogens as ***diseases caused by microorganisms***. Candidates should note that ***pathogens are not diseases*** but are ***microorganisms that cause diseases***.

Most of the candidates defined a zoonotic disease as one ***that affects both man and animals***. This definition is inappropriate and is worth noting that zoonotic diseases are diseases that are ***contracted*** or ***transferred from animals to humans***, and vice versa.

(b) Over here, candidates who really knew something about the disease performed quite well. However, it was evident that those who got the answers wrong, appeared not to have ever heard or know much about the disease.
Candidates tried to use several words to describe **"*blisters"*** associated with the disease. Some of them said swellings around the mouth and feet, boils on the mouth, etc. These answers indicated that the candidates at least, knew what they were talking about, or had practical knowledge on the disease.

(c) Candidates were expected to state and explain factors that cause increases in parasite population on animal farms. However, most of them stated the factors without explaining them. Consequently, such candidates earned partial scores for this question.

Question 6

(a) State four ways in which each of the following factors affect animal production:

(i) low temperature;

(ii) high relative humidity.

(b) State four ways in which animals grazing in a hot weather maintain a constant body temperature.

(c) State five effects of delayed removal of litter on poultry production.

(d) State three ways of controlling cannibalism in poultry.

(a) This question did not pose much challenges to the candidates. The only issue encountered were candidates' inability to spell correctly some words and that caused them to lose some scores.

Some candidates were not sure if there was any difference between low temperature and high relative humidity, so they stated similar answers for both low temperature and high relative humidity.

The following answers were expected:

(i) Low temperature

- Huddling of birds could result in suffocation;
- increases feed intake and hence cost of production;
- reduces feed efficiency as more nutrients / energy is needed for body maintenance;
- it leads to low water intake which affects the quality and quantity of products such as egg and milk;
- extremely low temperatures retard growth due to decreased water intake;
- vices such as cannibalism is more pronounced under low temperature conditions;
- extremely low temperatures could lead to chilling and death / cold stress.

(ii) High relative humidity

- favours growth of pathogens;
- leads to mouldiness as fungal activities are high;
- leads to stressful conditions;
- leads to reduction in feed and water intake;
- cause wet litter leading to ammonia build up and its consequent problems;
- enhances pasture growth;
- enhances growth of pests / parasites.

(b) This question, though simple, was misunderstood by some of the candidates. They rather indicated what should be done to the grazing animals to maintain constant body temperature. It is worth noting that the answers expected were referring to what the animals do in such situations, but not what the caretaker should do such as:

- staying under shade;
- sweating;
- reduced activity / grazing;
- frequent urination;
- drinking more water;
- panting.

(c) This question was quite simple and straightforward. Consequently, most of the candidates did not find any challenges providing responses to them. Those who got them wrong were candidates who had no idea about the question.

(d) Candidates did not find much challenges with this question. Majority of the candidates scored high marks in this question. It appeared to be the most answered question among the lot and answers such as:

- introduction of forage to distract the birds;
- provision of balanced diet especially addition of calcium and phosphorus
- provide adequate feed;
- debeaking of birds;
- use of required stocking density;
- proper ventilation;
- avoid keeping birds of different ages in the same pen;
- provision of adequate feed and water troughs;
- cull or isolate wounded birds.

In conclusion, I wish to advise candidates to improve their reading habits in order to build good vocabulary base. During examinations, they should spend the first 5 minutes to read over the questions, ensure they know what is expected of them, and select questions they intend to answer before starting work. This would go a long way to improve their time efficiency, as well as performance in examinations.

ANIMAL HUSBANDRY 3

1. GENERAL COMMENTS

The standard of the paper was comparable to those of the previous years. The general performance of the candidates was slightly above average.

2. SUMMARY OF CANDIDATES' STRENGTHS

(i) The handwriting was legible
(ii) They adhered to the rubrics of the paper
(iii) Generally, candidates did not copy the questions in their booklet before answering
(iv) Answers were presented logically
(v) Topics/areas that were well answered are:
  (a) Economic importance of pests, parasites, diseases
  (b) Diseases transmitted by ticks
  (c) Ways of controlling round worms
  (d) Parts of debeaked head of a bird
  (e) Functions of gizzard, skin, kidney

3. SUMMARY OF CANDIDATES' WEAKNESSES

(i) English language was a challenge to most of them in the following area
  (a) sentence construction which was grammatically wrong and meaningless
  (b) spelling mistakes was the order of the day for most candidate for technical words E.g. Tik for Tick, animea for anaemia, winds for wings, Babiciosis / Babeciosis for Babesiosis, knif for knife, Budizzo/Burddizo for Burdizzo, emansculator for emasculator, scarpel for scalpel, excreatory for excretory
(ii) Their knowledge on differentiating between two specimens is very poor. Some could not tabulate it whilst others could not use the required conjunction to differentiate between specimens
(iii) Some candidates answered some part of a question on a page and moved some leaflets away to continue the same question without making reference to the final page to the examiner in marking
(iv) The areas or topics which were poorly answered included the following:
  (a) Differences between tick and weevil
  (b) Uses of iodine tincture
  (c) Management practices carried out on the beak of a bird
  (d) Steps involved in debeaking

4. SUGGESTED REMEDIES

(i) Teachers should encourage their students to construct sentences correctly. Spelling drills and exercises will also help students to communicate more effectively
(ii) Candidates should familiarize themselves with the technical terms or words

(iii) Candidates should cultivate the habit of reading good books to correct deficiencies in their language
(iv) Candidates should read the rubrics carefully and comply
(v) Teachers should study the Chief examiners report thoroughly and address the deficiencies observed

5. DETAILED COMMENTS

Question 1

(a) Give three observable differences between specimens A and B.
(b) State three effects of specimen A on farm animals.
(c) List three diseases that could be transmitted by specimen A.
(d) Mention three ways in which specimen B is of economic importance in animal production.

The general performance on this question was good but for question 1 (a) where most of the candidates instead of the features used the role they play in animal production

(a) Most candidates were not able to differentiate between Tick and Weevil. Those who tabulated could not point out the visible characteristics between the two. Some mentioned Ticks cannot fly but weevils can fly without relating it to the visible structure which can perform the feat e.g. wings. Those who could not tabulate but stated did not provide any conjunctions. E.g. tick is big in size. Weevil is small in size without any conjunction. It should be stated that, tick is big in size whilst weevil is small in size.

Another observation was that candidates did not understand the word "pair" so some stated, "tick has four legs and weevil has three legs instead of "Tick has four pairs of legs whilst weevil has three pairs of legs'. It is quite easier if candidates could use tabulation in differentiation rather than the statement form. E.g.

Specimen A	Specimen B
Has four pairs of legs	Has three pairs of legs
Body divided into two parts	Body divided in three parts
Absence of antennae	Presence of antennae
Absence of rostrum	Presence of rostrum

(b) This part was well answered. Candidates were able to provide the required answers such as:
- they suck blood causing anaemia

- bites causing irritation / restlessness
- causes loss of weight etc

(c) Candidates were at home with this question. It was well answered i.e. diseases transmitted by ticks
- heart water disease
- red water disease
- east coast fever etc.

(d) Candidates were expected to mention the economic importance of weevils which they did justice to by going further to state appreciable answers such as provides employment for people to work in companies producing chemicals to destroy the weevils
- when infestation is high the cost of chemicals increases to the benefits of the manufacturer.

Other answers expected are:
- reduces the quality of feed;
- reduces the quantity of feed;
- increases cost of production to the farmer.

(e) This section was also well answered by candidates e.g.
- fumigation of silos / barns with recommended chemicals;
- early harvesting of matured grains;
- treatment of grains with recommended chemicals before storage.

Question 2

(a) State two uses of specimen C in animal production.

(b) Mention four activities which require the use of specimen D in animal production.

(c) (i) State three precautions which should be taken by the farmer when using specimen E for the purpose of castration.

(ii) State three disadvantages of using specimen E for carrying out castration in pigs.

(d) Name three tools which could be used in place of specimen E to carry out castration in farm animals.

(a) Many candidates could only mention the use of Iodine tincture for the treatment of wounds, forgetting that it is also a sterilizing agent and could be applied on the body to get rid of pathogens before treatment commences e.g. in castration etc.

Expected answers include:

- treatment of wounds;
- applied before castration;
- applied after castration;
- after disbudding; etc.

(b) This sub-question was well answered by candidates. They stated a lot of good points such as

- drenching;
- castration;
- dipping;
- artificial insemination.

(c) Candidates were also at home to the question on the precautions to take when using a razor blade. Answers provided were very good as:

- wear hard gloves to prevent infection;
- should be sterilized before usage;
- animal should be properly restrained;
- should be used by a skillful person.

(d) Candidates were also able to provide answers to the disadvantages of using a razor blade such as

- risk of blood loss;
- risk of infection;
- risk of transfer of zoonatic disease to farmer and many others.

(e) Candidates were also at home here with regards to tools that could be used to replace razor blade. Their challenges were with spelling of some tools e.g.

(i) Budizoo / Burddizo instead of Burdizzo;
(ii) emansculator instead of emasculator;
(iii) scarpel instead of scalpel;
(iv) knif instead of Knife.

Question 3

(a) (i) Mention four parts of specimen F.

(ii) Name the management practice which has been carried out on specimen F.

(iii) Outline the steps involved in carrying out the management practice named in (a)(ii).

(b) (i) State three ways in which specimen G is of economic importance in animal production.

(ii) State two ways of controlling specimen G in farm animals.

(a) (i) Students were able to list the parts very well only a few mentioned head. The parts mentioned includes (i) beak (ii) comb (iii) wattle (iv) nostril (v) eye. Some mentioned tongue which means they labelled from memory and did not observe the specimen.

(ii) This part was poorly answered as many candidates were mentioning beak and not debeaking which is the practice or the action word. Some also mistook the management practice as reasons for debeaking and hence giving answers such as:

- checking cannibalism
- preventing egg eating
- minimizing waste of feed etc

(iii) This part was also poorly answered by candidates. Most started by saying cut only the upper beak without mentioning the proportion of upper beak expected to be cut, tools to be used and how the bird should be handled. They are expected to mention the following requirements:

- restrain bird(s)
- gather debeaking instrument such as debeaker, knife, scissors
- sterilize instrument
- hold head firmly
- cut about 1/3 of the upper beak with any of the chosen instrument

(b) (i) This part was well answered. Answers provided include:

- causes low productivity
- increases cost of production
- death of animal
- reduction in market value etc

(iii)Candidates were able to answer this part very well.

Answers expected were:

- good sanitation
- practice rotational grazing
- regular drenching with recommended drugs
- controlled burning of infested pasture

Question 4

(a) Name one farm animal each from which each of the specimens H, J and K could be obtained.

(b) Mention the body system in which each of the specimens H, J and K plays a key role.

(c) (i) State one function of each of the specimens H, J and K.

(ii) State two features that enables specimen H to perform its function in the farm animal.

(d) (i) State two uses of specimen K.

(ii) Give two effects of damage of specimen K on livestock production.

(a) This question was a "manna from heaven" for candidates. They were able to provide the names of farm animals which possessed gizzard

- Chicken, duck, turkey, etc.
- Kidney e.g. cattle, sheep, goat etc
- Skin e.g. cattle, sheep, goat etc

The only setback for some candidates to this question was that they mentioned the class of animals for which the specimens displayed were obtained instead of the name e.g. they state poultry or ruminants.

(b) Most candidates could not answer this part correctly as spelling posed a challenge to them especially they spelt ***excretory*** as ***excretary*** whilst instead of digestive system they mention digestion system

(c) (i) This part was well answered by candidates. Some answers provided include:

Gizzard

- grind feed
- churms feed etc

Kidney

- removal of nitrogenous waste/urine
- osmoregulation etc

Skin

- manufacture of Vitamin D

- sensory organ
- thermoregulation etc

(d) (i) Features of gizzard: this was also well handled by candidates. They stated rough lining, mascular, presence of grit.

A few however stated grit or rough which gave them a zero mark. This sub-question was also well answered. They provided answers such as used for making shoes, bags, drums etc

(iii) Effect of damage to skin. This question was also well answered by candidates.

They stated

- poor / low quality skin / hide
- low market value
- infection by pathogen etc

BIOLOGY 2

1. GENERAL COMMENTS

The standard of the paper compared favourably with that of previous years. The general performance of candidates was a little better than the previous year.

2. SUMMARY OF CANDIDATES' STRENGTHS

(i) Most candidates displayed some improvement in expressing themselves well in English language.
(ii) Candidates provided answers to each question on fresh page.
(iii) Candidates exhibited satisfactory knowledge in the following areas:
  (a) Secondary sexual characteristics of males and females;
  (b) Genetics;
  (c) Classification of living things;
  (d) Translocation in plants.
(iv) Candidates showed mastery of matching corresponding points in a tabular form as in question 5(c).
(v) Few candidates provided accurate and standard genetic diagrams in question 4(a).
(vi) Candidates complied with the Paper instructions which required that they should answer two questions only from Section A and all the questions in Section B.

3. SUMMARY OF CANDIDATES' WEAKNESSES

(i) Candidates failed to go by the rubrics regarding biological drawings as in question 3(c) ii regarding the drawing of the ecological instrument used to collect large animals in the pond.
(ii) Candidates could not explain how vestigial structures are considered as an evidence of evolution as in question 4(b); description of how vegetatively producing stems serve their purpose as in 5(b) i; outlining the process of biogas production as in 5(d) and the procedures involved in administering mouth-to-mouth ventilation to an accident victim.
(iii) Technical terms were wrongly spelt as in question 1(a, b) (ii); 2(a, b) (iii), 3 (a-c) and 5(b)ii.

4. SUGGESTED REMEDIES

(i) Candidates should read all instructions to the paper and follow them to the letter.
(ii) Tutors should take their students through spelling drills with respect to technical terms and scientific words.
(iii) Tutors should encourage their students to work sufficient tutorials and assignments on how to provide concise and accurate answers.
(iv) Tutors should ensure that candidates know and understand the rubrics of the subject.

5. DETAILED COMMENTS

Question 1

(a) (i) Name two main parts of the nervous system.

(ii) List two components each of the main parts of the nervous system named in 1(a)(i).

(b) Copy and complete the table below with the part of the brain that is responsible for each of the list actions.

S/No.	*Actions*	*Part of the brain*
(i)	**Receives impulse from the semi-circular canals of the ears**	
(ii)	**Control of speech**	
(iii)	**Regulation of involuntary actions**	
(iv)	**Sensation of hunger**	
(v)	**Receiving smell**	
(vi)	**Retaining memory**	

(c) What is a conditional reflex?

(d) Give:

(i) two examples of conditioned reflex in dogs;

(ii) four examples of conditioned reflex in humans.

Most candidates attempted the question. However, their performance was satisfactory. This sub-question was not answered satisfactorily.

(a) Candidates should note that the main parts of the nervous system are:

- Central nervous system;
- Peripheral nervous system.

(ii) Main parts/ components of the nervous system are:

- Central nervous system: brain and spinal cord;
- Peripheral nervous system: autonomous/ autonomic nervous system and somatic nervous system

Again, most of the candidates could not matched the actions and parts of the brain responsible for that action.

The expected responses include:

(b) Parts of the brain responsible for actions are:

S/No.	Actions	Part of the brain
i.	- Receives impulse from the semi-circular canals of the ears	- Cerebellum
ii.	- Control of speech	- Hypothalamus/ cerebrum
iii.	- Regulation of involuntary actions	- Medulla oblongata
iv.	- Sensation of hunger	- Hypothalamus
v.	- Perceiving smell	- Olfactory lobe(s)
vi.	- Retaining memory	- Cerebrum

(c) Most of the candidate could not explain conditioned reflex. Conditioned reflex is an action/ those behaviour acquired from the past experience/ learning with a stimulus which is originally ineffective/ neutral in producing the response.

(d) (i) Generally, this sub-question was not answered satisfactorily.

The expected examples of conditioned reflex in dogs which include:

- Salivating at sound of a bell/ smell of food without the presence of food;
- Regulated defaecation to a particular location;
- Fetching a stick;
- Running errands;
- Dancing to music/ presentation of gift;
- Dancing to welcome the owner.

(ii) However, most of the candidates were able to give examples of conditioned reflex in humans. Their correct answers include:

- Walking;	- Cycling	- Talking;
- Swimming;	- Driving;	- Singing;
- Typing;	- writing;	- Jumping;
- Kicking a ball;	- Reading;	- Clapping;
- Eating;	- dancing;	

Question 2

(a) (i) What is translocation in plants?

(ii) Name the biological process that occurs before translocation takes place.

(iii) Name one tissue and one plant part each where translocation occurs.

(iv) Name four substances that are translocated in plants.

(b) (i) What is malnutrition?

(ii) State three effects of malnutrition in animals.

(iii) Name the classes of food in a balanced diet.

Most candidates answered this question satisfactorily.

(a) (i) Generally, candidates were able to explain Translocation, state biological process which occur before translocation where it occur before translocation and where it occur in plants. Their answers include:

Translocation is the transport/ movement of manufactured food substances from the leaves to all other parts of the plant.

(ii) Biological process that occur before translocation takes place is Photosynthesis

(iii) Tissue and plant part where translocation could occur are: Tissue: Phloem/ sieve tubes

Plant part: Leaves / branches / roots.

(iv) Substances translocated in plants

- Sugar/glucose/ sucrose;
- oils;
- Fatty acids;
- hormones/auxins;
- Amino acids;
- alkaloids/steroids/ resins.

(b) (i) Generally, candidates were able to explain malnutrition and effect of malnutrition as indicated below:

Malnutrition is the condition that results from taking a diet in which nutrients are either not enough/ too / much/ imbalanced such that the diet causes health problems.

(ii) Effects of malnutrition are:

- Susceptibility to diseases
- Susceptibility to deficiency diseases/ kwashiorkor/ beriberi/ pellagra/ scurvy/ rickets/ goitre
- Problems with physical growth/ stunted growth/ acromegaly/ gigantism/ cretinism
- Problems with mental development/ retardation
- May result to death.

(iii) Majority of the candidates could list classes of food in a balanced diet as indicated below:

- Carbohydrate;
- Protein;
- Vitamin;
- Fats and oil/ lipids;
- Mineral salts;
- Water.

Question 3

A pond at the back of a school hostel containing living organisms was abandoned for some time.

(a) Name two:

(i) producers;

(ii) consumers; that could be found in the pond.

(b) List three abiotic factors that would affect the organisms in the pond.

(c) (i) Name the instrument that could be used to collect large animals found in the pond.

(ii) Make a diagram, 6 cm to 8 cm long of the instrument named in 3(c)(i) and label fully.

(d) State three:

(i) benefits;

(ii) disadvantages; of the pond to the school and the environment.

Most of the candidates provided satisfactory answers to this question.

(a) (i) This sub-question was well answered however, it is worth noting that some of the candidates lost marks due to wrong spellings of names.

The expected responses are indicated below:

- Algae/ Spirogyra
- Ceratophyllum/ Hornwort;
- Water Lily/ Nymphaea;
- Duckweed/ Lemna
- Pistia/Water Lettuce;
- Water Fern;
- Diatoms;
- Euglena;
- Chlamydomonas;
- Arrow Head/ Sagittaria.

(ii) Expected responses of consumers in the pond are:

- Tadpoles;
- Water Snails;
- Zooplankton;
- Dragonfly nymph
- Water Snake;
- Tilapia/ Small Fish/ Catfish/ Mudfish.
- Mosquito Larvae;
- Water Scorpion;
- Pond Skater.
- Water Boatman;
- Amoeba
- Euglena;
- Leech;

(b) Abiotic factors that would affect organisms of the pond were satisfactorily answered by candidates.

Their correct responses include:

- Temperature/Heat;
- pH;
- Density;
- Pressure;
- Oxygen;
- Carbon (IV) oxide/ carbon dioxide.
- Rainfall;
- Depth;
- Turbidity;
- Light/ Sunlight Penetration/ Intensity;

(c) (i) Majority of the candidates were able to list instrument which could be used to collect large animals found in the pond as indicated below:

Sieve; sweep net; basket net/ fish net/ butterfly net; plankton net/ drag net.

Note: spellings must be correct to score in a, b and c

(ii) Many candidates presented very poor drawing, thus paying little regard to the rubrics in biological drawing. Candidates were expected to draw the instrument using the following steps:

Title (TL) - Diagram of instrument
Quantity (Q)
Clarity of lines (CL)
Size (Sz) (6cm to 8cm)
Neatness of labels (NL)
Details (D)
Instrument shown (IS)

Labels (L)
Wire mesh, net, handle, rim

(d) (i) Benefits of the pond to the school and the environment were correctly indicated by many candidates as follow:

- for ecological/ population studies/ research/ experiment of organisms that live in the pond;
- for collection of samples;
- balances water cycling in nature;
- habitat for some organisms/ biodiversity;
- breeding ground/niche for some organisms;
- for oxygen/ carbon dioxide balance in nature;
- Balances food chain/ food web.

(ii) Candidates correct responses regarding disadvantages of the pond include the following:

- Breeding spots for toads/frogs;

- Breeding ground for mosquitoes/ vectors of diseases/ water snail (which could harbour Schistosoma/blood fluke)
- Could be a death trap;
- Could cause air/water pollution from decomposing organisms;
- Health hazard for the environment/school.

Question 4

(a) A man, heterozygous for dark skin colour, *D*, is married to a homozygous light skinned woman, *d* and they have four children. With the aid of a genetic diagram each, determine the number of children that would be:

(i) light skinned;

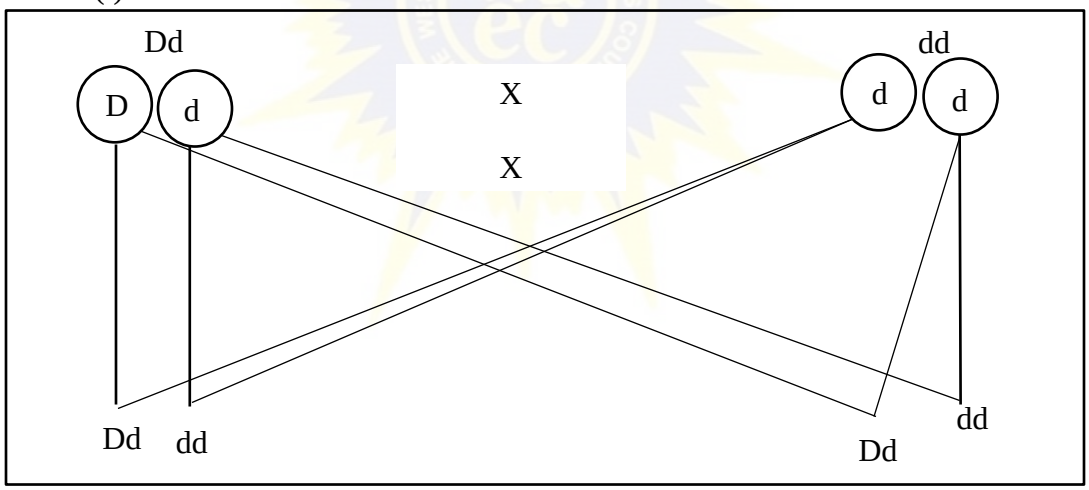
(ii) dark skinned if a light skinned child was married to a spouse who has the same genes for skin colour as the father.

(b) Explain briefly how vestigial structures are considered as an evidence of evolution.

Generally, candidates' performance was poor.

(a) Only a few candidates were able to provide accurate and standard genetic diagram as indicated below:

(i)



Parental genotype Dd

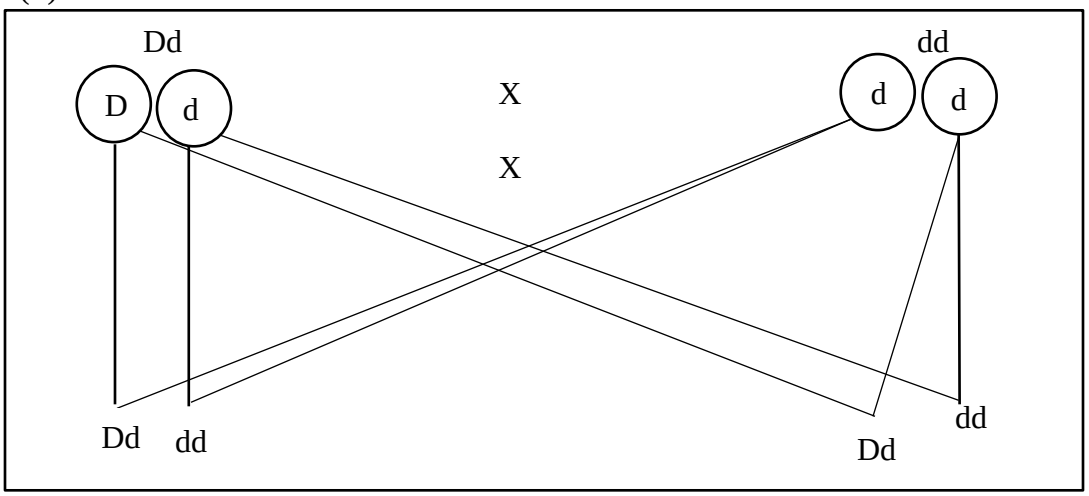
Gametes

Correct crossing (CC)

F1 generation (offspring) (dd)

The number of children that will be light skinned is two with (dd) genotype

(ii)



Parental genotype Dd
Gametes
Correct crossing (CC)
F1 generation (Offspring)
The number of children that will be dark skinned is two with (Dd) genotype

(b) How vestigial structures are an evidence of evolution was poorly answered by most of the candidates. Expected correct responses include:

- Vestigial structures like appendix or coccyx or caudal vertebrae or pyramidalis nasi or posterior auricular muscles or nipples in males or tonsils or wisdom teeth;
- Are rudimentary body parts that are smaller or simpler in structure than corresponding parts in their ancestral species;
- They are either underdeveloped or degenerated which may be due to changes in the environment or mode of life of the subsequent species;
- This shows that some creatures descended from organisms where these structures were functional.

Question 5

(a) State three secondary sexual characteristics each in:

(i) males;

(ii) females.

(b) (i) Describe how vegetatively reproducing stems serve their purpose.

(ii) Give two examples of vegetatively reproducing stems.

(c) State five differences between a DNA and an RNA molecule.

(d) (i) Outline the process of biogas production.

(ii) Name three crops that could be used to produce biogas.

(e) (i) State three advantages of rendering First Aid treatment to an accident victim.

(ii) State five procedures involved in administering mouth-to-mouth ventilation to an accident victim.

The performance of candidates in this question could only be said to be fair.

(a) (i) Candidates did not have much problems in listing secondary sexual characteristics in males as indicated below:

- Development of hairs in pubic areas or genital region/armpit/face/chest;
- Development of more powerful muscles;
- Increase in size of the penis or testes;
- Breaking or deepening of voice;
- Broadening of chest;
- Production of sperm/semen.

(ii) Again, candidates readily provided secondary sexual characteristics in females as indicated below:

- Development of hairs in pubic area or armpit
- Enlargement of breasts or mammary glands
- Broadening or enlargement of the hips or pelvic girdle
- Start of menstruation or ovulation
- Enlargement of uterus or vagina
- Body contour is rounded or prominent.

(b) (i) Candidates showed some knowledge regarding how vegetatively reproducing stems serve their purpose. Their correct responses were as follow:

- some stems possess or are modified to form runners or creepers which have nodes;
- forming adventitious roots; when in contact with the soil or can grow into new plants;
- suckers or short stems of parent plants just below the ground level give rise to new plants;
- terminal buds of swollen underground stem or rhizome or corn or tuber give rise to new plants or aerial shoot;
- lateral buds develop into (lateral) branches.

(ii) Candidates were expected to list examples of vegetatively reproducing stems.

They provided satisfactory answers which include the following:
sweet potato; *Desmodium;* runner grass; plantain; banana; pineapple; ginger; yam(tuber); cocoyam; Irish potato; sugar cane; cassava.

(c) Most candidates failed to bring clearly differences between DNA and RNA. The expected correct differences is indicated below in a tabular form:

DNA	RNA
• Located in the nucleus only;	• Located both in the nucleus and cytoplasm;
• It is a stable molecule;	• It is an unstable molecule;
• Exists in double strands forming a helix;	• Exists as a single strand;
• Contains deoxyribose sugar;	• Contains ribose sugar;
• Contains thymine in the pyrimidines base;	• Contains uracil in the pyrimidines base;
• It is a long chain molecule;	• It is short chain molecule;
• It is concerned with hereditary functions;	• It is concerned with protein synthesis;
• Has very large molecular weight.	• Has relatively smaller molecular weight.

(d) (i) Candidates showed complete lack of knowledge of the process of biogas production. Candidates were expected to outline the process of biogas production as indicated below:

- A container or digester is filled with the appropriate crop/organic waste/sewage/dung;
- A mixture of many bacterial species are added to the crop/organic waste under a suitable or optimum temperature;
- The crop/organic materials are fermented;
- To produce methane gas/biogas;
- The gas is then channelled through pipes;
- Collected or used;
- For cooking, heating and lighting.

(ii) Again, candidates could not list crops that could be used to produce biogas. The expected answers are:

- Maize/corn;
- Cassava;
- Jatropha;
- Grasses;
- Rye;
- Triticale;
- Wheat.

(e) (i) Performance of candidate on this sub-question could only be said to be fair. The advantages of rendering first aid treatment to an accident victim include:

- It prevents the present condition from getting worse;

- It makes recovery easy;
- It saves life/improves certain vital signs/pulse, temperature, unobstructed airway, breathing or prevent death;
- It reduces blood loss;
- It relieves pain/discomfort.

(ii) Majority of the candidates who attempted this sub-question showed absolute lack of knowledge as to how to administer mouth to mouth ventilation to an accident victim.

The expected procedures are outlined below:

- Lay the victim on the back on a flat or firm surface;
- Kneel beside the victim;
- Loosen all tight clothing around the neck of the victim;
- Remove all obstructions from the mouth or throat of victim;
- Raise the chin forward and press the fore head backwards;
- Take a deep breath with your mouth wide open;
- Pinch the victims nose shut;
- Cover the mouth of the victim with yours;
- Breathe strongly into the lungs to make the chest rise;
- Remove your mouth and let the air come out;
- Take a deep breath again and repeat the steps;
- Check the pulse around the neck or wrist to ensure the heart is beating;
- Place the victim in a recovery or sitting position;
- Seek medical help or take the victim to the hospital.

BIOLOGY 3

1. GENERAL COMMENTS

The standard of the paper compared favourably to that of the previous year. Candidates' performance was better than last year.

2. SUMMARY OF CANDIDATES' STRENGTHS

(i) There were many scripts with legible writing
(ii) Good number of candidates presented drawings that complied with the required basis for assessment of biological drawing
(iii) Specimens were correctly identified
(iv) Many candidates correctly matched structure / features to their functions

3. SUMMARY OF CANDIDATES' WEAKNESSES

(i) Many scripts of candidates that scored low marks or zero were hardly readable.
(ii) Scientific names and technical words were wrongly spelt
(iii) Candidates could not differentiate structural features from physiological features so included physiological features in their answers when structural differences were required

4. SUGGESTED REMEDIES

(i) Instructors should pay attention to the handwriting of students and insist on its improvement.
(ii) Instructors should take students through the requirements for biological drawing.
(iii) Instructors should take students through some past questions explaining how to handle a question involving two or more specimens.
(iv) Taxonomy is a key topic for the practical paper and therefore instructors should impress on students to make effort to pronounce the names of taxa in a manner that will ensure correct spelling

5. DETAILED COMMENTS

Question 1

Study specimens B and C and answer questions 1(a) to 1(g).

(a) Name the:
  (i) Kingdom;
  (ii) Phylum; to which each of the specimens B and C belong.
(b) State one reason each for the answer in 1(a)(i) and 1(a)(ii).
(c) In a tabular form, state three observable structural differences between specimens B and C.

(d) (i) Name the mode of nutrition exhibited by each of specimens B and C.

(ii) State one reason each for the answers in 1(d)(i).

(e) (i) Suggest the habitat of each of specimens B and C.

(ii) State two ways in which specimen B is adapted to its habitat.

(f) List two substrates on which specimen C can grow.

(g) State two ways in which specimen C is of economic importance.

(a) Candidates were asked to name the Kingdom and Phylum to which each of specimen B, Spirogyra and specimen C bread mould belongs.

A large number of candidates correctly identified the Kingdom Protoctista for Spirogyra and the Kingdom Fungi for bread mould. The names were correctly spelt. The phylum for each was correctly identified as Chlorophyta for spirogyra and Zygomycota for the bread mould.

The first letter of the name of each taxon should be capital. Some good students wrote the names of the taxa starting with small letters, so they lost the marks for the taxa.

(b) Candidates were asked to state one reason each for placing each specimen in the respective taxon. A number of candidates correctly stated the appropriate features of the specimens that belongs to respective taxa. For the kingdom Protoctista for specimen B, the expected features are unicellular organisms or eukaryotic cell. For the phylum chlorophyta for Spirogyra the expected features are possession of chlorophyll or filamentors or lack stem, root and leaf.

For the Kingdom Fungi for specimen C, the expected feature are multicellular, body consists of hyphae, shows saprophytic mode of nutrition. For the Phylum Zygomycota the expected features are presence of sporangium, hyphae are non-sephtate or absence of cross wall.

(c) Candidates were asked to state in a tabular form, three observable structural differences between spirogyra and Rhizopus.

Many candidates presented correctly structural feature that differ in the required tabular formation. Some candidates mixed structural features with physiological features.

Expected answers include the following:

Specimen B / Spirogyta	Specimen C / Bread mould
- Chlorophyll pigment present	Cholophyll absent / black / white colour present
- Mycelium / Hyphae absent	Mycelium / hyphae
- Spore absent	Spore present
- Mucilage present	Mucilage absent
- Sporangium absent	Sporangium present
- Septate	Non-Septate

(d) (i) Candidates were asked to name the mode of nutrition shown by each of specimen B and C. A number of candidates correctly indicated that photosynthesis / autotrophy for Spirogyra and saprophytic for specimen C – Rhizopus

(ii) Candidates were asked to state one reason each for their answers so i(d)(i) Candidates have no difficulty in stating the presence of chlorophyll or green pigment

For specimen C. few candidates identified the presence of a substrate carrying the bread mould.

(e) (i) Candidates were asked to state one habitat of each of specimens B and C. For habitat for Spirogypa, candidates correctly indicated pond ditches and slow-moving streams as the answer. For the habitat of bread mould, decaying dead organic matter was the expected answer but students wrongly indicated orange fruit and bread as the habitat.

(ii) Candidates were asked to state two ways in which specimen B is adapted to its habitat.

This question proved challenging to candidates. Some candidates identified correctly:

- the presence of chlorophyll for photosynthesis
- the presence of mucilage for protection
- its light weight body for buoyancy

(f) Candidates were asked to list two substrates on which specimen can grow. Majority of candidates correctly identified appropriate substrates which include kenkey, cooked yam, orange.

(g) Candidates were required to state two ways in which specimen C, bread mould is of economic importance. Some candidates mentioned correctly spoilage of food, recycle of mineral salts, decay of dead organic matter.

Question 2

(a) (i) State the Class to which each of specimens D and F belong.

(ii) Give one reason each for the answer in 2(a)(i).

(b) (i) State three structural similarities between specimens D and F.

(ii) In a tabular form, state three structural differences between specimens D and F.

(c) (i) Name the type of heterotrophic nutrition common to both specimens D and F.

(ii) Name the respiratory organ of each of specimens D and F.

(d) State two characteristics features of specimen F.

(e) Make a drawing, 8 cm to 10 cm long of the dorsal view of specimen F and label fully.

(a) (i) Candidates were asked to state the class to which each of specimen D, crab and specimen F, spider belongs

Many candidates correctly identified crustacean for D, crab and Arachnida for F, spider. A few candidates lost the marks for wrong spelling on the taxa however, many candidates gave wrong class.

(ii) Candidates were asked to give one reason each for the taxa selected for 2(a)(i).

Those who mentioned the correct taxa also gave the expected features of the crab and the spider, that belong to the respective taxa.

For Crustacea:

- Five pairs of walking legs
- Two pairs of antennae
- stalked eyes
- body divided into cephalothorax and abdomen
- presence of carapace

For Arachnida

- four pairs of walking legs
- four pairs of simple eyes
- body divided into cephalothorax and abdomen

(b) (i) Candidates were required to state three structural similarities between specimen D, crab and specimen F, spider.

A number of candidates correctly mentioned

- presence of exoskeleton

- presence of eyes
- two body divisions
- bilaterally symmetrical
- metameric segmentation
- presence of jointed appendages

(ii) Candidates were asked to state three structural differences between specimens D, and specimen F, spider in a tabular form.

Only few candidates gave correct differences with the corresponding points.

Other candidates' points did not correspond and therefore lost marks.

Candidates were expected to state the following:

D/Crab	F/Spider
Five pairs of legs	Four pairs of legs
Stalked eyes	Eyes not stalked
Absence of spinneret	Presence of spinneret
Absence of pedipalp	Presence of pedipalp
Gill present	Lungbook present
Antenna present	Antenna absent

(c) (i) Candidates were asked to name the mode of heterotrophic nutrition common to both specimen's D / crab and F / spider.

Most candidates could not give the expected answer which is Holozoic.

(ii) Candidates were asked to name the respiratory organ of each of specimens D / crab and F / spider

A good number of candidates identified gills for crab and lung book for spider

(c) Candidates were asked to state two characteristic features of specimen F / spider.

A good number of candidates gave the required features.

The expected features are:

- Body divided into two divisions
- Possession of four pairs of walking legs
- Possession of poison fang or chelicers
- Passion of spinneret
- Possession of pedipalp.

(e) Candidates were asked to make a drawing, 8 cm to 10 cm long of the dorsal view of specimen F / spider

While a number of candidates made effort to make clear lines and neat labels others gave horrible drawing without regards to the rules of biological drawing.

Some candidates showed body with three divisions instead of two.
Segmentation of the legs were not properly shown. They used several cross walls to divide the appendages. Many candidates could not draw within the limit of size required and did not indicate magnification.

Question 3

Study specimens G, H, J and K and answer questions 3(a) to 3(e).

(a) (i) Classify specimens G, H, J and K into their Divisions.
(ii) Arrange specimens G, J and K in ascending order of evolutionary trend.

(b) In a tabular form, state three observable differences between:
(i) specimens G and J;
(ii) specimens H and K.

(c) State three structural adaptations of specimen H to its habitat.

(d) State two observable structural similarities between specimens G and J.

(e) Make a drawing, 8 cm to 10 cm long of specimen G and label fully.

(a) Candidates were given specimens G / Fern plant; H / Euphorbia, J / Talinum and K / Twig of whistling pine.

(a) (i) Candidates were required to classify specimens G, H, J and K their Divisions.

A good number of candidates correctly placed the specimens in their appropriate divisions.
G / Fern: Filicinophyta
H / Euphorbia: Angiospermophyta / Angiospermatophyta
K / whistling pine: Coniferophyta
A number of candidates spelt the taxa wrongly and lost the marks

(ii) Candidates were asked to arrange the specimens G, J and K is ascending order of evolutionary trend.
This question was a novelty. Consequently, a handful of candidates could give the answer in the correct format.

The expected answer should be:
Specimen G/Fern → Specimen K / whistling pine → Specimen J/Talinum.

(b) In a tabular form, candidates were asked to state three observable differences between

(i) Specimen G and J;

(ii) Specimen H and K.

Some candidates gave the expected answer with the corresponding points. A number of candidates could not give appropriate answers
It can be observed that not enough attention has been given to the study of the plantae.

The expected answers are:

Observable differences

Specimen G / Fern plant	**Specimen J / Talinum plant**
Has horizontal stem / rhizome	Has vertical / upright stem
Adventitious roots present	Taproot present
Compound leaves / frond present	Simple leaves present
Hard stem	Succulent / fleshy stem
Sori present	Sori absent
Pinna present	Pinna absent

(c) Candidates were asked to state three structural adaptations of specimen H to its habitat.

A good number of candidates identified the appropriate features and matched them with their respective functions.

A number of candidates who had not covered Ecology could not give correct answers. Candidates were asked to state two observable structural similarities between specimens G/Fern plant and J/Talinum.

This question proved quite challenging to a good number of candidates. Candidates were hard pressed to identify the expected similarities.

The handful of candidates were able to give the expected answers:

- presence of stem
- presence of leaves
- presence of roots

(e) Candidates were asked to make a drawing of specimen G / Fern plant
Only a handful of candidates could give the appropriate drawing that showed the required details. A good number of candidates lost the marks on the drawing

CHEMISTRY 2

1. GENERAL COMMENTS

The standard of this year's paper compares favourably with that of the past years.
It was expected that candidates would perform better than last year but the story is a little different.

However, the general performance of the candidates were better although some performed abysmally.

Candidates should be encouraged by their tutors to adapt to the new format of the structure of the questions and stick to the instructions as some few deviated from the tasks given. Where they were asked to provide two/three responses, they gave three/four instead. This attitude could affect their performances as far as the individual questions were concerned. In general, the paper had enough recalls, comprehensions and application that spells out the good standard expected.

2. SUMMARY OF CANDIDATES' STRENGTHS

The general features noted in the candidates answers that need commendation include the following:

(i) recognition of types of energy changes from given thermochemical equations
(ii) knowledge on periodic properties (electron affinity and electronegativity), Faraday's constant, primary and secondary cells, saturated solution, factors affecting standard electrode potential values and their uses
(iii) determination of empirical and molecular formulae, from elemental data
(iv) type of chemical bond in compounds formed between pairs of elements and the properties of the compounds formed (ionic and covalent compounds)
(v) ability to plot graphs from given set of data by choosing the suitable scales and drawing inferences from the resultant graph
(vi) writing of electron configuration of elements and the significance of the principles used in filling electrons into orbitals of atoms
(vii) factors that determine the preferential discharge of ions at the electrode during electrolysis

3. SUMMARY OF WEAKNESSES

Major weaknesses identified include the following:

(i) distinction between a dehydrating agent and drying agent
(ii) description of an experiment to illustrate the effect of catalyst on the rate of decomposition of hydrogen peroxide when exposed to air
(iii) the use of the kinetic theory of matter to explain how solids change when heated
(iv) examples of endothermic processes

(v) drawing of the structure of amino acids and their functional groups identification. The formation of the dipolar ion (Zwitherion) by amino acids under acidic and alkaline conditions

(vi) effect of polarity on melting points of covalent compounds

(vii) elemental analysis of organic compounds

(viii) the constituent of cement

4. SUGGESTED REMEDIES

(i) early completion of the syllabus with more exercises on the relevant areas stated above

(ii) encouragement of candidates to do extra and personal studies

(iii) special emphasis on the treatment of organic chemistry and acids, bases and salts

(iv) organization of frequent quizzes and assignments alongside treatment of the various topics

5. DETAILED COMMENTS

Question 1

(a) State the type of energy change that occurs in each of the following reactions:

(i) $C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)}$**;**

(ii) $H^+_{(aq)} + OH^- \rightarrow H_2O_{(l)}$**;**

(iii) $Mg_{(g)} \rightarrow Mg^+_{(g)} + e^-$**.**

(b) Differentiate between electron affinity and electronegativity.

(c) (i) Define Faraday's Constant.

(ii) State the number of moles of electrons involved in each of the following redox reactions:

(α) $4H^+ + O_2 \rightarrow 2H_2O$**;**

(β) $H_2O_2 + 2H^+ \rightarrow 2H_2O$**.**

(d) Name a halogen which, at room temperature, is a:

(i) solid;

(ii) liquid;

(iii) gas.

(e) State two factors that determine the discharge of ions at the electrode during electrolysis.

(f) In silver-plating a steel spoon, what would be used as the

(i) anode?

(ii) cathode?

(iii) electrolyte?

(g) State the difference between a dehydrating agent and a drying agent.

(h) State two ways in which the reaction of sodium with ethanol resembles the reaction of sodium with water

(i) State one use of copper (II) chloride.

(j) Name the physical properties used in selecting separation techniques for the following mixtures:

(i) crude oil;

(ii) calcium trioxocarbonate (IV) and potassium chloride.

(a) The main task of this question was identification of the type of energy changes associated with various reaction equations. Most candidates had it correct. Only a few were unable to answer it appropriately

(b) The demand here was on the distinction between electron affinity and electronegativity. Majority of the candidates could not figure out that electron affinity is energy evolved / released. Rather, they said the energy involved.

(c) Vast majority of the candidates were able to define Faraday's constant and stated the number of moles of electron involved in the given redox reactions.

(d) Majority of the candidates were able to state the halogens with respect to their nature at room temperature

(e) The factors that determine the discharge of ions at the electrode during electrolysis was well answered by most of the candidates. It was a common task of knowledge and they had it correct

(f) The task here was identifying the anode, cathode and electrolyte in silver-plating of a steel material.

Almost half of the candidates were able to identify the anode as silver, cathode as the steel material but could not get the appropriate electrolyte as any soluble silver salt

(g) Almost 90% of the candidates could not differentiate between dehydrating agent and drying agent. The dehydrating agent removes elements of water from a compound whiles drying agent removes molecules of water from a compound.

(h) Vast majority of the candidates could give only one way in which reaction of sodium with ethanol resembles that of sodium with water i.e. both reactions evolve hydrogen gas. However, they were to state two. The other similarities such as: both occur in the cold, aqueous product in both are alkaline, both are exothermic reactions, both are reversible reactions, and both produce ionic products were not stated by the candidates.

(i) The task here involved the uses of copper (II) oxide which is recall. About 90% of the candidates stated for preservation of wood / as insecticide which is commendable.

(j) This section was well answered by majority of the candidates. The task was on separation technique for crude oil and for $CaCO_3$ and KCl. (soluble and insoluble salts)

Question 2

(a) The vapour density of a gaseous chloride of an element X is 67.5. The percentage of X in the salt is 47.41.

Determine the:

(i) empirical formula:

(ii) molecular formula of the salt.

[X = 64.0, Cl = 35.5]

(b) When hydrogen peroxide is exposed to air it decomposes.

(i) Write a balanced equation for the reaction.

(ii) Name the catalyst used.

(iii) Outline an experiment to illustrate the effect of the catalyst on the rate of reaction

(c) (i) Distinguish between a primary cell and a secondary cell.

(ii) State one example each of:

(α) primary cell;

(β) secondary cell.

(d) Explain in terms of kinetic theory, what happens to the particles of a solid when heated.

(a) The task was determination of empirical and molecular formula from information on vapour density and percentage composition. It was well done by majority of the candidates.

(c) About 90% of the candidates could not answer this question. This could be due to the fact that preparation of oxygen from decomposition of H_2O_2 was not familiar. They were asked to name the catalyst, but they were rather writing the formula of manganese (IV) oxide.

The expected answers are:

(i) $2H_2O_{2\,(l)} \rightarrow 2H_2O_{(l)} + O_{2(g)}$

(ii) Manganese (IV) oxide / Gold / Platinum

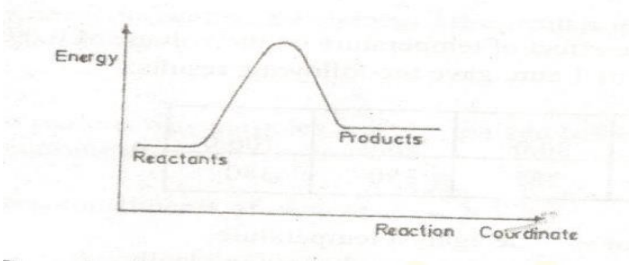
(iii)

- Fill two test tubes **A** and **B** (half way) with H_2O_2
- Add MnO_2 to **A** / Gold / Platinum
- (Warm each in turn) and apply a glowing splint to the surface of each test tube
- Using a stop watch, note how long it takes for the glowing splint to be rekindled in each case
- Test-tube **A** produces oxygen faster showing that the rate has increased by the catalyst

(c) This section was well answered by the candidates as it was familiar. Very few of them gave example of primary cell as dry cells instead of the Leclanche cell. However, they could give the electrolytes in the cells

(d) Only about 50% of the candidates were able to explain in terms of kinetic theory what happens to the particles of a solid when heated. However, they fail to outline but rather jumbled the steps involved.

Question 3



(a) (i) Copy the diagram above and indicate the following on it:

(α) activation energy;

(β) enthalpy change;

(γ) activated complex.

(ii) What type of reaction is represented by the diagram?

(iii) Give one process that could be represented by the diagram.

(b) (i) Draw the structure of 2-aminoethanoic acid;

(ii) State its functional group(s);

(iii) What is the general name for the ions it forms in alkaline or acidic medium?

(iv) If two molecules of 2-aminoethanoic acid combine, name the:

(α) type of reaction that occurs;

(β) products obtained in the reaction.

(c) (i) State the type of chemical bond in the compounds formed between each of the following pairs of elements:

(α) $_{20}$Ca and $_{8}$O;

(β) $_{6}$C and $_{17}$Cl.

(ii) State one property of the compound formed in each case.

(d) Name two metals which are usually extracted by electrolysis.

(e) (i) State two factors that could affect the value of standard electrode potential.

(ii) State two uses of standard electrode potential.

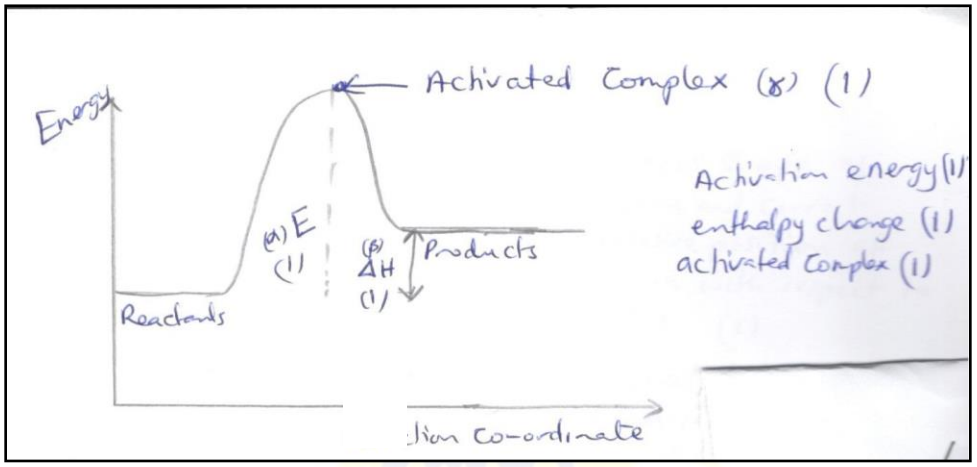
(a) Most of the candidates were able to copy and indicate the activation energy, enthalpy change and activated complex for the diagram (Endothermic reaction).

However, they could not state the process that was endothermic/ represented by the diagram.

(b) Only about 10% of the candidates who attempted this question did better. The rest performed abysmally. To draw the structure of an organic compound means all bonds and atoms should be shown. They could not identify the functional group(s) in the compound 2-amino ethanoic acid. The name of the ions they form in alkaline and acidic media was a problem for the candidates.

In fact, they could not name the product when two molecules of the compound combine as well as the type of reaction and the products obtained.
Section c, d, e and f were very well answered by majority of the candidates

(a) (i)

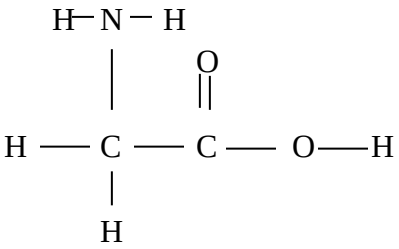


(ii) endothermic reaction

(iii) dissolution process e.g. NH_4Cl / KNO_3 / $Na_2S_2O_3$

Accept melting

(b) (i)



(All bonds must be shown.) Accept – OH

(ii) ~~amino~~ / NH_2

alkanoic acid group / —— COOH / Carboxyl / Carboxylic group

(iii) Zwitterion

(iv) (α) Condensation
(β) Dipeptide and water

(c) (i) (α) Ionic / electrovalent
(β) Covalent

(ii) Ionic Compounds

- high melting and boiling point
- soluble in water
- conduct electricity in solution or molten state
- consist of ions

Covalent compounds

- soluble in organic solvents
- low melting and boiling point
- do not conduct electricity
- consist of molecules

(d)

- sodium
- potassium
- magnesium
- calcium
- aluminium

(e) (i)

- concentration
- temperature
- pressure

(ii)

- to predict the direction / feasibility of a chemical reaction
- to calculate the e.m.f.
- to predict the standard electrode potential of unknown elements
- to predict the relative oxidizing or reducing powers of an element

(f) Saturated solution is a solution which contains the maximum amount of solute it can dissolve at a given temperature.

OR

Saturated solution is a solution that cannot dissolve any more solute at that a given temperature.

OR

A saturated solution is one in which the undissolved solute is in dynamic equilibrium with the solution at a given temperature.

Question 4

(a) Explain briefly how polarity affects the melting point of covalent compounds.

(b) (i) Sketch a graph showing the variation of pH with volume (cm^3) of NaOH added, when 25 cm^3 of 0.10 cm^3 of 0.10 mol dm^{-3} ethanoic acid is titrated with 0.10 mol dm^{-3} sodium hydroxide.

(ii) Indicate on the sketch a region on your titration curve which gives a buffer solution.

(iii) State why such a solution acts as a buffer.

(c) An investigation of the effect of temperature on the volume of 0.0095 g of a gas at a constant pressure of 1 atm. gave the following results:

Vol./cm^3	70.0	80.0	98.0	106.0
T/K	250	285	350	380

(i) Plot a graph of volume against temperature

(ii) Deduce whether or not the gas is behaving ideally.

(iii) Using the gradient of your graph, calculate the relative molecular mass of the gas

[R = 82.0 cm^3 atm. K^{-1} mol^{-1}]

(d) When asked to demonstrate the presence of the element Cl in the compound $ClC_6H_4NH_2$, a student fused the compound with sodium and dissolved the fusion mixture in water. The student then treated a portion of the filtered solution with aqueous $AgNO_3$ to give a precipitate

(i) State with reason whether or not the student's method is right, using the chemical principles involved in the procedure for the detection of chlorine in an organic compound.

(ii) What test may be carried out on the solution of the fusion mixture to demonstrate the presence of nitrogen?

Most of the candidates failed to attempt this question partly due to the fact that they saw the section (d) as organic chemistry.

Those who attempted this question were able to draw the graph of volume against temperature only.

(a) They could not explain how polarity affects the melting point of covalent compounds

(b) (ii)&(iii) They could not indicate the region which gives a buffer solution on their sketch and state why the solution acts as a buffer

(c) Candidates plotted the graph but could not deduce anything from the graph and calculate the relative molecular mass of the gas

(d) This section of the question was on elemental analysis of an organic compound to ascertain the presence of chlorine and nitrogen

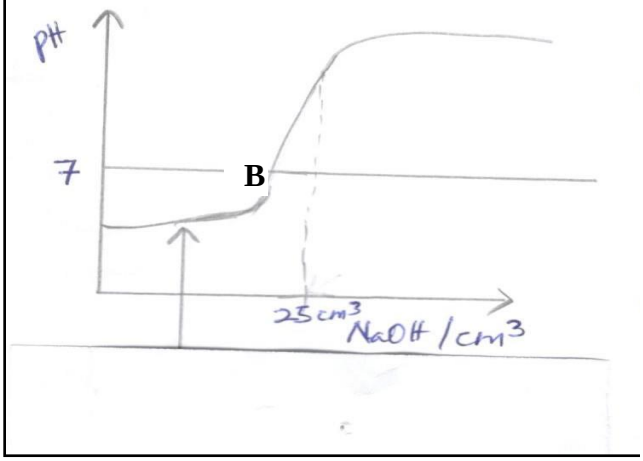
Almost all the candidates who attempted this question could not answer the task. This had to do with the sodium fusion test.

The expected answers are:

(a) Polar covalent compounds have strong intermolecular forces hence higher temperatures are needed to overcome these forces to convert the solid into liquid.

Hence polar covalent compounds have higher melting points.

(b) (i)



- Correct shape of curve and correct relative position of curve with respect to P^H7
- Correct labelled axes and indication that end point is at 25 cm^3 NaOH

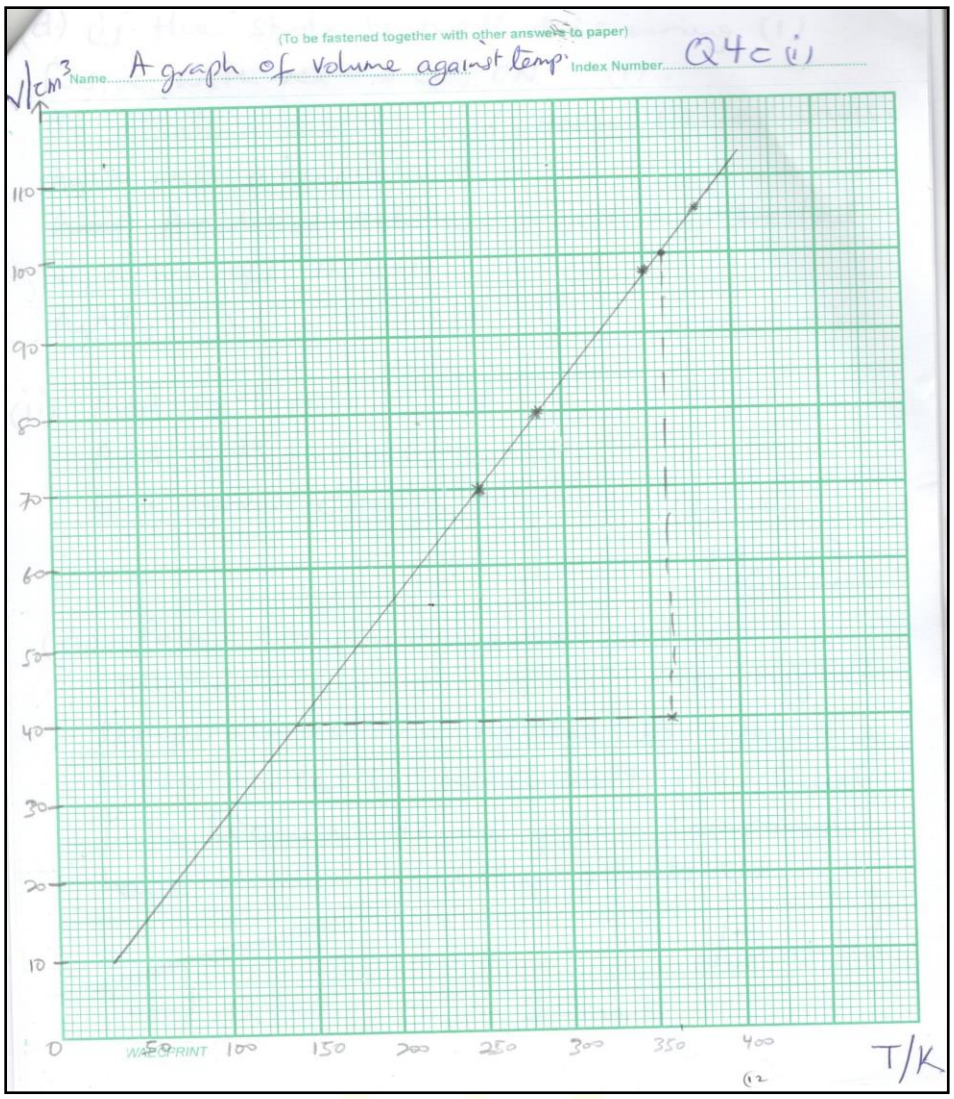
(ii) Buffer solution =point B on graph

(iii) Solution consists of ethanoic acid and sodi

and its salt with a strong base / weak acid and its conjugate base

CH_3COOH with CH_3COONa resist the change in pH on addition of small amounts of acid or base**.**

(c)



- correct scale
- linear graph with all points correctly plotted

(ii) Graph of volume versus temperature is linear, therefore gas is behaving ideally /

Since PV= nRT

V = $\frac{nRT}{P}$ V α T at constant pressure hence gas is behaving ideally.

(iii) PV = nRT

M = $\underline{mRT}$

PV

From the graph $\frac{V}{T} = \frac{100-40}{360-140}$

$= \frac{60}{220}$

$= 0.2727$

$= 0.27 \quad (\pm 0.01)$

$\therefore M = \frac{0.095 \times 82.0}{1 \times 0.27}$

$= 28.85 \quad (\pm 0.1)$

(d) (i) The student's method is wrong fusion with Na will give NaCl and NaCN
To alkaline solution add HNO_3 otherwise AgCN will precipitate**.**
Acidified solution must be boiled to drive off HCN
$AgNO_3 + Cl^- \longrightarrow AgCl + NO_3$

(ii) Add $Fe^{2+}_{(aq)}$
Add $Fe^{3+}_{(aq)}$ and HCl / heat
Blue colour

Question 5

(a) The decay rate measured on a Geiger Muller counter of a sample of sodium 24 at different times are given below.

Time/hr	**0**	**5**	**10**	**15**	**20**	**25**
Rate of decay/count	**730**	**570**	**455**	**365**	**292**	**232**

(i) Plot a graph of decay rate against time

(ii) Determine the half-life of sodium -24.

(iii) State what would happen to the rate of decay if:

(α) temperature is increased;

(β) pressure is increased.

(iv) Give reasons for your answers in (iii).

(b) The electron configuration of oxygen is as follows:

Is 2s $2p_x$ $2p_y$ $2p_z$

(i) Explain briefly the significance of the:

(α) arrows;

(β) letters x, y and z.

(ii) Why is the electron in the $2p_z$ orbital not located in the $2p_y$ orbital?

(iii) Using boxes similar to those in (b), draw the electron configuration of:

(α) carbon;

(β) phosphorus.

(iv) From the configuration for carbon, explain how carbon shows a covalency of four equivalent bonds.

(v) Give a diagram of the shapes of the orbitals used in forming the bond stated in (iv)

(c) State two reasons why particles must be ionized before analysed in the mass spectrometer.

(d) State three constituents of cement

Almost all the candidates answered this question but performed averagely.

(a) Candidates were able to plot the graph of the decay rate against time and determine the half-life. Only few were able to state the effect of increased temperature and pressure on the rate of decay. That it was a nuclear reaction and not affected by external factors such as temperature and pressure.

(b) Majority of the candidates were able to give the significance of the arrows in the box representation of the electron configuration of oxygen but failed to say what the letters x, y and z are.

They were able to use the Hund's rule to explain why the electron in the $2p_z$ orbital of oxygen not located in the $2p_z$ orbital.

Electron configurations of carbon and phosphorus were done.

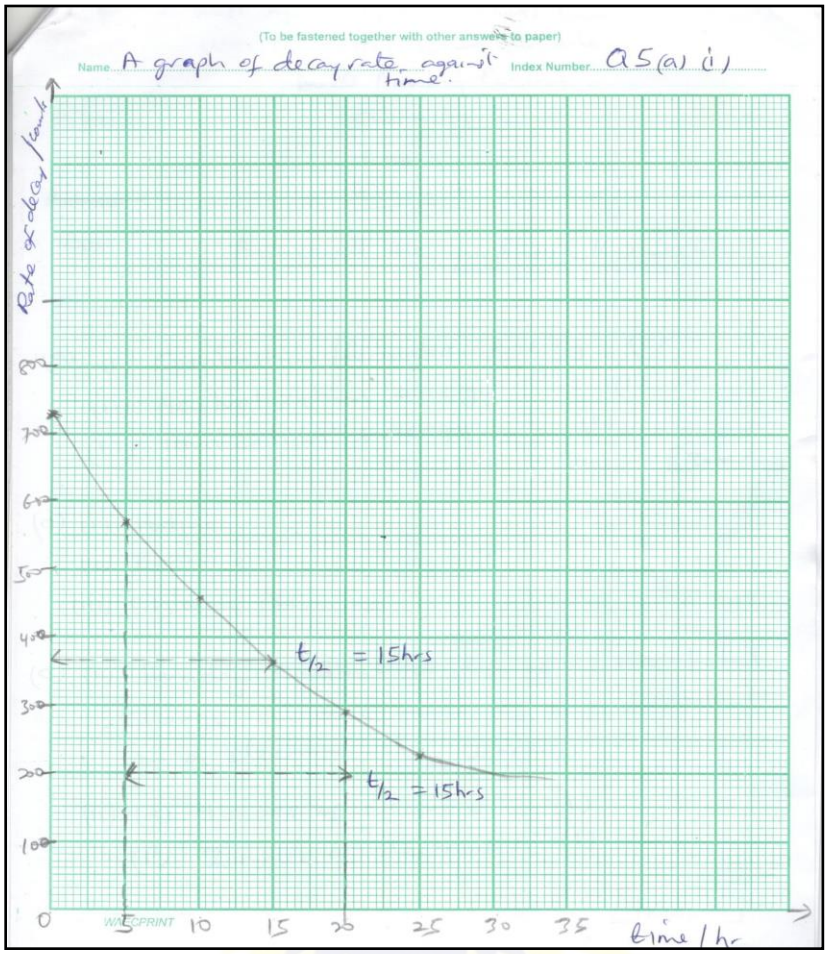
Although they were able to explain how carbon shows covalency of four equivalent bonds they could not give a diagram of the shapes of the orbitals formed.

(c) About 50% were able to give the reasons why particles must be ionized before being analysed in the mass spectrometer

(d) This section was poorly attempted. This could be due to the fact that they are not abreast with the production of cement.

Almost all the candidates could mention lime as (free lime). The constituents of cement was a little difficult for them as they see it as being made-up of clinker and gypsum only.

Expected answers are:



Correct scale

Correct graph with all points indicated

(ii) from the graph, initial point = 730, half of this value = 365, time interval between the two points = 15 hrs, stating the two points or any points on the graph should give a time interval of 15 hrs $\pm$ 0.1

(iii) (α) It will not affect the rate of decay

(β) It will not affect the rate of decay

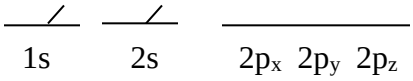
(iv) The decay process is a nuclear reaction/involves the nucleus of sodium – 24 and this is not affected by the external factors.

(b) (i) (α) the arrows indicate the spin of the electrons

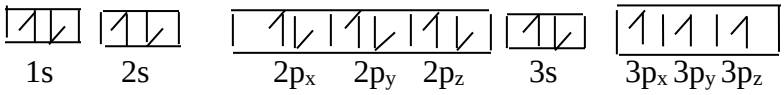
(β) the letters represents the direction in space of the three p orbitals along the x, y, z axes respectively

(ii) The $2p_y$ and $2p_z$ electrons are of the same energy. According to Hund's rule, electrons occupy these orbitals singly before pairing up, hence the electrons must occupy $2p_y$ and $2p_z$ singly before pairing up.

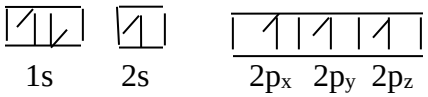
(iii) (α) Carbon



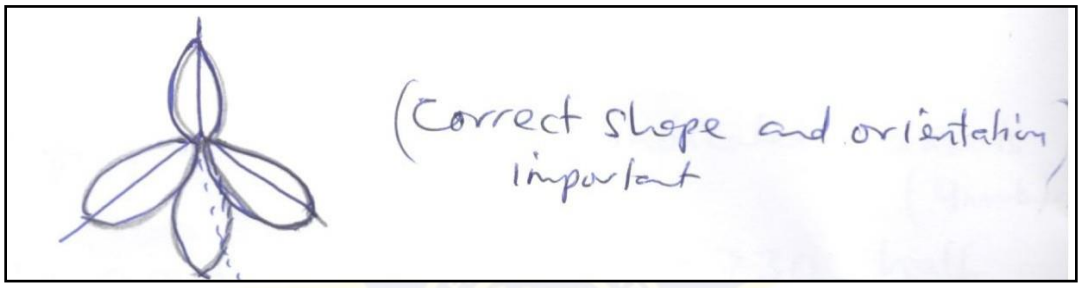
(β) Phosphorus



(iv) For carbon one of the 2s electrons is promoted to the vacant 2p orbital



(v)



(c)

- magnetic field deflects ions hence neutral atoms and molecules must be ionized because the mass spectrometer works by moving the particles with electric and magnetic fields
- measures the mass of charged particles, only ions will be detected

(d)

- lime / CaO / calcium oxide/calcium hydroxide/akaline
- silica / SiO_2 / silicon (IV) oxide
- alumina / Al_2O_3 / aluminium oxide/clay
- calcium sulphate / $CaSO_4$ / calcium tetraoxosulphate (VI)/gypsum
- Iron oxide / Fe_2O_3
- Sulphur / S
- Magnesia / MgO
- Limestone/$CaCO_3$

CHEMISTRY 3

1. GENERAL COMMENTS

The three alternative papers (A, B and C) were of comparable standard and as a unit, compared favourably with those of previous years. However, it looks like some teachers are not allowing candidates to do independent work.

(i) very poor performance this year especially with respect to titration i.e. question 1

(ii) some of the candidates did not have any titration table but used titre values for their calculations.

In some cases, these titre values were same or close to teacher's titres. An indication that practical work is no longer getting the needed attention

2. SUMMARY OF CANDIDATES' STRENGTHS

(i) Most of the candidates recorded burette readings to the requisite two decimal places. The calculated concentrations were converted to the appropriate significant figures

(ii) Generally, question 3 (in all the alternatives) was well handled by a good number of candidates

(iii) Calculation of solubility and concentration in mol dm^{-3} and g dm^{-3}

3. SUMMARY OF WEAKNESSES

(i) As already mentioned, some candidates did not record table of titre values, yet used titres in their calculations

(ii) For qualitative analysis many of the candidates performed and recorded tests that were not demanded by the question

(iii) Some candidates drew conclusions from irrelevant and inappropriate tests

(iv) Some candidates also committed errors in basic mathematical operations e.g. making concentration of a compound, subject of formula

(v) Poor usage of the English language. A few of the candidates could hardly express themselves clearly. A lot of spelling mistakes

(vi) Inability to outline how recrystallization is carried out in the laboratory

(vii) Inability to state the correct observation of simple experiment (e.g. precipitates were incorrectly described, and inferences stated did not correspond to observation recorded)

4. SUGGESTED REMEDIES

(i) Teachers must endeavour to expose students to a lot of practical exercises. They must make time to mark the exercises and also draw their attention to the essential points

(ii) Must be taught the procedure used in practical activities

(iii) Students must also be encouraged to cultivate the habit of reading

5. DETAILED COMMENTS

ALTERNATIVE A

Question 1

A is a solution containing 15.8 g dm^{-3} of $Na_2S_2O_3$.
B was obtained by dissolving 9.0 g of an impure sample of I_2 in aqueous KI and the solution made up to 1 dm^3.

(a) **Put A into the burette and titrate it against 20.0 cm^3 or 25.0 cm^3 portions of B using starch solution as indicator. Repeat the titration to obtain concordant titre values. Tabulate your results and calculate the average volume of A used. The equation for the reaction involved in the titration is: $1_2 + 2S_2O_3^{2-} \rightarrow S_4O_6^{2-}$**

(b) **From your results and the information provided, calculate the:**
- **(i)** **concentration of A in mol dm^{-3};**
- **(ii)** **concentration of I_2 in B in mol dm^{-3};**
- **(iii)** **percentage by mass of I_2 in the sample.**

(c) **Give reasons why the starch indicator was not added to the titration mixture at the beginning of the titration. [O = 16.0, Na = 23.0, S = 32.0, I = 127.0]**

Question 2

C is a mixture of two inorganic compounds. Carry out the following exercises on C.
Record your observations and identify any gas(es) evolved.
State the conclusions you draw from the results of each test.

(a) **Put all of C in a boiling tube and add about 10 cm^3 of distilled water. Shake thoroughly and filter. Keep both the residue and the fitrate**

(b) **(i)** **To about 2 cm^3 of the filtrate, add a few drops of silver trioxonitrate (V)**
followed by dilute HNO_3.
- **(ii)** **Add excess NH_3 solution to the resulting mixture in (b)(i).**

(c) **(i)** **Put the residue in a test tube, add about 2 cm^3 of dilute HCl and shake.**
- **(ii)** **Add NH_3 solution in drops to the mixture in (c)(i) and then in excess**

Question 3

(a) **(i)** **State what would be observed when $BaCl_2$ solution is added to a portion of a saturated Na_2CO_3 followed by dilute HCl in excess.**
- **(ii)** **A gas Q decolourized acidified $KMnO_4$ solution. Suggest what Q could be**

(b) **Name one substance used in the laboratory for drying each of the following substances:**
- **(i)** **ammonia gas;**

(ii) **carbon (IV) oxide.**

(c) Give a reason why a given mass of sodium hydroxide pellets cannot be used to prepare a standard solution.

Alternative A

Question 1

(b) (i) Most of the candidates were able to calculate the molar mass of $Na_2S_2O_3$ and proceeded to calculate the Conc. of $Na_2S_2O_3$ in mol dm^{-3}. However, some of them attached wrong units to the molar mass.

(ii) Conc. of B in mol dm^{-3}

An appropriate number of candidates handled this question well. Some however had problems with the mole ratio and could not even make C_B the subject of formula leading to wrong substitution.

(iii) % by mass of I_2 in the sample

Many of the candidates were able to calculate the molar mass and mass of I_2 respectively. The percentage by mass of I_2 in the sample was also correctly calculated by most of the candidates.

(c) In the various answers given, many left out the key point that is adding starch at the beginning would reduce the accuracy of the result

Question 2

Performance was encouraging. Apparently, candidates are now getting to understand how to handle mixtures in qualitative analysis. A few candidates however could not write their tests correctly and lost the relevant marks. Such candidates did not care about state / nature of sample that is, whether reagents were being added to the filtrate or residue.

Question 3

This question was satisfactorily answered by most of the candidates. However, for 3(b) many candidates lost marks for using formulae instead of names for the substances used for drying (i) ammonia gas (ii) carbon (IV) oxide. Others also failed to use IUPAC name i.e. sulphuric acid for tetraoxosulphate (VI) acid.

Expected answers are:

Question 1

(b) (i) Concentration of $Na_2S_2O_3$ in mol dm^{-3} $= \frac{\text{mass of } Na_2S_2O_3}{\text{Molar mass of } Na_2S_2O_3}$

Molar mass of $Na_2S_2O_3 = (2 \times 23) + (2 \times 32) + (3 \times 16)$

$= 158 \text{ gmol}^{-1}$

Concentration of $Na_2S_2O_3 = 15.8 \text{ gdm}^{-3}$

158 $gmol^{-1}$

$C_A = 0.100\ moldm^{-3}$ / $0.10\ moldm^{-3}$/$0.1\ moldm^{-3}$

(ii) $\frac{C_AV_A}{C_BV_B} = \frac{2}{1}$

$C_B = \frac{C_AV_A}{2 \times V_B}$

$= \frac{0.1 \times V_A}{2 \mathbf{x} V_B}$ (correct substitution)

= Say a mol dm^{-3} correct evaluation (3 s.f.)

b (ii) Alternative method

1000 cm^3 of **A** contains 0.10 moles of $Na_2S_2O_3$

∴ V cm^3 of **A** will contain $\frac{0.10\ V_A}{1000}$ mole $Na_2S_2O_3$

From the equation:

2 moles of $Na_2S_2O_3$ reacts with 1 mole I_2

∴ $\frac{0.10\ V_A}{1000}$ mole $Na_2S_2O_3$ will react with $\frac{0.10\ V_A}{2x1000}$ mole I_2

20/25cm^3 of **B** contain $\frac{0.10\ V_A}{2x1000}$ mole I_2

∴ 1000 cm^3 of **B** contain $\frac{0.10\ V_A}{2 \times 1000} \times \frac{1000}{V_B}$

$= \frac{0.10\ V_A}{2 \times V_B}$

= Say a mol

∴ Concentration of I_2 in **B** in mol dm^{-3} = a $moldm^{-3}$ (3 sig fig)

(No score for wrong unit)

(iii) Mass of I_2 in sample = moles of I_2 x molar mass of I_2

Molar mass of I_2 = 2 x 127

$= 254\ gmol^{-1}$

Mass of I_2 = **a** x 254

= Say **b** g (correct evaluation)

Percentage by mass of I_2 = $\frac{\text{mass of } I_2}{\text{Mass of sample}}$ x 100

= $\frac{b}{9}$ x 100

= Say **C** %

(c) - To obtain accurate end-point/To prevent the formation of complex which reduces the accuracy of the result.

Question 2

	TEST	**OBSERVATION**	**INFERENCE**
(a)	**C** + distilled water and filter	**C** partially dissolved green residue Colourless filtrate	 Fe^{2+} or Cu^{2+} salt
(b)(i)	Filtrate + $AgNO_{3(aq)}$	White precipitate	Cl^-, CO_3^{2-}, or SO_3^{2-}, S^{2-}
	+ $HNO_{3(aq)}$	Precipitate insoluble/No visible change	Cl^-
(ii)	resulting mixture in (b)(i) + excess $NH_{3(aq)}$	Precipitate soluble	Cl^- present
(c)(i)	Residue + dil HCl	Residue dissolved to form a blue solution	Cu^{2+} present
		(effervescence) / colourless, odourless gas evolved	
		The gas turned lime water milky	$CO_{2(g)}$ from CO_3^{2-}
(ii)	Portion of mixture from c(i) + $NH_{3(aq)}$ in drops then in excess	(Light) blue precipitate (Do not accept deep blue precipitate)	
		Precipitate dissolved in excess to form deep blue solution	Cu^{2+} confirmed

Question 3

(a) (i) -White precipitate

- Effervescence/gas evolved
- Precipitate dissolves/disappears

(ii) SO_2 /H_2S unsaturated hydrocarbon (accept any named unsaturated hydrocarbon)

(b) (i) Calcium oxide

(ii) Calcium chloride/ concentrated tetraoxosulphate (VI) acid

(c) Sodium hydroxide (NaOH) is deliquescent **(1)**, it absorbs water vapour (moisture)and carbon (IV) oxide from the air, and this would add to its mass

ALTERNATIVE B

Question 1

D is a 0.050 mol dm^{-3} HCl.

E is a saturated solution of $Ca(OH)_2$ at room temperature

(a) Put D into the burette and titrate it against 20.0 cm^3 or 25.0cm^3 portions of E using phenolphthalein as indicator. Repeat the titration to obtain consistent titre values. Tabulate your results and calculate the average volume of D used. The equation for the reaction is: $Ca(OH)_2 + 2HCl \rightarrow CaCl_2 + 2H_2O$

(b) From your results and the information provided, calculate the solubility of $Ca(OH)_2$ at room temperature in;

(i) moles per dm^3 (mol dm^{-3});

(ii) grammes per dm^3 (g dm^{-3});

(c) What volume of distilled water must be added to 500 cm^3 of E in order to reduce the concentration of Ca^{2+} ions to one quarter of its original value?

[H = 1.0, O = 16.0, Ca = 40.0]

Question 2

F is an inorganic solid. Carry out the following exercises on F.

Record your observations and identify any gas(es) evolved.

State the conclusions you draw from the results of each test.

(a) Divide F into two equal portions.

(i) Put the first portion of F into a dry boiling tube and heat strongly.

(ii) Put the second portion of F into a test tube and add about 10 cm^3 of dilute HNO_3 (filter if necessary).

(b) To about 2 cm^3 of the resulting solution:

(i) add dilute NaOH in drops and then in excess;

(ii) add dilute NH_3 in drops and then in excess;

(iii) add $HCl_{(aq)}$.

(c) From your results identify the ions in F.

Question 3

(a) (i) Give the reason why organic substances are usually recrystallized after they have been produced.

(ii) Outline how recrystallization could be carried out in the laboratory.

(b) State two pieces of apparatus required for the evaporation of sodium chloride solution to dryness.

Question 1

(b) Calculation of solubility of $Ca(OH)_2$

Performance was quite good. However, some candidates could not correctly make C_E the subject of formula. Again, some gave wrong units for formula mass of $Ca(OH)_2$.

(c) The major issue was that many of the candidates did not know, they had to divide the original concentration by 4 before applying the dilution law. Some also failed to deduct the initial volume from the new volume in order to arrive at volume of water to be added

i.e. $2000 - 500 = 1{,}500\ cm^3$

Question 2

Performance was quite good. Except that some of the candidates kept adding the reagents to F instead of resulting solution (F + dil HNO_3)

Question 3

(a) (ii) Some candidates performed creditably well on this question. Most candidates however failed to realize that the solution obtained after heating the mixture to dissolve the impure sample must be filtered while hot.

(b) Many candidates lost marks due to incorrect pieces of apparatus.

Expected answers are:

Question 1

(b) (i) $\frac{C_DV_D}{C_EV_E} = \frac{2}{1}$

$C_E = \frac{C_DV_D}{2V_E}$

$C_E = \frac{0.050 \times V_D}{2x\ V_E}$ correct substitution

= Say **Y** moldm^{-3} (correct evaluation to 3 s.f.)

Alternative method

1000 cm^3 of **D** contain 0.05 mole HCl

∴ V_D cm^3 of **D** will contain $\frac{0.05 \times V_D}{1000}$ mol HCl

From the equation:

2 mol HCl react with I mole $Ca(OH)_2$

∴ $\frac{0.05}{1000} V_D$ cm^3 HCl will react with $\frac{0.050}{2x1000} V_D$ $Ca(OH)_2$

∴ 1000 cm^3 of **E** will contain $\frac{0.050 \times V_D}{2x\ V_E}$ mole

= Say **Y** mol

The solubility of $Ca(OH)_2$ in moldm^{-3} = **Y** moldm^{-3}

(ii) Solubility in gdm^{-3}

Molar mass of $Ca(OH)_2$ = 40 + 2(16+1)

= 74 gmol $^{-1}$

Concentration of **E** in gdm^{-3} = 74 x Y

= Say **Q**

∴ Solubility of Ca $(OH)_2$ = Q gdm^{-3}

(c) Original concentration of Solution **E** in moldm^{-3}= **Y**

New concentration = $\frac{Y}{4}$

Let volume of diluted solution be V

Then $\frac{500 \times \mathbf{Y}}{1000} = \frac{V \times \mathbf{Y}}{1000x4}$

V = 2000 cm^3

Volume of water to be added = 2000 – 500

= 1500 cm^3

Question 2

	TEST	OBSERVATION	INFERENCE
(a)(i)	**F** + Heated strongly	Colourless gas evolved turns lime water milky Red residue/substance remains when hot Yellow when cold	CO_2 from CO_3^{2-}
(ii)	**F** + dil HNO_3	Effervescence colourless odourless gas evolved. Gas turns lime water milky.	CO_2 from CO_3^{2-} present
(b)(i)	Resulting solution from a(ii) + $NaOH_{(aq)}$ in drops then in excess	White (chalky) precipitate Precipitate soluble	Pb^{2+} **or** Ca^{2+} Pb^{2+}
(ii)	Resulting solution + $NH_{3(aq)}$ in drops then in excess	White (chalky) precipitate Precipitate insoluble/No visible change	Pb^{2+} **present**
(iii)	Resulting solution + dil HCl	White precipitate	Pb^{2+} **confirmed**

(d) The ions present in **F** are Pb^{2+} and CO_3^{2-}

Question 3

(a) (i) To purify the sample

(iii)

- Put sample in a beaker, and add a suitable solvent
- Heat mixture to dissolve the sample
- The solution obtained is filtered while hot
- The filtrate is partially evaporated and cooled to form crystals
- The resulting crystals are filtered and then dried

(b)

- Evaporating dish/beaker
- Bunsen burner/mentioned source of heat
- Tripod stand with wire gauze
- Stirring rod/glass rod.

ALTERNATIVE C

Question 1

G is CH_3COOH obtained by diluting 50.0 cm^3 of vinegar to 250 cm^3. H is 0.10 mol dm^{-3} NaOH.

(a) Put H into the burette. Titrate it against 20.0 cm^3 or 25.0 cm^3 portions of G using methyl orange as indicator. Repeat the titration to obtain concordant titre values. Tabulate your results and calculate the average volume of H used. The equation of the reaction is: $CH_3COOH_{(aq)} + NaOH_{(aq)} \rightarrow CH_3COONa_{(aq)} + H_2O_{(aq)}$

(b) From your results and the information provided, calculate the:

(i) concentration of CH_3COOH in mol dm^{-3};

(ii) concentration of CH_3COOH in the undiluted vinegar.

(c) If the density of the vinegar is 1.05 g cm^{-3}, calculate the percentage by mass of CH_3COOH in the undiluted vinegar. [H = 1.0, C = 12.0, O = 16.0]

Question 2

J is a mixture of two inorganic salts. Carry out the following exercises on J. Record your observations and identify any gas(es) evolved. State the conclusion you draw from the result of each test.

(a) Put all of J into a beaker and add 10 cm^3 of distilled water. Stir the mixture and then filter. Keep both the filtrate and the residue.

(b) Divide the filtrate into two portions.

(i) To the first portion add $NH_{3(aq)}$ in drops and then in excess.

(ii) To the second portion add about 1 cm^3 of dilute HNO_3 and a few drops of $AgNO_{3(aq)}$.

(c) (i) To the residue in a test tube, add 2 cm^3 of dilute H_2SO_4 and shake;

(ii) Pour 1 cm^3 of the resulting solution from (c)(i) into another test tube. Add $NH_{3(aq)}$ in drops and then in excess.

Question 3

(a) Calculate the volume of water that would be added to 50 cm^3 of 0.10 mol dm^{-3} of HCl to dilute it to 0.010 mol dm^{-3}.

(b) (i) State one:

(α) physical property;

(β) chemical reagent; that could be used to differentiate between sucrose and starch.

(iv) Sucrose and starch can be converted into the same product X, by a process Y using a reagent Z. Name

(α) product X;

(β) process Y;

(γ) reagent Z.

(c) State the use of a desiccator.

Question 1

(a) (i) Conc. of CH_3COOH in mol dm^{-3}

Most of the candidates were able to calculate the concentration as required

(b) (i) Conc. of CH_3COOH in the undiluted vinegar

Apparently, this question was difficult for a significant number of candidates. They failed to recognize that this can easily be done by multiplying the concentration obtained in (b) by the diluting factor. i.e. 250 /50 = 5

(e) % by mass of CH_3COOH in the undiluted vinegar

Many candidates could not get this far as they were unable to calculate the Conc. Of CH_3COOH in the undiluted sugar. However, most of them were able to calculate the molar mass of CH_3COOH. Teachers must endeavour to take students through similar questions.

Question 2

Performance was encouraging except that in few cases, tests were wrongly stated as well as observations and inferences.

Question 3

Clearly, most of the candidates were comfortable with this question and scored high marks. Some of the candidates, however, failed to subtract the original volume from the new volume after using the dilution law and hence lost some marks.

Expected answers are:

Question 1

(b) (i) $\frac{C_G V_G}{C_H V_H} = \frac{1}{1}$

$C_G = \frac{C_H V_H}{V_G}$

$= \frac{0.1 \times V_H}{20/25}$ (correct substitution)

= Say **Q** mol dm^{-3} **(1)** (correct evaluation to 3 s.f.)

(ii) Dilution factor = $\frac{250}{50}$

= 5

Conc. of undiluted vinegar = 5 x **Q**

= Say **R**

Alternative

If concentration of CH_3COOH in the undiluted vinegar is **N** then

$\frac{50 \times \mathbf{N}}{1000} = \frac{250 \times \mathbf{Q}}{1000}$

$N = \frac{250}{50} \times Q$

= 5 x Q

= Say **R**

(c) Molar mass of CH_3COOH = 4+(12x2) + (16x2)

= 60 g mol^{-1}

Mass of CH_3COOH in 1000 cm^3 of undiluted

Vinegar = 60 x **R**

= 60 **R**

1 cm^3 of undiluted vinegar weighs = 1.05 g

∴ 1000 cm^3 = 1000 x 1.05

= 1050 **g**

% by mass $CH_3COOH = \frac{60\ \mathbf{R}}{1050} \times 100$

= Say **Z**

Question 2

	TEST	OBSERVATION	INFERENCE
(a)	**J** + distilled water + filter	**J** partially dissolved to give white residue and colourless filtrate	Mixture of soluble and insoluble salt
(b)(i)	1st portion of filtrate + $NH_{3(aq)}$ in drops then in excess	White gelatinous precipitate precipitate dissolved	Zn^{2+}, Al^{3+} Zn^{2+} present
(ii)	2nd portion of filtrate + dil HNO_3 + $AgNO_{3(aq)}$	No visible reaction White precipitate	Cl^-
(c)(i)	Residue + $H_2SO_{4(aq)}$ + shaking	(Effervescence) Colourless odourless gas evolves which turns lime water milky	CO_2 from CO_3^{2-} present
(ii)	Solution from c(i) +$NH_{3(aq)}$ in drops then in excess	No precipitate is formed No visible change	Ca^{2+}, Na^+, NH_4^+ Suspected

Question 3

(a) Using dilution factor

C_1V_1 (undiluted) = C_2V_2 (diluted)

$V_2 = \frac{C_1V_1}{C_2} = \frac{0.1 \times 50}{0.010}$

$= 500\ cm^3$

Volume of distilled water to be added to the original solution

$= 500 - 50$

$= 450\ cm^3$

(b) (i) (α) - Solubility (in water)/ melting point

(β) - Iodine solution/ Benedict/Fehling's solution

(ii) (α) X - glucose

(β) Y - hydrolysis

(γ) Z - dilute mineral acid / enzyme(zymase)

(c) - To keep dry substances/

- solid substances dry

CROP HUSBANDRY AND HORTICULTURE 2

1. GENERAL COMMENTS

The standard of this year's paper compares favourably with that of the previous year. Candidates performance was the same as last year.

2. SUMMARY OF CANDIDATES' STRENGTHS

(i) Most candidates were able to answer the required questions within the stipulated time
(ii) Candidates have adequate knowledge in nutritional values of vegetables in humans
(iii) Candidates were able to adhere to the rubrics of the questions

3. SUMMARY OF CANDIDATES' WEAKNESSES

(i) Some candidates could not express themselves well in the English language
(ii) Poor spelling of scientific names and technical words
(iii) Inadequate knowledge in importance of staking in yam production
(iv) Candidates could not discuss / explain questions that demand so, although they are able to state the points required
(v) Some candidates could not explain growth medium, parboiling, staking and terms associated with farming systems.

4. SUGGESTED REMEDIES

(i) Technical terms and scientific names should be properly taught
(ii) Candidates must be told to properly explain/discuss points they stated to bring out the answers.
(iii) There should be proper teaching of growth medium, parboiling, staking and terms associated with farming systems

5. DETAILED COMMENTS

Question 1

(a) List four cultural methods of controlling blackpod disease on a cocoa farm.
(b) Discuss three ways in which each of the following practices is important in crop production:
(i) parboiling rice;
(ii) fermenting cocoa beans.
(c) Explain two reasons why it is important to nurse cabbage before transplanting.

(a) A lot of candidates could not mention the cultural methods of controlling black pod disease i.e. remove and destroy infested pod, regular weeding etc

(b) (i) This sub-question was poorly answered. Most of the candidates failed to state the importance of parboiling in rice. The expected answers include:

- reduction in grain breakage;
- gives high milling percentage;
- improves nutrients content of the grain.

(ii) Most candidates were able to mention correctly the development of the chocolate colour; the death of the embryo; easy processing of cocoa beans as the importance of fermenting cocoa beans

(c) This sub-question was poorly answered by the candidates because they lacked knowledge on the reasons for nursing cabbage seeds before transplanting. The expected correct responses include: to provide intensive care for young seedlings; to reduce chance of loss/death; to eliminate late germination.

Question 2

(a) Discuss five ways in which vegetables are of nutritional importance to humans.
(b) Give two examples of leafy vegetables.
(c) List four signs of maturity in maize plant.
(d) Give four reasons for staking yam plants in crop production.

(a) Most candidates were able to state the nutritional importance of vegetables but could not discuss. The only correct discussion was on roughage, aiding digestion and prevention of constipation.

(b) Most candidates correctly mentioned cabbage and lettuce as an example of leafy vegetables. However, others mentioned local names; examples alefu, nkontomre etc which were not accepted.

(c) A few candidates were able to mention the drying of the leaves, silk and the cob as signs of maturity of maize plant. However, a lot of them mentioned yellowing of the leaves which was not acceptable.

(d) All candidates who attempted this sub-question showed absolute lack of knowledge as to the reasons for staking yam plants in crop production.

Candidates were expected to provide the following reasons:

- to provide support for climbing plant;
- expose leaves to receive sunlight;
- to improve yield;
- to facilitate weeding.

Question 3

(a) Differentiate between budding and grafting as used in crop production.

(b) Describe three cultural practices in the maintenance of lawns

(c) Describe two methods of establishing lawns

(d) Give four examples of grasses used for lawn establishment.

(a) This sub-question was poorly answered. Most of the candidates could not bring out clearly the differences between budding and grafting. It must be noted that budding is a process of vegetative propagation where one bud/scion is joined to the cambium layer of the rootstock. Whereas in grafting a cambium layer of a branch consisting of several buds / scion is joined to cambium layer of the root stock of another plant to grow as one plant.

(b) Most of the candidates were able to state correctly the methods of maintaining lawns which include: mowing; weed control; watering/irrigation; fertilizer application, disease and pest control.

(c) Again, most of the candidates were able to list the methods of establishing lawns. However, a good number of them were not able to describe satisfactorily the listed methods.

(d) Quite a number of candidates scored marks for giving correctly examples of grasses used for lawn establishment. However, majority of them lost marks for wrong spellings of technical terms/scientific words.

Question 4

(a) (i) What are ornamental plants.

(ii) Give five reasons for establishing ornamental plants on a school compound.

(b) Discuss four factors that are considered in selecting a site for farm.

(c) State four reasons for sowing seeds in drills at the nursery.

(a) (i) Majority of the candidates did very well by explaining the term "ornamental plants" and scored the full marks. It must be noted that ornamental plants are plants that are grown for their aesthetic values / for their beauty.

(ii) Candidates did very well by giving reason for establishment of ornamental plants on a school compound and again scored high marks. Their answers included: for beautification, shade, serve as windbreak etc.

(b) Most candidates were able to state the factors that influence the choice of a site for a farm but could not explain the stated factors. Some candidates explained the factors rather than explaining how the factors are considered in selecting a site for farm. Some candidates mentioned climate as a factor which was not accepted. Factors such as vegetation, labour, soil type were hardly mentioned.

(c) This sub-question was poorly answered by most of the candidates. Reasons for sowing seeds in drills at the nursery include:

- easy identification;
- easier to prick-out;
- easy weeding.

Question 5

(a) What is a growth medium?

(b) List four substances that could be used as growth medium.

(c) State two advantages and two disadvantages of using each of the following types of pots for growing house plants:

(i) clay pot;

(ii) plastic pot.

(d) State four advantages and two disadvantages of vegetable propagation.

(a) Only a few candidates were able to explain growth medium. It must be noted that growth medium is any substance or medium in which root of plant can grow.

(b) Most candidates mentioned correctly only soil and sawdust. Growth media such as vermiculite, compost, manure were hardly listed.

(c) (i) Most candidates were not able to mention the advantages of clay pots. A few however, were able to mention that it can be steam sterilized. Protect roots from sudden change of temperature; are porous; can retain moisture. For disadvantages, only a few candidates mentioned correctly heavy to handle, are breakable as the correct answer.

(ii) All the candidates who attempted part (ii) showed absolute lack of knowledge of advantages and disadvantages of using plastic pot for growing house plants.

The expected advantages include:

- light to handle;
- not breakable;
- easy to clean.

The expected disadvantages include:

- less stable;
- less aerated / not porous;
- does not regulate soil temperature.

(d) (i) Candidates did well in answering this sub-question by providing the correct answers to the advantages of vegetative propagation.

(ii) Most candidates gave answers like “bulky”, cannot be stored for long periods” without adding “planting material” to bring out the exact disadvantages.

The expected correct disadvantages which were hardly mentioned include:

- no genetic variability;
- easy transfer of diseases from parent plants to offspring's.

Question 6

(a) Explain each of the following terms as used in crop husbandry:

(i) monocropping;

(ii) monoculture;

(iii) crop rotation;

(iv) relay intercropping.

(b) (i) What is repotting?

(ii) Give three reasons for repotting a house plant.

(c) Give three advantages of irrigating a farmland.

(a) Majority of the candidates could not satisfactorily explain the farming systems. They were not able to bring out the key phrases that will explain each of the farming methods adequately.

(i) Monocropping: It is the practice of growing one/single crop to majority and harvested at a same time on a piece of land before another crop is planted.

(ii) Monoculture: Is a system of farming in which one crop is cultivated on the same piece of land year after year / season after season.

(iii) Crop rotation: Is a method of farming where different crops are grown in a definite sequence or order on the same piece of land.

(iv) Relay intercropping: It involves the growing of two or more crops on the same piece of land such that part of their life cycles overlap.

(b) (i) This sub-question was poorly answered. Candidates knowledge about the pot plant industry is very low. Some of the wrong answers are:

- replacing soil in the pot
- replacing plant in the pot

Candidates should note that reporting is the act of transferring a house plant from an old pot to a new one.

(ii) Most of the candidates could not state reasons for repotting.

Expected answers are:

- when soil become less productive;
- when plant is pot bound.

(c) A few candidates were able to mention that:

- it keeps the soil moist / dissolves nutrients in the soil;
- promote microbial activities, as disadvantages of irrigating a farmland.

CROP HUSBANDRY AND HORTICULTURE 3

1. GENERAL COMMENTS

The standard of this paper compared favourably with that of the previous years. Candidates' performance was generally better than the previous year.

2. SUMMARY OF CANDIDATES' STRENGTHS

(i) Most candidates exhibited depth knowledge of the subject matter
(ii) Majority of the candidates were able to state the observable features of *Boerhavia erecta*
(iii) Candidates were able to give concise and precise answers
(iv) Candidates were able to do the calculation on plant population question very well

3. SUMMARY OF CANDIDATES' WEAKNESSES

(i) A lot of candidates could not state the title of the diagram and labeling was poorly done
(ii) Poor spelling of types of cocoa cultivated in West Africa and pests of cotton plant (Specimen G)
(iii) Inadequate knowledge in pests of crop plants

4. SUGGESTED REMEDIES

(i) Proper teaching of drawing of Agricultural inputs should be encouraged by teachers
(ii) Tutors should give exercises involving calculations as well as pests of crop plants
(iii) Scientific words and technical terms should be properly taught

5. DETAILED COMMENTS

Question 1

(a) (i) State four cultural practices that are carried out in the production of the crop from which specimen A was obtained.

(ii) Mention three effects of delayed harvesting of specimen A.

(iii) Give the reason for the inclusion of the crop of specimen A in a crop rotation programme.

(b) (i) Give one reason why specimen B may be used in the production of specimen A.

(ii) State four precautionary measures that must be taken using specimen B.

(a) (i) Candidates were able to answer this question very well by stating correctly staking, weed control and pest and disease control. For fertilizer application, candidates correctly mentioned phosphate/potash fertilizers to score the full marks

(ii) The effects of delayed harvesting, majority of the candidates correctly stated mouldiness, rodents and pests attack as well as reduction in yield and decrease in seed quality.

(iii) Majority of the candidates were able to state the basic reason for inclusion of cowpea in crop rotation programme correctly. Their correct answers include; to fix nitrogen on the soil / to improve soil fertility.

(b) (i) The uses of specimen B (Actellie pesticide) was stated correctly by many of the candidates to control post-harvest pest, or to control pest in storage. Candidates who stated that the Specimen B is used to control pest during crop production lost marks.

(ii) Most candidates stated correctly the precautionary measures such as protective clothing, wear safety glasses / goggle when using Actellic pesticide (B).

Question 2

(a) (i) Draw and label specimen C.

(ii) Mention two uses of specimen C.

(iii) State two ways in which specimen C is maintained.

(b) (i) List three types of specimen D that are commonly cultivated in West Africa.

(ii) Name three pests of the crop from which specimen D was obtained.

(a) (i) Majority of the candidates did not write the title of the specimen drawn – Diagram of specimen C (knapsack sprayer) – hence lost the marks.

Most candidates were able to state the labels correctly – tank, trigger, shoulder straps, tank lid/cap and nozzle.

(ii) Many candidates stated the correct uses of specimen C; for application of pesticides / for application of weedicides.

(iii) Most candidates correctly stated how knapsack is maintained after use – i.e. wash tank thoroughly with clean water after use, keep in a safe place and replace damaged parts.

(b) (i) Many candidates provided correctly the types of specimen D which are - Dura, Tenera and Pisifera. However, many of the candidates rarely stated or mentioned macrocarya type.

(ii) Pests of oil palm were excellently stated. Pest like leafminer, birds, mites, monkeys and termites were provided by most candidates hence scored full marks.

Question 3

(a) (i) List three planting materials for propagating the crop from which specimen E was obtained.

(ii) Describe the process of floral induction in the production of specimen E.

(iii) Name two diseases that attack the plant of specimen E.

(b) (i) Name three types of specimen F that are cultivated in West Africa.

(ii) A 5-hectare land is cultivated with specimen F at a planting distance 2.5 metres by 2.5 metres. Calculate the plant population.

(a) (i) Many candidates correctly mentioned/named the planting materials of specimen E (pineapple) as crown, slip and sucker

However, almost all candidates failed to state stem cutting and tissue culture as part of their answers.

(ii) Majority of the candidates failed to describe the process of floral induction in pineapple. They rather stated the importance of floral induction in pineapple. This description made them lose all marks allotted to the question

The process of floral induction involve the dissolution of appropriate quantity of calcium carbide in water, allow the mixture to cool and apply to the growing point.

(iii) Most candidates correctly mentioned diseases which attack the plant of specimen E (pineapple). However, a few candidates wrongly spelt the names of the diseases which caused them the marks. Diseases like Heart rot, root rot and mealy bug wilt were correctly stated by most candidates.

(b) (i) Types of cocoa cultivated in West Africa were correctly stated by most candidates. e.g. criollo, Amelonado, forustero. Candidates spelt trinitario wrongly and this caused them marks.

(ii) Some candidates correctly calculated the plant population of specimen F on a 5-hectares at a distance of 2.5 m by 2.5 m

Example – I ha = 10,000 m^2

$\therefore$ 5 ha = 5x10,000 m^2

= 50,000 m^2

Planting distance = 2.5m x 2.5m

= 6.25 m^2

Plant population = $\frac{50{,}000\ m^2}{6.25\ m^2/\text{plant}}$

= 8000 plants

Question 4

(a) (i) State five uses of the crop from which specimen G was obtained.

(ii) Name three pests of the crop from which specimen G was obtained.

(b) (i) Mention four observable features of specimen H that makes it to survive as a weed.

(ii) State three methods of controlling specimen H on the farm.

(a) (i) Majority of the candidates stated correctly the uses of cotton wool e.g. used for making thread, for making cotton yarn in textile industry fuzz for the manufacture paper and explosives and oil is extracted from the seed for industrial purposes

A few of the candidates could not state the uses correctly and this caused them the marks

(ii) Most candidates were able to state the pests of cotton plants (Specimen G) and scored full marks

(b) (i) Many candidates were able to state the observable features of specimen H, *Boerhavia erecta* which enable it to survive in their environment. Their answers include production of seeds, fast growth and seeds are easily detached from mother plant.

(ii) Most candidates correctly stated the methods of controlling specimen H - *Boerhavia erecta* and scored full marks in most cases.

FISHERIES 2

1. GENERAL COMMENTS

The standard was good and comparable to previous years. The standard of the question paper was the same as that of the previous years. The performance by candidates was better this year.

2. SUMMARY OF CANDIDATES' STRENGTHS

Majority of candidates showed scholarship in having read or undergone good tuition in the course work. There was ample display of familiarity with the topics and the course work. Questions on feed ingredients and water quality were answered very well.

3. SUMMARY OF CANDIDATES' WEAKNESSES

(i) A few questions were not numbered. This wasted valuable time of examiner in sorting out the question number.

(ii) Whether questions are numbered or not, it is helpful to introduce the answer in a very short sentence, not more than a sentence. It assists the examiner in recognizing the question being answered quickly.

(iii) Some candidates failed to read the questions well. Thus, some gave more points than required. This was a waste of time for both candidates and examiners.

(iv) Some answers could not be recognized quickly because of poor English expressions. This was not an English paper, but marks could only be awarded when the point is made right.

(v) Diagrams were poorly drawn.

4. SUGGESTED REMEDIES

(i) Candidates must simply take a few minutes to read the questions and the instructions very well and carry out these instructions.

(ii) Candidates must learn that it is not helpful to answer certain questions with single words.

5. DETAILED COMMENTS

Question 1

(a) Explain each of the following terms:
- **(i) capture fisheries;**
- **(ii) culture fisheries.**

(b) (i) What is an *estuary*?
- **(ii) List four fishery organisms that could be found in an estuary.**

(c) (i) What is a *diadromous fish*?
- **(ii) List three materials required in the construction of an aquarium.**
- **(iii) Mention three activities involved in the management of the aquarium.**

(a) Candidates must note that capture fisheries is essentially hunting for fish from wild water bodies, whilst culture fisheries involves planting and rearing of fish in controlled aquatic medium

(b) (i) Most candidates defined estuary as the meeting place of two rivers
It must be noted that an estuary is not the meeting place of two rivers.
It is where freshwater and marine water meet and mix, a semi-enclosed body of fresh water that has a free connection with the open sea and within which sea water is measurably diluted with fresh water or the confluence of a river and the open sea

(ii) The candidates were not very familiar with fishery organisms that could be found in an estuary.

Common fishery organisms that could be found in an estuary include clam, mullet, shrimp, star fishes, sardines and sea urchins.

(c) (i) Candidates did not know what a diadromous fish is. They were only guessing the answers

Diadromous fishes are those that spend part of their lives in fresh water and other part in marine environment.

They can be: Anadromous or catadromous

(ii) Candidates were able to mention some materials such as glass, plastic and adhesive as some materials needed for aquarium construction.

Candidates did not however mention filter, air pump, light and plants as parts of the materials required for the construction of an aquarium

(iii) Candidates were familiar with the management of aquarium such as regular changing of water, feeding fish regularly, monitoring water quality and removal of dead fish and debris.

Candidates however did not mention scrape off algae /and wash of accessories which are also important aquarium management practices

Candidates must study the construction and management of an aquarium.

Question 2

(a) (i) State three fish pond maintenance activities.

(ii) List four fish pond water quality parameters.

(b) (i) State four fisheries regulations in Ghana.

(ii) State three objectives of fisheries management.

(c) Describe the life cycle of a named tilapia fish.

(a) (i) The responses given by candidate to this question was appropriate.

Candidates mentioned the following pond management practices:

- control of water level
- repair of leakages
- predator control
- weed control
- fertilizer application
- removal of silting
- liming
- re-grassing of dyke

(ii) Candidates understanding of fish pond water quality parameters was limited to:

- pH
- temperature
- dissolved oxygen
- turbidity

Other important fish pond water quality parameters listed below were not mentioned by the students,

- ammonia content
- hardness
- conductivity
- sulphide
- nitrite / nitrate

(b) (i) The responses to the fisheries regulations were very vague. E.g. simply stating (i) fishing with light, (ii) close season, etc is not sufficient.

Candidate must state what the regulation is. Is it allowed or not; Example, (i) fishing with light is prohibited (ii) no fishing is allowed during close fishing seasons.

(ii) Similarly, objectives of fisheries management must be stated as a complete sentence and not bullet points.

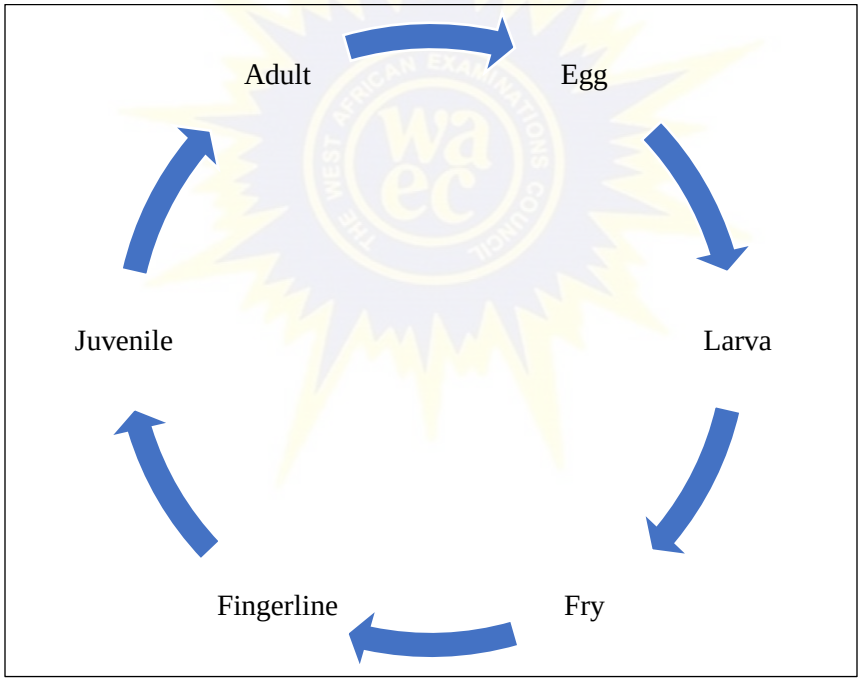
The following were some of the objectives of fishery management expected from the candidates

- To maximize fish production (that is yield)
- To maintain sustainable levels of stock
- To conserve fisheries resources and their environment
- To maximize economic returns from fisheries
- To maintain spawning stocks

(c) It was very poorly answered, and most candidates did not state that the egg develops into a larva and then to fry. To them, the egg develops into a fingerling, then adult.

A named Tilapia: Oreochromis niloticus
Tilapia zilla
Sarotherodon

Life cycle



Question 3

(a) Explain four effects of fishing with a small mesh size net.

(b) (i) Name three types of fish landing sites in Ghana.

(ii) Give one location of each of the types of landing sites named in (b)(i).

(c) Name two fish food products.

(a) Candidates mostly stated the effects but could not explain the effects of fishing with a small mesh size net.

Some of the expected effect of the use of small mesh size nets includes

- small fishes will be caught
- over fishing
- depletion of fishing stock
- possible collapse of the fishing industry
- high fishing pressure
- migration of fishers
- change in livelihood of fishers
- food reduction
- change in fish population structure.

(b) (i) Candidates answered this question very well. They were able to provide responses including

- Sandy beach
- Harbour
- Lagoon shore
- river banks
- lake shore

(ii) Candidates were only able to mention location for only lagoon and river banks. They were unable to give examples of towns where lake shores, beaches and harbour could be located.

(c) Candidates were able to mention few fish products such as salted fish, dried fish and smoked fish.

Other fish food products which were not mentioned by candidates included fish fillets, fish chunks, fish flakes, canned fish and pickled fish.
Candidates also mentioned fertilizers and manures which are not fish food products

Question 4

(a) Describe the processes of feeding in Tilapia.

(b) State six ways in which fish are adapted for protection.

(c) State six ways of sustaining maximum fish yield from marine habitat.

(a) Candidates ran away from this question. The few who attempted it could not describe the processes of feeding at all.

The candidates were expected to mention the following steps in the process of feeding in tilapia:

- mouth opens
- water containing small food particles / organism then enters the opened mouth
- mouth closes
- food and water passes through the gills
- the gill rakers trap the food
- food move from the mouth to the pharynx
- food is swallowed
- digestion in the gut
- undigested food is egested

(b) The adaptations were stated, but not for protection or how they protect the fish.

Candidates probably did not read the question well.
Candidates were expected to provide the following adaptation and how they are used for protection:

- slimy body prevents the attachment of parasites to the body
- scales prevent damage to the fish flesh
- eyes are located to detect predators/enemies with ease in water
- have powerful muscles and fins to escape from enemies
- colourful pattern / reflective skin body provide camouflage
- dorsal surface is darker to match the colour of the water from above while the ventral surface is ligher to match to colour from below
- the lateral lines detects vibration by pressure changes in the water to enable the fish to escape from predators
- powerful jaw, dentition for defence / attack
- presence of spines for defence or attack

(c) The question was very poorly attempted. Candidates did not understand what is meant by “sustaining maximum fish yield.

Candidates were expected to provide ways of sustaining maximum yields such as:

- establishment of more close areas i.e. more marine protected reserves
- providing license / permit for vessels
- gear restrictions
- enforcing quota systems for fishing crafts
- education on consumption patterns of marine fish
- mesh size regulation for gears

- enforcement of close seasons / impose close seasons

Question 5

(a) State five challenges associated with the setting up of a fish farm.

(b) List five items of expenditure in capture fisheries.

(c) Give one example each of the following fish organisms:

(i) mollusc;

(ii) crustaceans;

(iii) euchinoderm;

(iv) cartilaginous fish.

(d) State two characteristics of each of the following aquatic habitats:

(i) marine;

(ii) brackish water;

(iii) fresh water.

(a) Candidates should learn how to express challenges. Certainly, they are not expressed as bullet points, but as clear sentences.

Some of the responses expected from the candidates as challenges with the setting up of a fish farm included:

- Difficulty in getting a suitable site
- high cost of land
- high cost of construction
- access to capital / funds
- high running cost / other inputs
- poor technical know how
- poor infrastructural facilities
- lack of access roads / poor accessibility to site
- poor power supply

(b) Candidates did not answer this question and the few that answered did not understand the question.

Some of the common items of expenditure in capture fisheries are

- vessel- processing facilities
- fuel-medical expenses
- labour-cost of repairs
- maintenance-storage facilities

(c) Candidates answered (i), (ii) and (iv) very well. They were however not able to give examples of Enchinoderms. (e.g. sea urchins and sea cucumber)

(d) Candidates answered this question well. They were able to use characteristics such as salinity and level of turbulence to differentiate the three aquatic habitats.

Question 6

(a) (i) Name four fishing gears used in capture fisheries.
(ii) Mention four fishing crafts used in capture fisheries.
(b) Define each of the following body measurement of fish:
(i) standard length;
(ii) total length;
(iii) fork length.
(c) (i) Name three fresh water bodies in Ghana.
(ii) List three job opportunities in the fisheries industry.

(a) There was confusion between fishing gear, craft and fishing equipment.

Candidates must study and be able to distinguish between these.

(i) Fishing gears in capture fishery

- cast net
- hook and line
- purse seine net
- pole and line
- harpoon
- traps
- scoop net
- beach seine

(ii) Fishing crafts used in capture fisheries

- canoes
- trawlers
- purse seiners
- boat
- raft
- plank

(b) In (i), (ii) & (iii) Candidate did not know the point of the body where each measurement starts and ends in all three cases. The fork length for instance, ends in the middle of the caudal fin lobes and not in the middle of the tail.

(c) (i) Candidates only gave the types of fresh water bodies (e.g river, reservoir) but not the names i.e. Volta lake, Volta river, River Tano, River Densu, River Pra, River Ankobra etc

(ii) This question was well answered by the candidates who selected them.

(iii) Job opportunities such as teaching and research, craft manufacture etc were mentioned.

FISHERIES 3

1. GENERAL COMMENTS

The standard of the paper was at par with those of previous years.
The performance of candidates was slightly above the performance in the previous years.

2. SUMMARY OF CANDIDATES' STRENGTHS

(i) Candidates were able to identify specimens properly.
(ii) Candidates used the appropriate terms in the subject

3. SUMMARY OF WEAKNESSES

The only drawing was not satisfactorily done.
Apparently not much practical work is done in the schools

4. SUGGESTED REMEDIES

Teachers must endeavour to expose the students to the practical work recommended in the syllabus.

5. DETAILED COMMENTS

Question 1

(a) Identify each of the specimens labelled A, B and C.
(b) Name the main nutrient components of each of the specimens labelled A, B and C.
(c) State one function of each of the nutrients named in 1(b).
(d) State three ingredients that could be used in place of each of the specimens labelled A, B and C.
(e) Mention two organisms that could be found in the specimen labelled D.

(a) This was generally well answered.
(b) This was also generally well answered. However, the question on nutrient content of bone meal was not satisfactory. Candidates mostly named minerals as the component of bone meal, instead of specifically calcium.

(c) For the functions of the nutrients, most candidates mentioned that the calcium is used for the formation of teeth, forgetting that teeth are not common in fishes.

(d) The question on alternative ingredient to provide the contents in the specimens was generally well answered.

(e) A number of candidates could not name organisms present in the specimen D. Some named Tilapia, catfish instead of phytoplankton and zooplankton.

Question 2

(a) Examine the specimen labelled E carefully

(i) State four signs which indicate that specimen E is wholesome for consumption.

(ii) Name two fishery organisms that could be used to produce specimen E.

(b) Outline the processing steps that were used to achieve the level of the specimen labelled F.

(c) (i) Identify the specimen labelled G.

(ii) Describe how specimen G could be used in the fishing industry.

(iii) State two methods adopted by fishers when specimen G is not available.

(iv) Mention three possible observations that could be made when specimen G is not used.

(a) (i) The question on signs of wholesomeness of the canned fish was very poorly answered. Many candidates did not indicate the signs which were present on the specimen. However, a few indicated what should be on the specimen.

Many just mentioned "Expiry date", "International standards Organization". They were supposed to indicate that the Expiry date is shown, and that the product is not expired.

(ii) This question was well answered.

Candidates were able to mention fishery organisms that could be used to produce Specimen E such as sardines / Sardinella, salmon and tuna.

(b) Concerning the process of smoking of fish, many just named a smoking kiln, neglecting to mention the setting of fire in the kiln.

The expected processing steps to achieve level of specimen F (Whole smoked fish) were

- selection whole fish
- gutting
- washing in clean water
- allowing fish to drain
- arrangement of fish on tray
- setting of fire
- storing tray in the oven
- turn fish / orientation of tray

(c) (i) In this question, many candidates mentioned “Ice Block". Even when the Ice block was crushed, some still referred to it as Ice block.

For instance, in (ii) some candidates wrote that the ice block is pit in the container and fish is placed on it. The ice block is put on the fish.

(ii) Candidates were expected to provide the following responses

- pieces of specimen G (crushed ice) is mixed with harvested fish

  OR
- place a layer of ice in container, arrange fish on the ice and place another layer of ice on the fish.

Teachers must distinguish between Ice cube, ice block and crushed ice.
(iii) In this question, an alternative to the use of ice to keep fish fresh was expected.

Many candidates wrote “smoking” of the fish.

An alternative to the use of ice to keep fish fresh include

- storing in brine
- wrapping fish in leaves
- landing fish as early as practicable / possible
- covering fish with wet jute sack

On the use of ice to preserved fresh fish temporary, it is apparent that the practical were not carried out in the schools.

(iv**)** Candidates could not answer this question correctly. The expected observation when specimen G (ice) is not used are:

- foul smell
- soft flesh
- sunken eyes
- slimy skin
- appearance of maggot / flies

<u>Question 3</u>

(a) (i) Identify each of the specimens labelled H, J and K.
(ii) State one use of each of the specimens labelled H, J and K.
(b) (i) Draw and label specimen H.
(ii) State two effects of low readings of each of specimens J and K.
(c) (i) State one major use of the specimen labelled L in fish farming.

(ii) State three methods of applying the specimen labelled M to a fish pond.

(a) (i) Candidates identified the specimens appropriately.

(ii) A lot of strange answers were given for the uses of specimen H, J and K.

Some candidates even indicated that the thermometer is used to check turbidity. Also that the litmus paper is used to measure pH of "solutions", forgetting that the answer must have a bearing on aquaculture.

The following responses were expected

Specimen H - Thermometer measures the temperature of the water in the pond.
Specimen J - The pH paper measures the level of acidity or alkalinity of the water in the fish pond
Specimen K - Secchi disc measures the level of transparency of the pond water

(b) (i) This diagram was poorly drawn and labelled

(ii) Candidates poorly answered this question.

<u>Effects of low reading of specimen J (pH paper)</u>
Water is acidic leading to

- poor growth / reproduction
- skin lesion / wearing of skin
- stress
- high mortality

<u>Effect of low reading of specimen K (Secchi disc)</u>
Water is turbid leading to

- stress
- poor visibility
- clogging of gills
- high mortality

(c) (i) On the use of specimen L (Urea), some candidates indicated it is used as feed for fish.

It is mainly used to fertilize the pond and to promote the growth of phytoplankton.

(ii) Candidate could mention the sack method and the broadcasting methods of apply specimen M (cow dung) and not the heap and platform methods.

FORESTRY 2

1. GENERAL COMMENTS

The standard of the paper was consistent with previous years. Even so, candidates performance ranged from good to poor. It is important to note that a few more candidates passed than those who failed.

2. SUMMARY OF CANDIDATES' STRENGTHS

The following observations were made about candidates' strengths:

(i) Orderly and logical presentation of responses to questions by candidates
(ii) No candidates wrote down, any of the questions before answering them
(iii) The handwriting of candidates was good and readable
(iv) The aspects of the paper that were answered well are:
  (a) Income generating activities in the forestry sector
  (b) Natural Tropical Forests
  (c) Forestry Commission of Ghana and its functions
  (d) Stakeholders of the Forestry Sector in Ghana

3. SUMMARY OF CANDIDATES' WEAKNESSES

The following weaknesses were identified during the marking exercise:

(i) Although most candidates wrote meaningful sentences and expressions in their bid to deal with questions, the efforts were froth with spelling mistakes such as writing 'tempolary' and 'temporaly' instead of temporary; 'permiant' and 'perminent' instead of permanent; 'expecially' instead of especially, 'millitary' instead of 'military', 'pistil' instead of 'pestle' and 'Tropography' in place of 'Topography' among others.
(ii) Poor handling of definitions, technical terms and understanding of the requirements of some questions
(iii) The use of agricultural terminologies in answering questions.
(iv) The areas or topics that were poorly answered included the following:
  (a) factors that determine the choice of plant species for forest plantation establishment;
  (b) forest nurseries;
  (c) environmental conservation and
  (d) wildlife conservation.

4. SUGGESTED REMEDIES

(i) The quality of teaching should be improved
(ii) Candidates should cultivate the habit of reading good books to correct deficiencies in their language;
(iii) Candidates should familiarize themselves with technical terms

(iv) Candidates should carefully read the questions and rubrics and comply
(v) Candidates should learn to write boldly and legibly so that their scripts could be easily read and fairly assessed

5. DETAILED COMMENTS

Question 1

(a) Mention five ways of conserving wildlife.
(b) Give four reasons why surveying is important in forestry.
(c) State three factors that may affect the accuracy of surveying in forestry.
(d) Give six disadvantages of developing seedlings in polypots.
(e) Explain the term logging.

This question was prohibitive to most candidates and the few that attempted to tackle the question did poorly.

(a) The candidates who attempted this question were able to give answers to the way of conserving wildlife satisfactorily
(b) Candidates were unable to deal with the reasons why surveying is important in forestry.

The expected answers to this sub-question are:

- for determining mature / merchantable trees
- for determining an area of a piece of land
- for the establishment of boundaries of a piece of land
- for preparing a plan or map of an area
- for determining the number or types of tree species
- to know which tree species is growing faster/rate of growth of tree species
- to locate the positioning of related forest resources
- for determining the yield

(c) Candidates could not handle the factors affecting the accuracy of surveying; that has to do with topography or slope of land, ground cover, condition of soil, physical condition of the person, metallic object near compass, failure to take into account the magnetic variation and poor judgement of personnel / parallax error.

(d) Candidates again, could not give answers to the disadvantages of developing seedlings in polypots. The required answers are difficulty of obtaining containers, growth of moss on the plant/pots, difficulty of obtaining fertile soil, transportation difficulties, the labour-intensive nature of the process, limitation on root development, roots overgrowing beyond the container and the occurrence of damping-off disease.

(e) Candidates were unable to explain the term logging – which is the act or process of felling and extracting timber from forest to the processing centre (Sawmill) in the form of log.

Question 2

(a) Mention ten income generating activities in the forestry sector.

(b) Name five non-timber forest products that could be obtained from Ghana's forests.

(c) State five benefits which could be derived from non-timber forest products.

This was popular, and it is important to note that all candidates attempted this question. It is also worth noting that candidates had their highest scores on questions from this question. It was the starter question for most candidates.

(a) Most candidates got quite a good score from this section. However, it was problematic to a few candidates. The required answers ranged from businesses in the timber industry to non-timber products, hunting and ecotourism.

(b) Candidates did well by providing answers bordering on a wide range of Non-timber Forest Products (NTFPs) such as fuelwood, bushmeat, snails, mushrooms, yams, honey, rattan, medicines, sponge, chewing stick, ropes, pets, canes, wax, wrappers/leaves among others. It is satisfactory to note that most candidates were aware of the ecosystem services that could be obtained from forests

(c) Candidates were able to provide the benefits that are derived from NTFPs such as pets, food/feed/meat, oral hygiene, medicines/health, income/ employment/livelihood, wrappers/wrappings, art and craft/ decoratives, ropes, tannins/dye, roofing, poles, etc. However, a few candidates found it confusing.

Question 3

(a) State six factors that determine the choice of plant species for forest plantation establishment.

(b) (i) Name the two main types of nurseries which could be established by a forester.

(ii) State four features of each of the nurseries which you have named in (b)(i).

(iii) Give two advantages of each of the nurseries named in (b)(i).

This question was one of the most popular questions, but candidates performed very poorly upon attempting to deal with it. As attractive as it appeared to candidates there was a general lack of understanding of the requirements of the question.

(a) Candidates could not bring out the factors that determine the choice of plant species for plantation establishment; such as fast growth rate, resistance to diseases and pests, multiple purpose uses of species, ability to withstand harsh environmental conditions, coppicing ability among others.

(b) Nearly all the candidates who attempted this question could provide the answers to the sub-question. This emphasized the fact that candidates had good tutorials on permanent and temporary nurseries. However, candidates exhibited total lack of knowledge on the features of permanent and temporary nurseries as well as the advantages of each of the two types of nurseries.

Question 4

(a) State six characteristics of a natural tropical forest.

(b) (i) List the divisions of the Forestry Commission of Ghana.

(ii) State four functions of the Forestry Commission of Ghana.

(c) Name seven stakeholders of the forestry sector in Ghana.

It was one of the popular questions of the paper. Most candidates attempted this question. Some candidates did very well while a few others performed poorly.

(a) Most candidates found this part of the question difficult and therefore could not provide answers on the characteristics of natural tropical forest. Simple answers such as multi storeyed canopy layers, multi-species of trees and lianas or climbers, prominent buttresses, forest floor covered by litter of fallen leaves from trees, presence of varied NTFPs, presence of major and minor streams etc were expected from candidates.

(b) (i) Most candidates were able to provide answers that referred to the Forest Services Division, Wildlife Division and the Timber Industry Development Division.

(ii) Most candidates struggled in handling this part of the question. A few candidates failed to provide answers at all. Those that tried to provide answers did so with measured difficulty of expressions. This part required of candidates to give responses such as co-ordination and integration of the development of programmes, management of resources across the divisions, facilitation of the implementation of objectives, provision of technical and administrative support to the divisions, monitoring of the compliance of standards and targets set for the performance of the divisions, linking of development partners, publication of relevant information and reports on activities of the commission, promote ecotourism and the rest of it as functions of the forestry commission

(c) A few candidates showed lack of understanding of this part of the question while others did quite well. Generally, candidates were expected to bring out answers

relating to public sector entities, non-governmental organizations, training institutions, traditional authorities, hunters, development partners, farmers, traders, security agencies etc.

Question 5

(a) (i) Explain the term environmental conservation.

(ii) Explain four ways in which forests contribute to environmental conservation.

(b) Give five reasons why wildlife conservation is important.

It was one of the most repulsive questions and the candidates who attempted it did not have a good handle on the question.

(a) (i) Environmental conservation refers to the judicious use of the air, land, water bodies, forests as well as all forms of vegetative cover/resources for the benefit of human beings and for posterity. In instances where a candidate for lack of adequate knowledge or power of expression explains the concept as 'an area of land created for protected plants and animals of a given area of land; it becomes compelling to be considerate.

(ii) Some of the answers that were provided to this part of the question were absolutely wrong, candidates indicated afforestation, reforestation, crop rotation and over cropping instead of providing responses such as:

- forests absorb / take up CO_2 for photosynthesis and thereby prevent global warming and give off O_2 which is necessary for life
- forests serve as habitat for a wide range of organisms because they generate a suitable micro-climate
- forests protect water bodies by reducing evaporation and constitute buffer zones for the water bodies
- forests control erosion and siltation
- forests could serve as wind breaks to control the damaging effects of strong winds
- forests generate suitable micro-climate for agriculture etc

(b) Candidates were able to handle this question well.

Question 6

(a) (i) Explain the term natural regeneration.

(ii) Give three advantages of natural regeneration.

(b) State five effects of improper log extraction methods on the forest.

(c) Describe each of the following types of processed forest products:

(i) veneer;

(ii) plywood;

(iii) particle board.

(d) Explain each of the following terms as used in forestry:

(i) salvage permit;

(ii) forest reserve.

This question was one of the least popular questions. The extremely poor performance of the candidates who attempted it gives ample evidence of the repulsive character of the question. Lack of command over expression in English language made it difficult for the candidates to score the mark on sub-question (a)(i), even though the idea existed.

(a)Some descriptive features of natural forests were expressed instead of the advantages of natural regeneration such as; no cost to the forester, no need to follow formal processes as in plantation establishment, stabilization of natural ecosystem and no requirement for special management skills. Most candidates could not provide answers to the seemingly confusing sub-sections (b), (c) and (d) of the question. This demonstrated lack of knowledge on those aspects of the paper

(b) The following answers were expected.

- ill-displacement of seeds on forest floor
- damage of streams
- invasion of forest by pioneer species / vines
- poor regeneration of the forest
- excessive loss of animal habitats
- destruction of seedlings and saplings
- creation of tracks for gulley erosion

(c) Description of processed forest products

(i) <u>Veneer</u>

- Logs which are sliced into sheets and dried

(ii) <u>Plywood</u>

- Veneer sheets which are glued together and pressed

(iii) <u>Particle board</u>

Boards made from wood chippings, dried, glued and pressed

(d) <u>Explanation of terms</u>

(i) <u>Salvage permit</u>

It is a timber felling right given to the merchant / group of people / community to harvest trees that are serving as impediment to implementation of a state project / development.

(ii) Forest reserve

Normally a large area of land where plants / trees either grow naturally or planted and specially reserved by government under laws and regulations for specific purposes.

FORESTRY 3

1. **GENERAL COMMENTS**

   The standard of the paper was comparable to those of previous years. The general performance of candidates was a little above average.

2. **SUMMARY OF CANDIDATES' STRENGTHS**

   The Chief examiner observed the following strengths:

   (i) Candidates handwriting was quite legible
   (ii) Almost every candidate answered two or three of the questions
   (iii) The areas which were answered well were:
      (a) Differences between of specimen Honey;
      (b) Uses of Honey;
      (c) Weeds which grow in natural water bodies;
      (d) Types of forest products;
      (e) Uses of plywood;
      (f) Tools used together with chainsaw machine;
      (g) Uses of chain-saw machine;
      (h) Food chain involving lizard;
      (i) The habitats of Lizard and Toad.

3. **SUMMARY OF CANDIDATES' WEAKNESSES**

   The candidates exhibited the following weaknesses:

   (i) there were a lot of sentences and expressions which were not understandable.
   (ii) there were many spelling mistakes, common among them were alligator which is spelt as *aligator*. Terrestrial as *terestrial*, crocodile as *crocrodile*, water lettuce as *water letuse*, ceiling as *sealing*, water lily as *lilly*, pruning as *prunning*, aquatic as *acquatic* and others.
   (iii) Most of the students stated differences between specimens G and specimen H which were not corresponding. For example: Specimen G (lizard) possesses a tail while specimen H (Toad) possesses long hind limb. The lizard possesses dry skin while the toad possesses soft skin.
   (iv) Areas which were poorly answered were:
      (a) Uses of water;
      (b) Uses of specimen C (bark of a tree);
      (c) Labelling of parts of chain saw;
      (d) Ways in which cutlass could be used when using chain saw;
      (e) Differences between Lizard and Toad;
      (f) Differences between amphibians and reptiles.

4. **SUGGESTED REMEDIES**

(i) Candidates must go through past questions of WASSCE to get acquainted with the nature of question.

(ii) Candidates should develop the habit of reading books to enable them to improve, upon their spelling ability and also to improve upon their expressions.

(iii) Candidates must be given more exercises.

5. **DETAILED COMMENTS**

Question 1

(a) Give two observable differences between specimens A and B.

(b) State three uses of each of specimens A and B to the forester.

(c) Name four weeds which grow in natural bodies of specimen B.

(d) Mention three reptiles which are commonly found in natural bodies of specimen B.

This question was popular with candidates and general performance was good.

(a) On the observable differences between Honey and Water some candidates could not state the colour of the honey but stated that honey has a colour while water is colourless. Actually, it should have been honey is dark or brown in colour while water is colourless. Honey has odour while water is ordourless, honey is thick or viscous while water is light or less viscous. Honey is opaque while water is transparent.

(b) Honey is used to cure diseases or used as medicine, it is used as food, as substitute for sugar, in cosmetic industry and in confectionary. Water is used for drinking, for washing, bathing or cleaning, for construction, for sharpening of cutlasses, for irrigation at the nursery or crops, for cooking, for transport and for generation of electricity.

(c) Weeds which are grown in natural bodies of water. These are water lettuce, water hyacinth, water lily, duck weed, water lemna, elodea, typha, aquatic fern kariba weeds

(d) Reptiles found in natural bodies of water are crocodile, snake, alligator, turtle and mud skipper

Question 2

(a) Name the type of forest product to which each of specimens C and D belongs.

(b) State four uses of each of specimens C and D.

(c) Mention two tools that could be used to harvest specimen C.

(d) Mention three processes involved in the production of specimen D.

Marks scored in this question were low. Candidates found it difficult to score all the marks in each of its sub questions.

(a) The bark of a tree is a Non-timber forest product NTFP and the plywood belongs to Timber products.

(b) Most of the candidates could not answer this question satisfactorily as if they were not familiar with its uses in the villages.

Bark (Specimen C) is used for fencing, roofing, ceiling, bedding, medicine and for the extraction of dye for clothing.

Plywood (Specimen D) is used for making car parts, for ceiling, fencing, partitioning of rooms, for art and craft, furniture, for the construction of kitchen cabinet, kiosks, chop box, money box and for making marker or black board. Some candidates thought chairs and tables are separate from furniture

(c) Tools that could be used to harvest the bark of a tree are, chainsaw machine, axe, chisel, cutlass/Machet

(d) Processes involved in the production of plywood are boiling / heating, peeling, slicing.

Question 3

(a) Draw specimen E and label any three parts.

(b) Give three uses of specimen E.

(c) State four precautions that should be taken when using specimen E.

(d) Mention four ways in which specimen F could be useful when using specimen E in the forest.

(a) In this question, the candidates drew the chain saw machine and labelled them well.

(b) Chainsaw machine is used for felling / thinning trees, for dividing / splitting wood, for cross cutting of logs, for pruning and for debarking.

(c) The candidates had average performance in this question, however some of the candidates could not mention most of the precautions as expected. The precautions that could be taken when using chainsaw machine are as follows;

Machine must be held firmly; The operator should stand on a firm or stable ground or platform; he must be healthy and well fed; the machine must have enough fuel; the machine must be well lubricated; the cutting chain must be well sharpened; operator must not take in alcohol or hard drug before using the machine

(d) Cutlass could be useful whenever one is using chainsaw in the following ways: For creating access route to the felling site; for clearing weed at the felling site; for removing climbers and lianas; it is used for creating escape route; for marking logs and for killing harmful animals like snake, scorpion etc.

Question 4

(a) Name the class into which each of specimens G and H could be classified.
(b) State four observable differences between specimens G and H.
(c) Draw a food chain of specimen G and three other organisms.
(d) Mention the habitat of each of specimens G and H.

(a) Lizard belongs to the class reptilian and the Toad belongs to the class amphibian.
(b) Observable differences between Lizard and Toad, only observable ones

Specimen G (Lizard)	**Specimen H (Toad)**
- Presence of scales on body	- Absence of scales
- Elongated body shape	- Oval body shape
- Possession of tail	- Absence of tail
- Fore and hind limbs almost the same	- Hind limbs larger and longer (well developed)
- Digits not webbed	- Webbed digits

(c) Some candidates presented a nice food chain of prey predator but lacked producer. There can't be, a food chain without a producer. It should look like this:

Producer → 1^{o} Consumer → 2^{o} Consumer → 3^{o} Consumer
Producer → grasshopper → lizard → snake → Hawk

(d) Economic importance of Toad

- It feeds on harmful insects, slugs etc
- for research
- used as food in some countries like China
- attracts snakes to the house
- they pollute water bodies / makes water bodies unattractive

(e) Habitat for Toad are Terrestrial / Aquatic

GENERAL AGRICULTURE 2

1. GENERAL COMMENTS

The standard of the paper could be compared to that of the previous years. The general performance could be described as above average and same as last year.

2. SUMMARY OF CANDIDATES' STRENGTHS

(i) Candidates have adequate knowledge on "Agricultural practices that could adversely affect sustainable agriculture.
(ii) They have good knowledge on soil conservation.
(iii) They have enough information on "Effect of diseases in crop production."
(iv) They have very good knowledge of causes of mortality in broilers.
(v) Control of tapeworm infestation.
(vi) Contribution of forest to national economy.

3. SUMMARY OF CANDIDATES' WEAKNESSES

(i) Candidates still could not spell correctly technical words, scientific terms and names of crops.
(ii) Majority could not explain the chemical weathering process of (i) hydrolysis (ii) oxidation and (iii) solution.
(iii) They could not state the functions of abomasum in ruminants.
(iv) Most candidates have little knowledge on the causes of "diminishing returns in agricultural production".
(v) Control of endo and ectoparasites.
(vi) Causes of motility in poultry.

4. SUGGESTED REMEDIES

(i) Tutors should teach the scientific terms and names properly.
(ii) There should also be proper teaching of the chemical processes of weathering.
(iii) More practical work should be carried out.

5. DETAILED COMMENTS

Question 1

(a) Give five reasons why farmers harrow farmlands.
(b) (i) State five benefits that could be derived from irrigating farmlands.
(ii) Explain three problems associated with practicing irrigation.

(a) Very few candidates attempted this question and the performance was average. Some gave reasons for ploughing instead of harrowing:

Reasons for harrowing include:

(i) improves soil structure;
(ii) provides good soil with for easy sowing of seeds;
(iii) encourages easy root penetration;
(iv) mix organic matter in the soil;
(v) used to cover seeds and fertilizers after broadcasting;
(vi) helps remove weeds.

(b) (i) This was fairly well answered by candidates who attempted it. Most of them were able to give four instead of five benefits of irrigation

(ii) Most candidates could not explain the problems associated with practicing irrigation

The expected answers include:

- accumulation of salts;
- may cause leaching of soil nutrients;
- may cause water logging in poorly drained soils;
- may spread soil borne pathogens.

Question 2

(a) (i) Explain the term sustainable agriculture.

(ii) State five agricultural practices in West Africa that could adversely affect sustainable agriculture.

(b) Explain four ways in which forest contribute to national development in West Africa.

(a) Majority of the candidates attempted this question

(i) Some could not explain the term "sustainable agriculture" The expected explanation is the systematic improvement in agricultural production to yield the greatest possible benefits to the present generation without adverse effects on the environment.

(ii) Almost all the candidate could state the agricultural practices in West Africa that could adversely affect sustainable agriculture

(b) This was very well answered by almost all the candidates that attempted it.

Question 3

(a) What is weathering of rocks?

(b) Explain how each of the following processes leads to weathering of rocks:

(i) hydrolysis;

(ii) oxidation;

(iii) solution.

(c) Explain four ways in which living organisms influence soil formation.

Very few candidates attempted this question. They however answered is poorly.

(a) Candidates gave correct answer to the question "What is weathering"

(b) Most of the candidates could not explain how each of the following processes lead to Weathering.

The expected explanations are as follow:

(i) hydrolysis (ii) oxidation and (iii) solution

(i) Hydrolysis – chemical composition of nutrients in rock are altered when they react with water. The minerals change in form causing fragmentation of the rocks
$CaSiO_3 + 2H_2O \rightarrow H_2SiO_3 + Ca(OH)_2$

(ii) Oxidation – Oxygen combines with many elements and some minerals in rocks to form a new compound which cause disintegration of the rock
$4FeCO_3 + O_2 \rightarrow 2Fe_2O_3 + 4CO_2$

(iii) Solution – water dissolves a wide range of soluble minerals from rock e.g. feldspar and mica causing the rock to disintegrate.

Question 4

(a) What is soil conservation?

(b) State three ways in which each of the following practices contribute to soil conservation on the farm:

(i) cover cropping;

(ii) organic manuring.

(c) Explain one way in which each of the following processes contribute to loss of soil nutrients:

(i) burning;

(ii) crop removal;

(iii) leaching;

(iv) erosion.

(a) & (b) Most candidates attempted these questions and did fairly well (c)(ii). Most of the candidates however could not explain how "crop removal" and "leaching" contribute to loss of soil nutrients.

Expected answers are:

- Crop removal – when crops are harvested and taken away from the land, it rids that piece of land of its nutrients
- Leaching – water dissolves nutrients and washes the elements beyond the reach of crop roots

Question 5

(a) Name four food crops which are propagated by cutting.

(b) Enumerate four factors that could affect the success of layering.

(c) Give four advantages of pruning in tomato cultivation.

(d) State two ways in which each of the following nursery practices are important:

(i) shading;

(ii) pricking-out.

Very few candidates attempted this question

(a) Some could not mention the food crops that are propagated by cutting

(b) This was also poorly answered. The expected answers for the factors that affect the success of layering include:

- physiological state of the plant
- age of layered plant part
- climatic factors
- type of rooting medium
- skill of the operation

(c) Most of the candidates were to give the advantages were to give the advantages of pruning in tomato cultivation even though a few were writing or pruning in general.

(d) This question was well answered.

Question 6

(a) Enumerate five effects of diseases in crop production.

(b) (i) Distinguish between a storage pest and a field pest of crops.

(ii) Give two examples each of storage pests and field pests of crops.

(c) State five ways of controlling insect pests of stored grains.

Almost all the candidates attempted this question and the performance was fairly good.

(a) Candidates could enumerate the effects of diseases on crop production

(b) (i) Most of them could "distinguish between a storage pest and a field pest of crops" and could give examples of storage pests and field pests

(c) Most candidates could state the ways of controlling storage pests

Question 7

(a) Explain each of the following terms as used in animal production:

(i) culling;

(ii) dipping;

(iii) quarantine.

(b) Explain five causes of mortality of broiler production.

Candidates who attempted it did fairly well.

(a) Most of them could explain the terms (i) culling and (ii) dipping as used in animal Production. However, majority of them could not explain "quarantine".

Expected answer is:

Quarantine is a practice where animals being introduced into a new locality/existing flock are first kept in isolation and observed for signs of disease/ill health before they are mixed with the rest of the flock if found free of disease

(c) Most of the candidates could explain the causes of mortality in broiler production

The expected responses include:

- diseases
- deformity
- food poison
- injuries
- starvation
- lack of water
- suffocation
- extreme temperature
- overcrowding
- poor ventilation
- pests and parasites
- poor sanitation
- cannibalism

Question 8

(a) Mention three sources of minerals in animal production.

(b) State two functions of the abomasums of ruminants.

(c) Distinguish between inbreeding and cross breeding in animal production.

(d) (i) List four hormones involved in reproduction of farm animals.

(ii) State one function of each of the hormones named in (i).

Few candidates attempted this question

(a) The performance was quite good.

(b) Most of the candidates could not state the functions of the abomasum of ruminants

Expected answers are:

- digestion of protein;
- absorption of water.
- secretion of hydrochloric acid to kill harmful bacteria

(c) Most of the candidates could not distinguish between inbreeding and cross breeding. Expected answer is inbreeding is the mating of closely related animals while cross breeding is the mating of purelines of different breeds of animals

(d) Most candidates were able to list the reproductive hormones and stated one function of each of the hormones listed.

Question 9

(a) (i) What are marketing boards?

(ii) State five functions of marking boards.

(b) Mention three objectives of agricultural extension.

(c) State five factors that affect the supply of agricultural labour.

Few candidates attempted this question

(a) Most of them knew what marketing boards are but could not give the functions of marketing boards

Expected functions include:

- giving technical advice to farmers;
- standardization and grading of produce;
- performance of inputs to farmers;
- provision of storage facilities;
- give incentives to farmers.

(b) Most of the candidates could mention the objectives of agricultural extension

(c) This was poorly answered. Most of the candidates stated factors affecting the supply of agricultural produce instead of factors affecting the supply of agricultural labour.

The expected answers include:

- population size;
- age;
- sex/gender;
- health;
- level of wages/salary;
- socio-cultural environment;
- degree of industrialization.

Question 10

(a) (i) State the law of diminishing returns.

(ii) Explain the main cause of diminishing returns in agricultural production.

(b) Mention five characteristics of agricultural extension education.

(c) Give three

(i) advantages of *Group Extension Method;*

(ii) disadvantages of *Group Extension Method.*

(a) Most candidates could state the law of "diminishing returns" but could not explain the main causes of diminishing returns in agricultural production.

Expected answers are:

- wrong combination of factors of production
- over concentration of a variable factor on piece of land e.g. labour
- land is limited in supply

(b) Most candidates could mention the characteristics of agricultural extension education

(c) This was also fairly well answered

GENERAL AGRICULTURE 3

1. GENERAL COMMENTS

The standard of the paper compared favourably with that of previous years with respect to contents, syllabus coverage and level of difficulty.

The performance of candidates was generally better this year than last year.

2. SUMMARY OF CANDIDATES' STRENGTHS

The Chief Examiner commended candidates for the following features noticed in their scripts:

(i) Calculation of germination percentage
(ii) Names of crops attacked by cotton stainer and weevil
(iii) Correct identification of cotton stainer, weevil and tapeworm
(iv) Symptoms and control of tapeworm infestation in farm animals

3. SUMMARY OF CANDIDATES' WEAKNESSES

The following weaknesses were noticed in the scripts of candidates:

(i) Poor construction of sentences that made it extremely difficult for examiners to comprehend
(ii) Inability to describe damages caused by cotton stainer and weevil to crops
(iii) Inability to outline steps involved in carrying out germination test on cowpea
(iv) Wrong spellings of technical terms and scientific names
(v) Inability of some candidates to work on profit and loss account

4. SUGGESTED REMEDIES

The Chief Examiner made the following suggestions meant to remedy the weaknesses of candidates:

(i) Teachers should periodically use question and answer to drill students on scientific words and technical terms
(ii) Teachers should give exercises involving preparation of profit and loss account
(iii) Teachers should organize more practical lessons involving identification of specimens

5. DETAILED COMMENTS

Question 1

(a) Name two crops each that specimens A and B attack.

(b) Describe three types of damages caused by each of specimens A and B.

(c) What type of mouthpart does specimen A possess?

(d) Mention two ways of controlling each of specimens A and B?

(a) Majority of the candidates performed well in Part (a) as they correctly provided crops that are attacked by cotton stainer (A) and weevil (B). however, some candidates wrongly stated that weevil attack cowpea.

(b) A good number of candidates correctly provided the description of damages caused by the two pests (cotton stainer and weevil). Few of the candidates however, described the end result of the damage caused and not the damage itself.

(c) This sub-question was well answered by most of the candidates. However, some of the candidates described the mouth part wrongly as "sucking and piercing" instead of "piercing and sucking".

(d) Quite a member of candidates were able to provide the correct ways of controlling these pests (cotton stainer and weevil). However, few of them just stated "spray" without indication the kind of chemical to use. Some also stated "spray with chemical" without indicating the specific / appropriate / recommended chemical.

Question 2

(a) (i) Outline the steps involved in carrying out germination test on specific C.

(ii) Give two reasons for carrying out germination test on specimen C before sowing.

(iii) State three precautions that should be taken to ensure good results from the germination test.

(b) A farmer sowed 150 grains of specimen C. Calculate the germination percentage if 125 grains germinated into healthy seedlings.

(a) (i) Most of the candidates could not outline the steps involved in carrying out germination test on specimen C (Cowpea). Majority of them presented the floatation method which is used to separate good seeds from bad seeds. However, few candidates who got some of the steps right could not provide correctly the method of finding germination percentage as part of the steps. Candidates should note that, the formular for calculating germination percentage is:

$$\frac{\text{Total seed germination}}{\text{Total seed sown}} \times 100$$

(ii) A good number of candidates could not give the reasons for carrying out

germination test on specimen C (cowpea) before sowing.
Candidates should note that the main purpose of carrying out germination test is to:

- assess the viability of seed lot;
- to reduce wastage of seed and
- to determine seed rate.

(iii) This sub-question was poorly answered by most of the candidates. Candidates should note that the precautions taken to ensure good results from germination test include: provision of moisture; provision of optimum temperature and availability of air/oxygen.

(b) This sub-question was well-answered by most of the candidates. Most of them correctly calculated the germination percentage of the grains.

Question 3

(a) (i) Mention three symptoms of specimen D infestation of farm animals.

(ii) State four ways of controlling specimens D.

(b) (i) State four uses of specimen E to humans.

(ii) Name two ectoparasites that could be found on specimen E.

(iii) Name two farm animals from which specimen E could be obtained.

A great majority of the candidates attempted this question and exhibited a fairly good familiarity and ideas about animal health.

(a) (i) Generally, candidates did not find much difficulties in stating the symptoms of tapeworm (Specimen D) infestation in farm animals. Their answers included emaciation / loss of weight, loss of appetite, diarrhoea, loss of wool, anemia, general weakness.

However, some candidates listed wrongly low production, restlessness and isolation as some of the symptoms.

(ii) Majority of candidates gave correct control of Tapeworm (Specimen D) infestation.

However, it was observed that some candidates were not aware that deworming is the same as drenching as used in controlling endoparasites in farm animals.

(b) (i) Candidates' performance on this sub-question was only fair as most of them could list the uses of skin of sheep (Specimen E) to humans.

Their correct responses include:

- for making shoes;
- used as food;
- for making drums;
- for making clothing;
- for making belts.

(ii) Candidates were generally familiar with this sub-question. They therefore answered it well by correctly providing examples of ectoparasites found on skin of sheep (Specimen). Their answers included lice, tick, mites and fleas. However, few candidates mispelt the name of the ectoparasites.

(iii) Candidates were able to mention the farm animals from which these pests could be obtained. Farm animals included sheep, goat and cow.

Question 4

The data below were obtained from EMB farms Limited for the year ending 31st December 2017.

Study the data carefully and answer the questions that follow.

Item	**Amount (GH¢)**
Inputs	**1,500**
Miscellaneous Expenditure	**140**
Produce in storage	**150**
Advertisement	**150**
Rent	**100**
Sale of farm produce	**940**
Transportation	**750**
Vegetable on the field	**450**
Layers in pen	**500**
Salaries	**1,150**

(a) Prepare a Profit and Loss account for EMB Farm Limited.

(b) Determine the profit or loss for EMB Farms Limited.

(c) (i) Name the farming system practices by EMB Farms Limited.

(ii) Give the reason for your answer in (c)(i).

(iii) State two advantages of the farming system practiced by EMB Farms Limited.

Many candidates who attempted this question failed to answer it satisfactorily.

(a) This question tasked candidates to prepare a Profit and Loss account for EMB Farm Limited for the year ending 31st December 2017.

A great number of the candidates were not able to draw and provided the various headings satisfactorily. For the table heading, some just wrote profit and loss account without indicating date and name of the company. Some candidates also interchanged the position of the item hence lost all the marks.

(b) In most cases, once the entries were correctly done, calculation of the Profit or Loss was correct.

(c) (i) Most of the candidates were able to state the type of farming system practiced by EMB Farm Limited. However, few of them spelt the farming system wrongly. Good number of them wrote either Mix or Miss farming instead of Mixed Farming.

(ii) Candidates were able to assign reasons for their choice of farming system. Reason such as EMB Farm produced both crops and animals on the same farm was provided.

(iii) Majority of the candidates were able to give the advantages of the farming system practiced by EMB Farm Limited. However, advantages such as the following were rarely stated:

- insurance against total failure of farm business;
- crop residue used as bedding for farm animals.

INTEGRATED SCIENCE 2

1. GENERAL COMMENTS

The standard of the paper is the same as that of the previous years. The questions were spread across the syllabus.

Performance of candidates however fell below that of 2018 for school candidates.

2. SUMMARY OF CANDIDATES' STRENGTHS

The Chief examiner identified some strengths in candidates work among which are the following:

(i) Neat lay-out of answers commendable
(ii) Candidates had their strengths in Biology and Agric-related questions
(iii) Candidates who understand the questions attempted provided responses that were straight forward and to the point; candidates who adhered to the instructions/ rubrics of the paper scored high marks
(iv) Very few candidates copied questions before answering unlike in previous years
(v) Candidates performed satisfactorily in the following areas:
  (a) Definitions of compound and mixture;
  (b) Environmental factors that affect the life cycle of crops;
  (c) Plotting of points for the drawing of graphs.

3. SUMMARY OF CANDIDATES' WEAKNESSES

The following were weaknesses of candidates reported by the Chief Examiner:

(i) Common English words such as: knife, bacteria, manure, wheelbarrow, nutcracker, volumetric etc were wrongly spelt;
(ii) Candidates had problems with Physics and Chemistry related questions / concepts;
(iii) Lack of understanding of some of the questions resulted in the candidates giving irrelevant responses to question;
(iv) Poor understanding / usage of the English language by candidates, making it difficult for the examiners to understand what the candidates wanted to put across;
(v) Some candidates lacked in-depth knowledge of some key scientific concepts "greenhouse effect", hald-wave rectification, organic/inorganic compounds etc;
(vi) Some candidates answered less and others more questions than the number specified. In many cases candidates provided more than specified. In many cases candidates provided more responses for a question instead of the number requested for.

4. SUGGESTED REMEDIES

(i) Stakeholders in secondary education to provide solutions to the weaknesses in student's performance in the WASSCE;

(ii) Students should be encouraged to adhere to the rubrics of each question as recommended. The need for thorough discussion of Chief Examiners report cannot be over emphasized. New ways of displaying Chief Examiners reports to students to be considered;

(iii) Students should be made to take their English language lessons seriously since it affects students' ability to comprehend questions – close collaboration between the English and Science departments is recommended;

(iv) Vocabulary drills in science departments is recommended;

(v) Experienced teachers could be invited to schools to take newly trained teachers/students on how to answer questions.

5. DETAILED COMMENTS

Question 1

(a) (i) Define each of the following terms:

(α) compound;

(β) mixture.

(ii) State two differences between an element and a compound.

(b) Explain each of the following terms:

(i) greenhouse effect;

(ii) climate change.

(c) (i) What is electrical rectification?

(ii) Using simple wave diagrams, explain half-wave rectification.

(d) State one way in which each of the following environmental factors is important to the life cycle of crops:

(i) rainfall;

(ii) temperature;

(iii) sunshine;

(iv) wind.

(a) This item was very popular, answered by almost all candidates. Definitions of element/compound were correctly given but most candidates could not provide the differences between the two concepts such as elements made of same kind of atoms have their own set of properties or cannot be broken down into any simpler substance as against compound of atoms of different element, properties differing from those of their constituents correspondingly.

(b) Generally, poorly answered with many who attempted it scoring zero as they were unable to state that the trapping of infrared radiations in the earth's surface by CO_2/other greenhouse gases causes the warming of the earth's surface neither were

they able to identify the two elements – a change in the earth's weather temperature, experienced over a long term on a large scale.

(c) Many candidates provided good responses, majority however wrote 'alternative' instead of alternating. The explanation of half-wave rectification was a disaster; a few drew the wave diagrams but could not label the axes correctly and so scored zero; the explanation that follows the wave diagram was a huge challenge to many.

(d) Many were unable to state the importance of rainfall / temperature in the life cycle of crops i.e. for seed germination / dissolving mineral salt etc and for germination of and drying of seeds

Question 2

(a) (i) Give three reasons why goats are not normally kept under the intensive system of management.

(ii) Name two diseases that affect rabbits.

(b) (i) Draw the structure of $_{11}Na^{+}$.

(ii) State two differences between *organic compounds* and *inorganic compounds*.

(c) (i) What are decomposers?

(ii) Name three common decomposers in an ecosystem.

(d) (i) Name three structures in the middle ear that help in the transmission of sound waves;

(ii) Mention two ways in which earmuffs are important.

Not a popular question – candidates failed to state the

(a) (i) aggressive nature of goats, highly selective in feeding, reduced resistance to diseases if kept under intensive system and reduced growth rate as reasons why goats are not kept under intensive system of management.

(ii) Even though candidates know of coccidiosis, snuffles, among the diseases that affect rabbits, they had challenges with the spelling and therefore lost marks

(b) (i) Most candidates know the structure of the sodium atom but were not familiar with the sodium ion with the ten (10) electrons in two shells of 2 and 8 respectively

(ii) The responses to such a familiar question were rather very disappointing as many candidates were unable to give straight forward difference between organic and inorganic compounds – covalent, highly conductive, non-electrolytic etc and ionic, do not burn, electrolytic etc respectively.

(c) Decomposers were averagely well-defined, and majority gave examples of decomposers except a few who gave 'worms' 'vulture', ringworms centipede which were not correct

(d) (i) Candidates failed 'to satisfy' the demands of the question which specifically asks for 'structure in the middle ear'. A few who gave malleus, stirrup, incus as expected had serious challenge with the spellings of these structures

(ii) Ear muffs were alien to a number of candidates and so they gave responses that were far-fetched – protecting the ear against noise of high frequency and against hearing loss etc are responses expected of candidates.

Question 3

(a) An electrical appliance rated 1.5 kW, 240V is left running for 2 hours. Calculate the

(i) current drawn;

(ii) electrical energy consumed.

(b) (i) In what two ways does mulching help to conserve the soil?

(ii) Give two examples of mulching materials.

(c) (i) What is pollution?

(ii) List three major atmospheric pollutants.

(d) (i) State two benefits of each of the following minerals to the human body:

(α) potassium;

(β) calcium.

(ii) Name one source of each of the minerals listed in (d)(i).

Perhaps the most popular question.

(a) Most candidates were comfortable with the calculation in (i) but had some challenges with the unit of energy in (ii) – kWh or joules/J where the time (2hrs) had to be given in seconds for substitution in E = PE i.e. 1.5 x 1000 x 60 x 60 = 1.08 x 107 J / joules.

(c) Pollution was well defined by many who attempted the question and named atmospheric pollutants correctly.

(d) Benefits / sources of potassium and calcium were satisfactorily provided by candidates.

Question 4

(a) (i) State the method of preparing a salt from each of the following pairs of substances:

(α) dilute tetraoxosulphate (VI) acid and dilute sodium hydroxide;

(β) lead (II) trioxonitrate (V) and sodium chloride.

(ii) Write a balanced chemical equation for the reaction between lead (II)

trioxonitrate (V) and sodium chloride.

(b) (i) What are *tidal waves*?

(ii) State four ways in which water could be contaminated.

(c) (i) State two ways in which legumes are important in crop production.

(ii) State three advantages of crop rotation.

(d) (i) State three qualities of a good thermometric liquid;

(ii) Give one precaution that must be taken when using a liquid-in-glass thermometer.

(a) This item was very unpopular among candidates. The few who attempted (a) demonstrated their challenge with the IUPAC nomenclature; balancing the equation was satisfactorily done.

(b) Poor knowledge of tidal waves was demonstrated as the few who attempted the item used 'waves' in their responses – they failed to state that these wave-like swellings on surface of water are caused by the effect of gravitational interaction between the moon, sun andthe earth.

(c) Candidates were comfortable with importance of legumes, crop rotation.

(d) Candidates were rather poor at precautions to be taken when using a liquid – in – glass thermometer – e.g. reading to be taken at eye level, bulb to be inserted well into the substance etc are responses expected of candidates.

<u>Question 5</u>

(a) State

(i) two functions of the placenta in mammals;

(ii) two structural features of the placenta which adapt the placenta to its functions.

(b) Explain why each of the following pairs of nuclides are isotopes.

(i) $^{16}_{8}O$, $^{17}_{8}O$

(ii) $^{12}_{6}O$, $^{14}_{6}O$

(c) List five farming practices that check soil erosion.

(d) (i) Arrange the following stages of water treatment for public consumption in the correct order:

chlorination, sedimentation, screening, sand filtration and aeration.

(ii) State the significance of each of the following stages in water treatment:

(α) screening;

(β) filtration;

(γ) chlorination.

Question five (5) was also, very unpopular

(a) (i) Candidates concentrated on only 'exchange of materials' between mother and foetus and neglected 'secretion of hormones and attachment of foetus to the uterine wall as alternative answers

(b)(i) & (ii) were poorly answered by the very few who attempted these items. Most, if not all, of such candidates failed to 'explain' why the nuclides are isotopes even though they understand the concept of isotopy being due to differences in the number of neutrons basically for $^{16}_{8}O$, $^{17}_{8}O$ candidates are expected to show the number of protons (8) for both and the neutrons for each 8 and 9 respectively and for the nuclides $^{12}_{6}C$, $^{14}_{c}C$ the number of protons (6) and no of neutron for each i.e. 6 and 8 respectively – simple subtractions effected.

(d) Responses provided suggest candidates were unfamiliar with the stages involved in water purification and did not give correct reasons for carrying out each stage.

Question 6

(a) State five post planting practices on cereal farm to ensure a high yield.

(b) (i) Define mechanical advantage of a simple machine.

(ii) Give two examples of second class levers.

(c) (i) Name four apparatuses needed in the preparation of a standard solution.

(ii) Calculate the volume of water needed to dilute 20 cm^3 of 5.0 M HCl to 1.0 M HCl solution. [H = 1.0, Cl = 35.5]

(d) (i) State three differences between *hypogeal germination* and *epigeal germination.*

(ii) Give one example of seeds that undergo

(α) hypogeal germination;

(β) epigeal germination.

Perhaps the most popular item responded by, almost all candidates.

(a) (i) Candidates scoring very high marks in the process

(ii) Few got spellings of knife, nutcrackers wheelbarrow etc wrong

(c) Atomic masses of the atoms provided confused a few students. Quite a number were unable to subtract the initial volume (V_i) got from the relationship $C_1V_1 = C_2V_2$ from the final vol. i.e. 100 cm^3 – 20 cm^3 = 80 cm^3 to answer the question.

(d) (i) Majority of candidates could not state the differences between the two oppositely related concepts associated with seed germination – 'epigeal' and 'hypogeal'.

Some confused ‘epicotyl’ in hypogeal germination with ‘hypocotyl’ in epigeal germination. Nevertheless, few candidates were able to state clear distinction between the two concepts. These are simple concepts that could be demonstrated by the teacher.

INTEGRATED SCIENCE 3

1. GENERAL COMMENTS

The standard of the paper is the same as that of the previous years. The performance of candidates has appreciated slightly.

2. SUMMARY OF CANDIDATES' STRENGTHS

Commendable strengths of candidates reported by the Chief Examiner include:

(i) Precise answers - Many candidates gave precise and unambiguous answers

(ii) Construction of sentences has improved. Correct scientific words are used to explain expected principles.

(iii) There is much improvement in identification of illustrated specimens and apparatuses

3. SUMMARY OF CANDIDATES' WEAKNESSES

Some of the weaknesses of candidates noticed and reported by the Chief Examiner include:

(i) Poor spelling of scientific words;

(ii) Inadequate graph plotting skills;

(iii) Lack of experience in practical work resulting in inability to answer questions based on practical work.

4. SUGGESTED REMEDIES

(i) Teachers should introduce new words with emphasis on correct spelling

(ii) Teachers should teach graph work with emphasis on

- labelling of axes
- choice of good scales
- correct plotting of points
- drawing of line of best fit

(iii) Teachers should incorporate practical demonstration in lesson delivery.

5. DETAILED COMMENTS

Question 1

In an experiment to investigate the effect of sugar solution on onion tissues, pieces of epidermal tissues of equal sizes were peeled from inner fleshy leaves of onion. A number of the tissues were placed in six test tubes containing sugar solutions of different concentrations. After a few hours the cells of the tissues were observed to have deformed. The percentage of the deformed cells in the various solutions are presented in Table 1 below.

Study the table carefully and answer the questions that follow:

Table 1

Concentration of solution (%)	*Deformed cells (%)*
0.0	**0**
0.5	**0**
1.0	**10**
1.5	**78**
2.0	**99**
2.5	**100**

(a) Plot a graph of percentage with deformed cells on the vertical axis and concentration of sugar solution on the horizontal axis (A graph sheet is provided on page 7).

(b) Draw and label a diagram to show the appearance of the onion cell in the

(i) 0.5 % concentrated solution;

(ii) 2.5% concentrated solution.

(c) Give one reason each for the appearance of the cells drawn in (b).

(d) State two environmental factors that could have the same effect on a plant as the concentrated sugar solution.

(a) Most candidates answered this sub-question correctly. They chose good scales and labelled the axes correctly. To score for the line shape, candidates were expected to join adjacent points with straight lines. However, most candidates did not use a straight edge to rule the line of best fit.

(b) Most candidates were able to draw the diagram of the appearance of the onion cell in the 0.5% concentration solution correctly but could not draw the diagram of the appearance of onion cell in 2.5% concentrated solution correctly. The cytoplasm was not separate from the cell membrane as expected.

(c) The reasons given by most of the candidates for the appearance of the cell drawn include: the protoplasm does not lose water/ because cell sap was of the same concentration as sugar solution/ Isotonic.

The expected reason is, protoplasm loses water through osmosis/because the cell was in hypertonic solution.

(d) Most candidates answered this part correctly. Candidates stated the environmental factors that could have the same effect on plant as the concentrated sugar solution as; light, temperature/warmth, relative humidity, wind, water/precipitation/Rainfall, nutrition/nutrient and low carbon dioxide concentration.

Question 2

Fig. 2 illustrates two farm products labelled A and B.
Study the illustration carefully and answer the questions that follow.

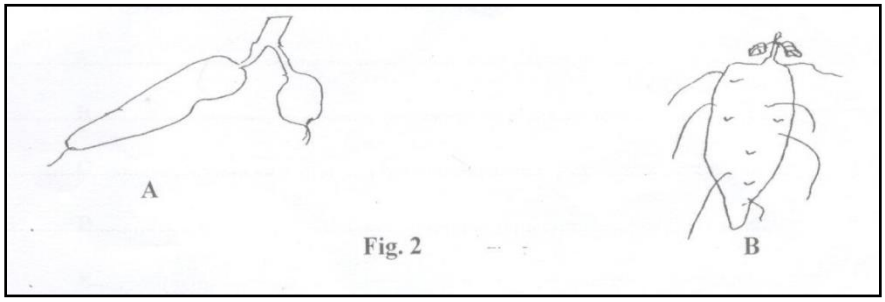


Fig. 2

(a) Identify each of the products labelled A and B.
(b) State the mode of development of each of the products labelled A and B.
(c) State the mode of cultivation of each of the products labelled A and B in terms of:
  (i) method of propagation;
  (ii) land preparation;
  (iii) plant distance.
(d) Name four food products that can be obtained from the product labelled A.
(e) State the function of the product labelled A in the diet of animals.
(f) Name one disease that affects the product labelled A in the soil.
(g) Name one disease that affects the plant of the product labelled A.

Most candidates answered question two and their performance was impressive.

(a) Most candidates identified the product as A – Cassava tuber/manioc/manihot esculenta and B – Yam Tuber/dioscorea alata/rotundata/esculenta/bulbifera/dumentorum.

(b) Most candidates could not state the mode of development of products as A develops from the root and B develops from the stem.

(c) (i) Most candidates stated correctly the mode of cultivation as A- stem cutting, B- setts/yam seed/small tubers/whole tuber/tuber bulb/tissue culture.

(ii) Most candidates stated correctly the mode of cultivation of product in terms of land preparation as A – clearing and burning of land/stumping, ploughing and harrowing, ridging and mound/heap making, manure/ fertilizer application. B – clearing and burning of land/stumping, ploughing and harrowing, ridging and mound/heap making, manure/ fertilizer application.

(iii) Most of the candidates stated correctly the mode of cultivation of product in terms of planting distance for A as (90 cm -100 cm) × (100 cm – 150 cm)/ (0.9 m - 1.0 m) × (1 m – 1.5 m) or 60 cm × 60 cm (on ridges) 75 cm × 150 cm (flat ground) 78 cm × 120 cm (monocrop) 120 cm × 120 cm (intercrop with maize). However, most of the candidates stated a wrong planting distance for B. They were expected to state the planting distance for B as (100 cm -120 cm) × (100 cm – 120 cm)/ (1.0 m - 1.2 m) × (1.0 m – 1.2 m) or 90 cm apart on mounds.

(d) Most of the candidates named the food product that can be obtained from A correctly as cassava flour/bread, gari/cassava flakes, cassava dough, cassava chips, starch, tapioca/pudding, kokonte, banku/cassava paste, fufu, macaroni, biscuits, animal feed, attike/couscous, beer.

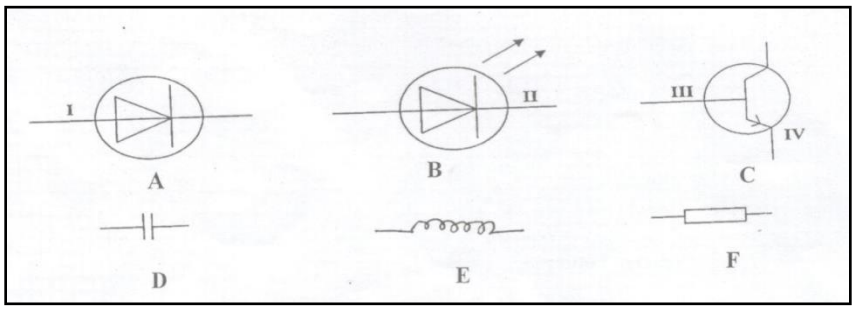
(e) Most of the candidates answered this sub-question correctly by stating the function of the A in the diet of animals as provide energy and fattening animals.

(f) Most of the candidates could not answer the question correctly, candidates were expected to name the disease that affects A in the soil as white thread, tuber rot/root rot/ root knot.

(g) Most of the candidates were able to name the disease that affects the plant of A as white leaf spot, brown leaf spot, cassava mosaic, anthracnose, sudden wilt, cassava ash/powdery mildew, super elongation, spiral nematode, cassava bud necrosis, white thread, tuber rot/ root rot and root knot.

Question 3

Fig. 3 shows the symbols of six electronic components labelled A, B, C, D, E and F.
Study the figure and answer the questions that follow:



(a) Identify each of the components whose symbols are labelled A, B, C, D, E and F.

(b) Name each of the terminals labelled I, II, III and IV.

(c) State one function of each of the components whose symbols are labelled A, B, C, D and E.

Most of the candidates had difficulties answering this question.

(a) Most of the candidates identified component with symbol D as the Cell instead of Capacitor which was the correct response. Also, component with the symbol F was wrongly identified as Load, variable resistor or resistance instead of Resistor. In addition, component with symbol E was identified as coil or coiled wire which was wrong, instead, candidates were expected to write inductor, induction coil, solenoid or choke. However, most candidates identified components A, B and C correctly as A- Diode, B- Light emitting diode/LED and C – Transistor.

(b) The terminals or leads of the diode I and II could not be dealt with at all. Most candidates had no idea about this question. However, a few candidates stated correctly that, I – anode/positive,
II – cathode/negative, III – base, IV – emitter.

(c) Most candidates answered the function of the Diode component with symbol A as "it is used to convert or change direct current to alternating current" which was a wrong response. Candidates were expected to state that it is used to convert or change alternating current to direct current which is the correct meaning of electrical Rectification. Again, most candidates wrote the functions of the capacitor component with symbol D as "generate electricity or electric power or current, instead of store electrical charges or energy which was the correct response. This was because most candidates identified the capacitor as Cell and subsequently gave the function of the cell in the sub- question C. The response for option E, where candidates were to state the functions of a solenoid or choke or inductor or induction coil was wrongly answered by most of the candidates. Candidates wrote it is used in electromagnet which was wrong, rather candidates were expected to state that it is used in electromagnetism or as electromagnet. Other incorrect responses given by candidates with their corresponding correct answers are as follows; it converts or changes mechanical energy to electrical energy instead of electrical energy to mechanical or magnetic energy, it generates mechanical energy instead of generates magnetic field or energy, it allows A.C to pass through but blocks D.C instead of allows D.C to pass through it but blocks A.C. other function or uses of the solenoid which was not stated by candidates includes, its used in telephone earpiece to convert the speech to current, it is used in magnetic relay in telecommunications.

Question 4

(a) State one use of each of the following pieces of laboratory apparatus:

(i) dropping pipette;

(ii) test tube;

(iii) gloves;

(iv) reagent bottle;

(v) goggles.

(b) State the observation that would be made when each of the following activities are performed:

(i) NH_3 gas is brought near HCl vapour;

(ii) red litmus paper is put in orange juice;

(iii) red litmus paper is put in dettol;

(iv) blue litmus paper is put in baking powder.

(c) Name two instruments in the laboratory that could be used to determine the

(i) accurate volumes of liquids;

(ii) mass of a substance.

Most candidates answered this question.

(a) Most candidates answered this sub-question correctly. Responses written by candidates include:

(i) the dropping pipette is used to transfer small amounts of liquid/ transfer liquid drop by drop;

(ii) test tube is to hold/mix/heat chemicals in experiments/reaction;

(iii) the gloves is for protection from contact with harmful substances/ for holding hot objects/ protective barrier against germs/ bacteria;

(iv) the reagent bottle is used to hold/store chemicals in liquid or powder form/ for mixing chemicals;

(v) goggles is used to protect eye and its surrounding areas from particles/water/ chemical/ radiations.

(b) (i) A few candidates were able to write the correct answer for the observation to be made when NH_3 gas is brought near HCl vapour as white fumes.

(ii), (iii) and (iv) Most candidates stated No colour change of the litmus paper, colour of litmus paper change to blue, and no colour change of litmus paper respectively.

(c) (i) Some candidates stated beaker instead of graduated beaker. However, most candidates stated the following instruments as response:

Pipette, burette, graduated/measuring cylinder, volumetric/ graduated flask.

(ii) Most candidates stated spring balance as an instrument to determine the mass of a substance but that was wrong, however, some candidates wrote electronic balance, chemical balance, top-pan balance, lever balance and beam balance as correct response.

PHYSICS 2

1. **GENERAL COMMENTS**

The questions set were within the scope of the syllabus. The standard of the questions compared well with the previous ones.

The performance of candidates was fair. Few candidates produced fairly good responses to questions, but the general performance was fairly satisfactory, compared to the previous years'.

2. **A SUMMARY OF CANDIDATES' STRENGTHS**

(i) The rubrics were adhered to.
(ii) Most candidates stated correctly the uses of satellites.
(iii) Candidates stated correctly what is meant by a laser being monochromatic, coherent and collimated.
(iv) Doping was well explained by candidates and a p-n junction diode connected in forward bias mode was correctly drawn.
(v) Some candidates stated correctly what is meant by terminal velocity and also derived the two equations of motion correctly.
(vi) Candidates stated correctly what a machine is and expressed correctly the relation between mechanical advantage, velocity ratio and efficiency of a machine.
(vii) Wave was correctly defined by candidates and they also arranged the waves given in increasing order of wavelength.
(viii) The concise and coherent answers given by some candidates should be encouraged.

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

(i) Some candidates did not comprehend some theories in Physics.
(ii) Candidates were not able to state what is meant by dimensions of a physical quantity
(iii) Units were mixed up and some calculations were not carried out in SI unit by some candidates.
(iv) Candidates had difficulty in solving problems on kinematics and heat change.
(v) Candidates could not draw correct ray diagram to indicate the production of virtual image by converging lens.
(vi) Candidates had problems with questions on static electricity.
(vii) Some candidates were not able to calculate binding energy and binding energy per nucleon of helium nucleus.

4. **SUGGESTED REMEDIES**

(i) Teachers should explain Physics theories and principles well for students to understand; and also apply them.
(ii) Students should prepare adequately before attempting the Physics examination.

(iii) Candidates should solve past Physics examination questions.
(iv) Chief examiner's report on Physics should be read by candidates.
(v) Candidates should improve on their standard in English language to enable them to understand the questions adequately.
(vi) Candidates should give concise answers to questions.

5. DETAILED COMMENTS

Question 1

(a) What is a blackbody?

(b) Write an equation for the total energy, E radiated at all wavelengths per unit area per unit time at temperature T.

Most candidates correctly stated what blackbody is and also wrote the equation that relates E to T.

(a) Blackbody is a material that absorbs all the radiation that falls on it.

(b) $E = \sigma T^4$

Where σ is the Stefan-Boltzman's constant

Question 2

(a) What is meant by dimensions of a physical quantity?

(b) The speed, c, longitudinal waves in a stretched wire is given by the equation c $= \sqrt{\frac{E}{\rho}}$ **, where E is the Young's modulus for the material of the wire and ρ is its density. Show that this equation is dimensionally correct.**

(a) Candidates could not state correctly what is meant by dimensions of a physical quantity. The expected answer is: -Dimensions of a physical quantity is the powers to which the fundamental quantities of mass (M), length (L) and time (T) are raised.

(b) They could not also show that the above equation is dimensionally correct. Most of them did not put square bracket around the physical quantities while solving the problem.

$[c] = LT^{-1}$

$[\frac{E}{\rho}] = \sqrt{[\frac{ML-1T-2}{ML--3}]}$

$= LT^{-1}$

Question 3

(a) When is a satellite said to be in parking orbit?

(b) State two uses of satellites.

Some candidates were not able state what a satellite is but most of them gave the uses of satellites.

The expected answer is: A satellite is in parking orbit when its period of revolution is equal to the period of rotation of the earth.
Candidates gave correctly the uses of satellites.

Question 4

The permitted strain on a steel wire of diameter 1.0 mm is 1.0 x 10^{-3}. Calculate the maximum load that could be placed on the wire.
[young's modulus for steel = 2.0 x 10^{11} M n^{-2}, π = 3.142]

Few candidates solved this problem correctly. The expected equation to be used and the corresponding answer are:

$$Y = \frac{F/A}{Tensile\ Strain}$$

F = Y x A x Strain

F= $\frac{2 x 10^{11}}{4}$ x3.142 x (1.00 x 10^{-3})^2 x 10^{-3} = 157 N

Question 5

State three advantages of Fibre Optics.

This question was popular and was answered by most candidates. Advantages are:

- High information carrying capacity
- Free of noise associated with electrical interference.
- Work over longer distances without regeneration.
- Lighter and easier to handle.
- Crosstalk between adjacent channels is negligible.
- Wide band application
- Low maintenance cost

Question 6

What is meant by a laser being

(a) monochromatic?

(b) coherent?

(c) collimated?

Most candidates gave the correct response as:

(a)	monochromatic	-	consist of one wavelength
(b)	coherent	-	all parts are in phase
(c)	collimated	-	all parts travel in the same direction

Question 7

(a) Explain the term doping.

(b) Draw a *p-n* junction diode connected in the forward bias mode.

Doping was well explained by many candidates and the drawing of the p-n junction diode was correctly done by most candidates, as requested

Question 8

(a) (i) What is meant by the term terminal velocity?

(ii) State three factors that affect the terminal velocity of a body in a liquid.

(iii) Given that for a uniformly accelerated motion, $s = \left(\frac{v+u}{2}\right) t$ and $v = u + at$, where the symbols have their usual meanings, derive two other Newton's equations of motion.

(b) (i) A bus travelling at 30 m s^{-1} along a straight road passes a stationary taxi cab. The cab begins to move 5 s later with a uniform acceleration of 2 m s^{-2} in the same direction as the bus. Calculate the

(α) time taken by the cab to catch up with the bus.

(β) distance the cab had travelled to catch up with the bus

Some candidates answered this question correctly.

Terminal velocity is the constant maximum speed attained by a body falling through a fluid/liquid.

(ii) Factors that affect terminal velocity in liquid are

- Size of the body
- Shape of the body
- Weight of the body
- Temperature of the liquid
- Density of the liquid

- Viscosity of the liquid.

Most candidates derived correctly the two equations requested.

(b) Candidates were not able to solve this problem correctly. The expected solution: -

Let time travelled by cab = t

Time travelled by the bus = (t + 5)

Distance travelled by bus, $s = 30(t + 5)$

Distance travelled by cab, $s = ut + \frac{1}{2}at^2 = 0 + \frac{1}{2} \times 2 \times t^2 = t^2$

Therefore $t^2 = 30(t + 5)$

$t^2 - 30(t + 5) = 0$

$t = 34.36$ s

Distance travelled by the cab to catch up with the bus, $s = 30(34.36 + 5) = 1180.8$ m

OR $s = (34.36)^2 = 1180.6$ m

Question 9

(a) (i) Explain the statement, the specific heat capacity of water is 4200 J kg^{-1} K^{-1}.

(ii) State three ways in which the high specific heat capacity of water is important.

(b) An aluminium can of mass 100 g contains 200g of water at 15°C. The can with its contents is placed in a freezer at -5 ° C. Calculate the quantity of heat that has to be removed from the water and the can for their temperature to fall to -5 ° C. [Specific heat capacity of water = 4.2 J g^{-1} °C^{-1}, specific latent heat of ice = 340 J g^{-1}, specific heat capacity of aluminium = 0.9 J g^{-1} °C^{-1}, specific heat capacity of ice = 2.0 J g^{-1} °C^{-1}]

(c) (i) What is a *machine?*

(ii) State the relationship between the mechanical advantage, velocity ratio and efficiency of a machine.

(iii) Draw and label a block and tackle system of velocity ratio 5.

Most candidates explained the statement that the S. H. C. of water is 4200 J $kg^{-1}K^{-1}$ however, most of them were not able to state three ways in which the high S. H. C. of water is important.

Ways in which the specific heat capacity of water is important

- enables the temperature of the sea to rise and fall slowly than that of the land leading to land and sea breeze.
- enables water to be used as coolant in nuclear reactors to generate steam for production of electricity.

- enables water to be used to cool engines and radiators of cars and central heating systems.
- supports aquatic life.

(a) Candidates were requested to calculate the amount of heat that would be removed from aluminum can of mass 100 g containing 200 g water of at 15 ^{o}C to a temperature of a freezer at -5 ^{o}C in which the can is. (SHC and SLH were given)

Most candidates could not solve this problem correctly. The expected solution is:
Heat lost by can in cooling from 15 ^{o}C to -5 ^{o}C = 100 x. 9 x [15 – (-5)] =1800 J
Heat lost by water in cooling from 15 ^{o}C to 0 ^{o}C = 200 x 4.2 x 15 = 12,600 J
Heata lost by water to freeze at 0 ^{o}C = 200 x 340 = 68,000 J
Heat lost by ice in cooling from 0 ^{o}C to -5 ^{o}C = 200 x 2.0 x [0 – (-5)] = 2000 J
Total heat removed = 1800 + 12600 + 68000 + 200 = 84,400 J cm

Some candidates answered this question satisfactorily. They stated what a machine is and gave the relation between E, M.A. and V.R. correctly. Expected responses are

i) A machine is a device in which a force (force) applied at one end is used to overcome another force (load) at some other point.

ii) Efficiency $=\frac{Mechanical\ Advantage}{Velocity\ Ratio}$ x 100 %

iii) A diagram of block and tackle of velocity ratio 5 has two pulleys in the lower block and three pulleys in the upper block with one rope passing round the pulleys.

Question 10

(a) (i) Explain the term *parallax* as used in Optics.
(ii) Define the *principal focus of a converging lens.*
(iii) Using a ray diagram, illustrate the production of a virtual image using a converging lens.

(b) (i) Define a *wave*.
(ii) Arrange the following waves in increasing order of wavelength: visible light, radio waves, infrared waves, *x*-rays, microwaves and ultraviolet waves.

(c) Two open organ pipes of lengths 50 cm and 50.9 cm give beats of frequency 6.0 Hz, when sounding their fundamental notes together. Neglecting end corrections, calculate the velocity of sound in air.

Most candidates could not explain parallax and could not define the principal focus of converging lens. They could also not draw the correct ray diagram.

The expected answers are:

(i) Parallax is the apparent movement of two objects owing to the movement of an observer's eye.

(ii) The principal focus of a converging lens is a point on the principal axis where rays which are close and parallel to the principal axis/paraxial rays converge after passing through the lens.

(iii) Diagram to illustrate production of virtual image using a converging lens:

Most candidates defined wave correctly and also correctly arranged the given waves in ascending order.

(d) Candidates were asked to calculate the velocity of sound in air when two open organ pipes of lengths 50 cm and 50.9 cm gave beats of frequency 6.0 Hz, when sounding the fundamental notes together.

Many candidates were not able to calculate the velocity of sound in air.

The expected solution:

$f = \frac{v}{\lambda} = \frac{v}{2l}$

$\Delta f = f_1 - f_2$

$6 = \frac{v}{2} \left[\frac{1}{0.5} - \frac{1}{0.509}\right]$

$V = \underline{339.30 \text{ m s}^{-1}}$

Question 11

(a) (i) Define *static electricity*.

(ii) State two practical uses of static electricity.

(iii) Given two identical uncharged metal spheres, A and B, mounted on insulating supports, an ebonite rod and a piece of fur, describe with the aid of diagrams, how sphere A could be charged positively and sphere B negatively.

(b) (i) Define mutual induction.

(ii) A transformer supplies 12 V when connected to 240 V mains. If the transformer takes 1.1 A from the mains to light ten 12 V, 24 W lamps arranged in parallel, calculate

(α) the efficiency of the transformer;

(β) the cost of supplying power for 10 hours at GH¢5.00 per kW h.

This question was not popular and only few candidates attempted it.

Candidates could not define static electricity; they could also not state practical uses of static electricity.

Expected answers: (i) Static electricity is electric charges at rest.

(ii) Practical uses of static electricity:
- Electrostatic paint spraying
- Dust collection in chimney
- Garden spray for plants
- Photo copying
- Protection of building.

Very few candidates were able to define mutual induction.
Mutual induction is the production of an emf in one circuit as a result of the changing current/flux in another circuit.

Calculation:

Efficiency of transformer = $\frac{output\ power}{input\ power}$ x 100%

= $\frac{10\ x\ 24}{1.1\ x\ 240}$ x 100%

= <u>90.9%</u>

Cost of power supply = Energy x cost

= 0.24 x 5 x 10

= <u>GH¢12.00</u>

<u>Question 12</u>

(a) (i) Define half-life of a radioactive element.

(ii) Sketch a graph of the relation $N = N_0 e^{-\lambda t}$ and indicate the half –life. The usual meanings of the symbols are implied.

(iii) The initial number of atoms in a radioactive element is 6.0 x 10^{20} and its half-life is 10 hours. Calculate

(α) the number of atoms which have decayed in 30 hours.

(β) the amount of energy liberated if the energy liberated per atom decay is 4.0 x 10^{-13} J.

(b) (i) What are *nucleons*?

(ii) Define the *binding energy* of an atom.

(iii) Given that the mass of a proton is 1.0073 u, the mass of a neutron is 1.0087 u and the mass of a helium nucleus is 4.0015 u, calculate

(α) the binding energy of the helium nucleus;

(β) the binding energy per nucleon of helium. [1 u = 931 MeV]

Most candidates were able to define half-life, sketch the exponential graph requested and carried out the calculation.

(i) Half-life is the time taken for one half of the radioactive element to decay.

(ii) Graph expressing the relation $N = N_0e^{-\lambda t}$

(iii) Calculation of number of atom that decayed in 30 hours.

$$\frac{N}{N_0} = \frac{1}{2^{t/t_{1/2}}}$$

$$\frac{N}{6.0\ X\ 10^{20}} = \frac{1}{10^{30/10}}$$

Amount left not decayed = $\frac{6.0\ x\ 10^{20}}{8}$ = 7.5 x 10^{19} atoms

Amount decayed = 6.0 x 10^{20} – 7.5 x 10^{19}

= <u>5.25 x 10^{20}</u> atoms

These questions were satisfactorily answered by many candidates.

(i) Nucleon is the protons and neutrons in the nucleus of an atom.

(ii) Binding energy is the minimum work or energy needed to separate the nucleons in the nucleus of an atom.

(iii) (α) Mass defect = [Mass of (2 protons + 2 neutrons)] – Mass of helium nucleus

= {[2(1.0073) +2(1.087)] – 4.0015}

= 0.0305u

Binding energy = 0.0305 x 931

= <u>28.4 MeV</u>

(β) Binding energy per nucleon of helium = $\frac{28.4}{4}$ = <u>7.1 MeV</u>

PHYSICS 3

1. GENERAL COMMENTS

The standard of the paper is good. The performance of candidates was, generally, similar to that of last year.

2. A SUMMARY OF CANDIDATES' STRENGTHS

(i) Most of the candidates were able to record processed data to appropriate number of decimal places / significant figures especially for division, inverse operations and trigonometrical evaluations
(ii) Most of the candidates were able to summarise data collected in one table.
(iii) Most of the candidates were able to draw graphs using data collected
(iv) Most of the candidates were able to compute slope of graphs using large right-angled triangle
(v) Most of the candidates were able to evaluate given expressions using correct substitutions
(vi) Most of the candidates were able to answer correctly at least one question from Section B.

3. A SUMMARY OF CANDIDATES' WEAKNESSES

(i) Most of the candidates did not record at all values of given specimen
(ii) Most of the candidates did not record Log T to at least 3 significant figures
(iii) The accuracy of the experiments for most of the candidates was poor
(iv) Most of the candidates did not answer fully Section B
(v) Most of the candidates used odd scales in plotting the graphs.

4. SUGGESTED REMEDIES

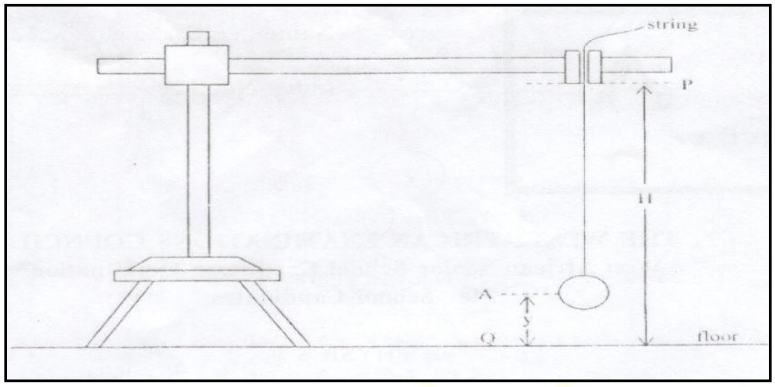
(i) Candidates should pay attention to instructions and demand of questions
(ii) Candidates have to spend time on the study of the physics subject, particularly the theory, to facilitate the understanding and easy handling of the physics practicals, especially the Section B.
(iii) Tutors should take students through physics practicals more frequently

5. DETAILED COMMENTS

ALTERNATIVE A

Question 1

(a)



You are provided with a stop watch, a metre rule, a split cork, retort stand and clamp, a pendulum bob, a piece of thread and other necessary apparatus.

(i) **Place the retort stand on a laboratory stool. Clamp the slip cork**

(ii) **Suspend the pendulum bob from the split cork such that the point of support P of the bob is at a height H = 100 cm above the floor Q. The bob should not touch the floor and H should be kept constant throughout the experiment.**

(iii) **Adjust the length of the thread such that the centre A of the bob is at a height y = AQ = 20.0 cm from the floor.**

(iv) **Displace the bob such that it oscillates.**

(v) **Take the time t for 20 complete oscillations.**

(vi) **Determine the period T of oscillation and evaluate T^2.**

(vii) **Repeat the procedure for four other values of y = 30.0 cm, 40.0 cm, 50.0 cm and 60.0 cm. In each case, determine T and T^2.**

(viii) **Tabulate the results.**

(ix) **Plot a graph of T^2 on the vertical axis and y on the horizontal axis, starting both axes from the origin (0,0).**

(x) **Determine the slope, s, of the graph and the intercept c on the vertical axis.**

(xi) **If in this experiment $sR = c$, calculate R.**

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

(b) **(i)** **The bob of a simple pendulum is displaced a small distance from the equilibrium position and then released to perform simple harmonic motion. Identify where its**

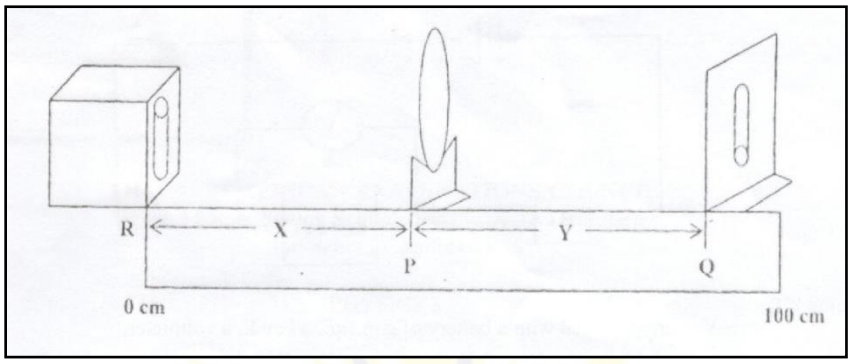
(α) **kinetic energy is maximum;**

(β) **acceleration is maximum.**

(ii) An object of weight 120 N vibrates with a period of 4.0 s when hung from a spring. Calculate the force per unit length of the spring. [g = 10 m s^{-2}, π = 3.142]

Question 2

(a)



You are provided with a converging lens and holder, a screen, a ray box containing an illuminated object pin and a metre rule.

(i) **Place the lens in its holder such that it is facing a distant object seen through a well-lit laboratory window. Move the screen to and fro until a sharp image of the distant object is formed on it.**
Measure the distance, f_0, between the screen and the lens.

(ii) **Clamp the metre rule securely to the table**

(iii) **Place the illuminated object pin at the end R of the metre rule. Place the lens at a position P such that X = RP = 20 cm**

(iv) **Move the screen to a position Q to receive a sharp image of the object. Measure the distance y = PQ.**

(v) **Evaluate $Z = (X+Y)$.**

(vi) **Repeat the procedure for five other values of x = 25 cm, 30 cm, 40 cm and 45 cm and in each case, record *X*, *Y* and evaluate *Z*.**

(vii) **Tabulate the results.**

(viii) **Plot a graph with *Z* on the vertical axis and *X* on the horizontal axis. Draw a smooth curve through the points.**

(ix) **Determine from your graph the minimum value of $Z = Z_0$ and its corresponding distance X_0.**

(x) **Evaluate $W = \frac{1}{2}\left(\frac{Z_0}{4} + \frac{X_0}{2}\right)$**

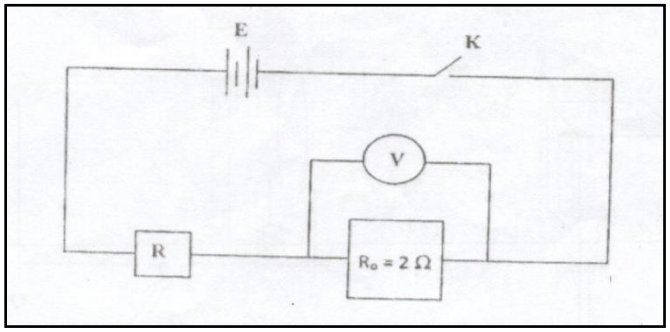
(xi) **State two precautions taken to ensure accurate results.**

(b) **(i) Draw a ray diagram to show how a convex lens forms an image of magnification less than 1.**

(ii) **Name two structures in the human eye and one corresponding feature each in the lens camera, that perform similar functions.**

Question 3

(a)



You are provided with a battery of e.m.f. E, a key k a voltmeter,
A standard resistor $R_0 = 2\ \Omega$, a resistance box R and some connecting wires.

(i) **Measure and record the e.m.f. E of the battery.**

(ii) **Set up a circuit as shown in the diagram above with the key open.**

(iii) **Set the resistance on the resistance box to R = 2 Ω.**

(iv) **Close the key, read and record the potential difference V on the voltmeter**

(v) **Evaluate V^{-1}.**

(vi) **Tabulate the results.**

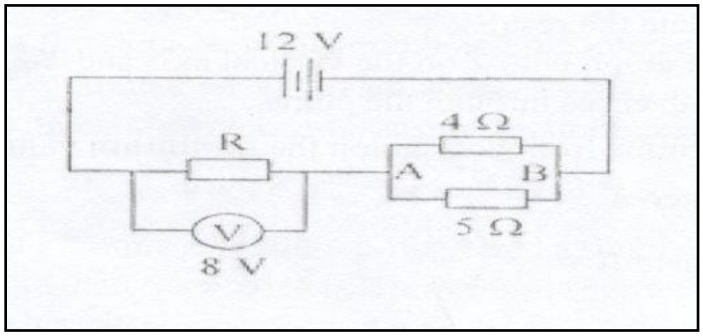
(vii) **Plot a graph with R on the vertical axis and V^{-1} on the horizontal axis, starting both axes from the origin (0,0).**

(viii) **Plot a graph with R on the vertical axis and V^{-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) Calculate α and β from the equations: $s = R_0\alpha$ and $c = -(R_0 + \beta)$.**

(xi) **State two precautions taken to ensure accurate results.**

(b) **(i)**



In the circuit diagram above, the battery has negligible internal resistance.

Calculate the power dissipated as heat in the Section AB of the circuit.

(ii) An electric equipment of power rating 3.6 k W is to be connected to a 240 V line whose circuit breaker is rated 20 A. Justify whether or not the breaker would open when the equipment is switched on.

Question 1

The candidates did all that was required of them. They measured y and t and evaluated T and T^2. They also started their graphs from the origin as required. Most of them were meticulous and so were awarded the accuracy mark. Most candidates recorded y as whole numbers without a decimal point. This showed their ignorance of accuracy of measuring instruments.

(b) (i) The maximum kinetic energy occurs at the equilibrium or rest position of the bob. The maximum acceleration is at an amplitude position. A good number of candidates indicated correctly the above positions.

(ii) To calculate the force per unit length K, the candidates had two options:

$T = 2\pi\sqrt{\frac{M}{k}}$ or $T = 2\pi\sqrt{\frac{e}{g}}$

A lot of the candidates used the latter option. The extension e was calculated, and k was calculated using $= \frac{F}{e}$.

Question 2

A lot of the candidates did not record f_o, indicating that they did not carry out the preliminary instruction. Many candidates failed to record X to the accuracy of the metre rule. It was expected that values of X should be recorded to 1 decimal place.

(b) (i) It has been observed that drawing of ray diagrams has been major challenge to candidates. This year is no exception. The performance of candidates on this question was poor.

(ii) Most of the candidates provided the required structures of the eyes and the lens camera.

Question 3

The explicit instruction to candidates to measure and record the emf E of the battery was completely ignored by the candidates. R_0 was also not recorded.

The candidates are however commended for demonstrating the desirable qualities:

(1) Composite table used to summarize data collected.
(2) Graph drawn correctly with labels and appropriate scales provided for the axes.
(3) Slope correctly determined using a large right-angled triangle.
(4) Intercept, c, on the vertical axis correctly shown.

(b) (i) The calculation of power dissipated as heat in the section AB of the circuit was easily dealt with by most the candidates.

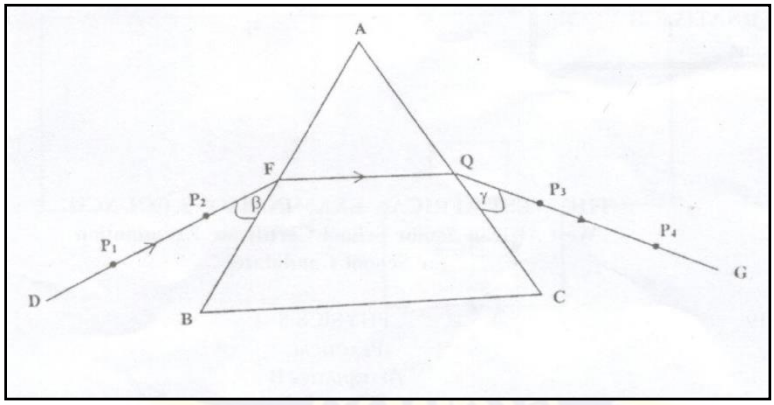
(ii) Many candidates were unable to solve this sub-question. Candidates were to calculate the current drawn by the equipment when it is connected to the 240 V supply as

$$I = \frac{P}{V} = \frac{3.6 \text{ x } 10^3}{240} = 15 \text{ A}$$

Since the current drawn is less than 20 A, the circuit breaker will not open.

ALTERNATIVE B

Question 1



You are provided with a triangular prism, a drawing board, drawing sheets, Four optical pins, drawing pins and other necessary materials.

Use the diagram above as a guide to carry out the following instructions.

(i) **Draw the outline *ABC* of the prism provided on a drawing sheet.**

(ii) **Remove the prism. Measure and record the refracting angle, A, of the prism**

(iii) **Draw a line *DF* to make an angle $\beta = 20^o$ with *BA***

(iv) **Fix two pins at P_1 and P_2 on *DF*. Replace the prism on its outline.**

(v) **Look through the side AC of the prism and fix two other pins at P_3 and P_4 such that they appear to be in a straight line with the images of the pins at P_1 and P_2.**

(vi) **Remove the prism and the pins.**

(vii) **Draw a straight line through P_3 and P_4 to meet *AC* at Q.**

(viii) **Measure the angle γ.**

(ix) **Evaluate $\theta = (90 - \beta)$ and $\phi = (90 - \gamma)$.**

(x) **Repeat the procedure for four other values of $\beta = 30^o, 35^o, 40^o$ and 50^o. In each case, record γ and evaluate θ and ϕ.**

(xi) **Tabulate the results.**

(xii) **Plot a graph with θ on the vertical axis and ϕ on the horizontal axis, starting both axes from the origin (0, 0). Draw a smooth curve through the points.**

(xiii) **At the point of intersection, read the values of θ_m and ϕ_m and record them as θ and ϕ respectively.**

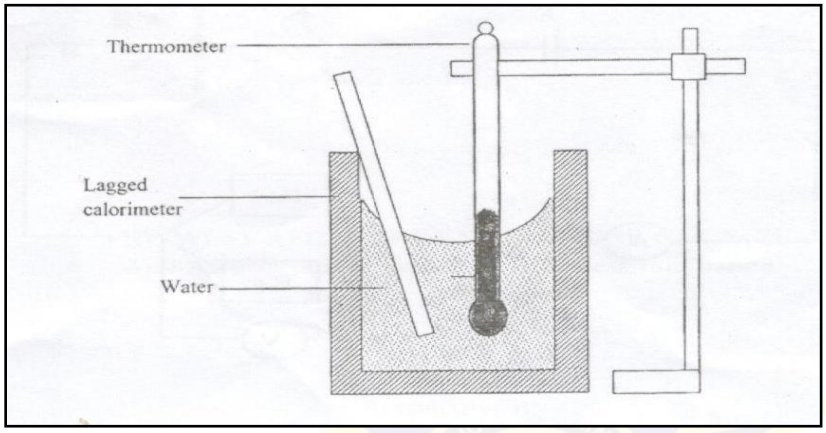
(b) (i) Define dispersion of light.

(ii) A ray of light moves from a certain medium into air at an angle of incidence 20^o. If the speed of light in the medium is 2.0×10^8 ms^{-1}, calculate the angle of refraction in air.

[Speed of light in air = 3.0×10^8 m s^{-1}]

Question 2

(a)



You are provided with a Bunsen burner, weighing balance, thermometer, glass stirrer, pyrex beaker, metal block, lagged calorimeter, measuring cylinder, water and other necessary apparatus.

(i) Weigh and record the mass, Mc, of the calorimeter.

(ii) Measure and record the temperature θ_R, of the laboratory.

(iii) Use the measuring cylinder to transfer a volume V = 50 cm^3 of water into the calorimeter

(iv) Calculate the mass Mw of water transferred, given that the density of water is 1000 kg m^{-3}.

(v) Clamp the thermometer as shown in the diagram above.

(vi) Place the metal block in the beaker and add a reasonable amount of water to cover the block completely

(vii) Heat the mixture and allow it to boil for about 3 minutes.

(viii) Transfer the hot metal block quickly into the water in the calorimeter and stir

(ix) Read and record the highest temperature, θ, attained by the mixture

(x) Evaluate the rise in temperature $T = (\theta - \theta_R)$ and T^{-1}.

(xi) Repeat the procedure for four other volumes V = 70 cm^3, 90 cm^3, 110 cm^3 and 130 cm^3. In each case, record M_W and θ and evaluate T and T^{-1}.

(xii) Tabulate the results.

(xiii) Plot a graph with M_W on the vertical axis and T^{-1} on the horizontal axis.

(xiv) **Determine the slope, *s*, of the graph and the intercept, *c*, on the vertical axis.**

(xv) **Calculate k from the equation, c = $\frac{M_c k}{4200}$.**

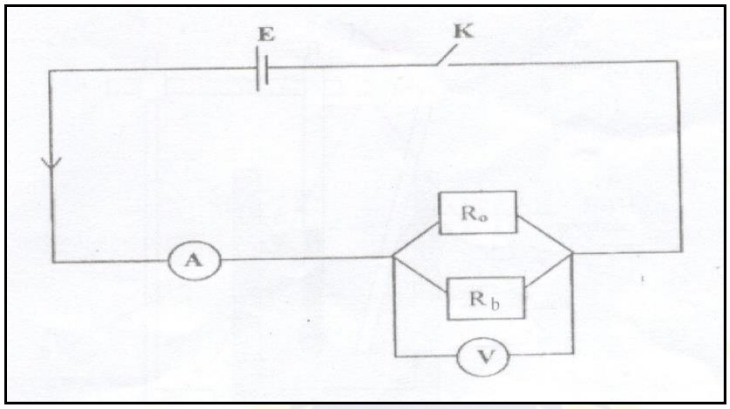
(xvi) **State two precautions taken to obtain accurate results.**

(b) **(i)** **State the law of conservation of energy.**

(ii) **A metal block of mass 0.50 kg is heated to 110°C and quickly immersed in 0.45 kg of water at 20°C. Calculate the equilibrium temperature of the mixture. [Specific heat capacity of water = 4200 J kg^{-1} K^{-1}, specific heat capacity of the metal = 134 J kg^{-1} K^{-1}]**

Question 3

(a)



You are provided with a cell of e.m.f. *E*, key k, resistance box R_b, standard resistor R_0 of resistance 2 Ω, ammeter, voltmeter and other necessary materials.

(i) **Set up a circuit as shown in the diagram above, leaving the key open.**

(ii) **Set the resistance in the resistance box to R = 2 Ω**

(iii) **Close the key, read and record the current *I* on the ammeter and its corresponding potential difference, V, on the voltmeter.**

(iv) **Evaluate P = $\frac{I}{V}$ and R^{-1}.**

(v) **Repeat the procedure with R = 5 Ω, 7 Ω, 10 Ω and 12 Ω. In each case, evaluate $P = R^{-1}$.**

(vi) **Tabulate the results.**

(vii) **Plot a graph with P on the vertical axis and R^{-1} on the horizontal axis, starting both axes from the origin (0, 0).**

(viii) **Determine the slope, *s*, of the graph and the intercept, *c*, on the vertical axis.**

(ix) **Evaluate c^{-1}.**

(x) **State two precautions taken to ensure accurate results.**

(b) (i) Why is it important to earth electrical appliances?

(ii) A wire carries a current of 100 mA. Calculate the time taken by 5.0 x 10^{20} electrons to pass a given cross-section of the wire. [Magnitude of electronic charge = 1.6 x 10^{-19} C]

Question 1

(a) Most of the candidates were successful in the tracing of the rays. Other successes of candidates include:

(1) Composite table used to summarize data collected;
(2) Labels of graph axes correctly provided;
(3) q_m and f_m correctly shown;
(4) μ correctly evaluated using correct substitution;
(5) At least one precaution stated correctly.

Weakness of the Candidates

(1) The refractive angle A not recorded
(2) Straight line making 45° with the horizontal axis not drawn correctly
(3) Accuracy of the results, based on the value of μ, is poor.
(4) Majority could not get the best fit curve.

(b) (i) Dispersion was correctly defined by candidates.

(ii) Majority of the candidates were not able to solve the problem. They needed to recall that the refractive index n of the medium is given by

$$n = \frac{c}{v} = \frac{3.0\ x\ 10^8}{2.0\ x\ 10^8} = 1.5$$

In the question, the angle of incidence is in the material while the angle of refraction r is in air. They needed to recall that

$n_{air} \sin r = n \sin 20$

$\sin r = n \sin 20$, since $n_{air} = 1$

$= 1.5 \sin 20$

$= 0.513$

$r = 31°$

Question 2

(a) In some schools, the candidates could not perform the experiment for all the five different volumes of water since the calorimeter supplied to the candidates could not contain the last volume, 130 cm^3. Some candidates were able to perform the experiment for the first three volumes and others the first four volumes.

Strength of the Candidates

(1) Data collected summarized in a composite table.

(2) Axes of graph correctly distinguished.
(3) Slope of the graph correctly determined using a large triangle.
(4) Intercept, c, on the vertical axis correctly shown.
(5) At least one correct precaution provided in acceptable language.

Weakness of the Candidates
(1) Value of intercept not recorded
(2) Calculation of k done with wrong substitution

(b) (i) Many candidates did not state correctly the law of conservation of energy. In almost all the answers, the word *state* was used instead of the word *form*.

In this case, the words are not interchangeable. State of energy cannot be used for form of energy.

(ii) This problem was appropriately solved by most of the candidates.

Question 3

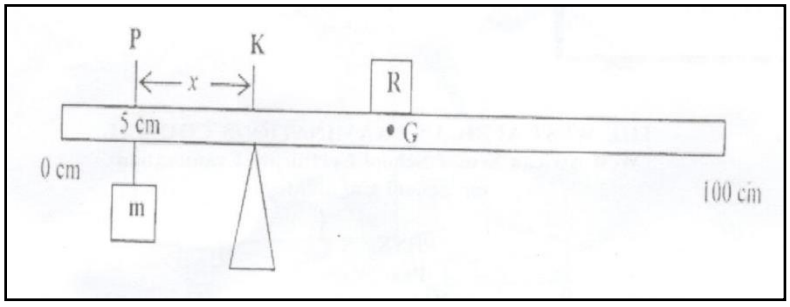
(a) Strengths of the Candidates
(1) Composite table provided to summarise data collected.
(2) Slope correctly computed using a large right-angled triangle.
(3) Intercept on the vertical (P) axis correctly shown and read.
(4) At least one precaution for ensuring accurate results stated.
(5) At least one correct answer provided for Section B.

Weakness of the Candidates
Accuracy of the results of the experiment is poor

ALTERNATIVE C

Question 1

(a)



You are provided with a uniform metre rule, weighing balance, knife edge, set of masses 100 g, 120 g, 150 g, 170 g and 220 g, body labelled R and length of string.

(i) Record the mass M_R of R.

(ii) Weigh and record the mass, M_0, of the metre rule

(iii) Balance the metre rule horizontally on the knife edge. Read and record the balance point, G, of the metre rule.

(iv) Fix R securely at G.

(v) Suspend the 100 g mass by means of a string at P, the 5 cm mark, of the metre rule. The position P should be kept constant throughout the experiment.

(vi) Place the knife edge at K such that the metre rule is in horizontal equilibrium. Measure and record the distance $x = PK$.

(vii) Evaluate x^{-1}.

(viii) Repeat the procedure for four other masses m = 120 g, 150 g, 170 g and 220 g.
In each case, measure x and evaluate x^{-1}.

(ix) Tabulate the results

(x) Plot a graph with x^{-1} on the vertical axis and m on the horizontal axis.

(xi) Determine the slope, s, of the graph and the intercept c, on the vertical axis.

(xii) If in the experiment $s = \frac{1}{45(M_R - W)}$, calculate W.

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

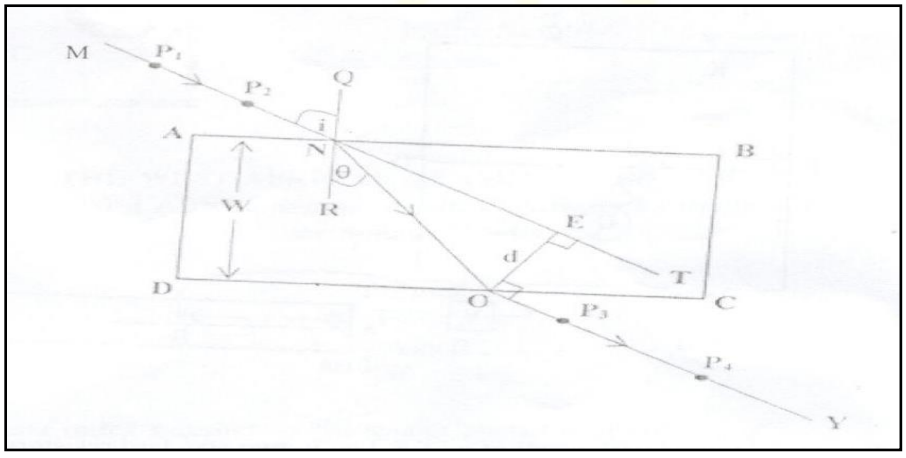
(b) **(i)** State the *principle of moments*.

(ii) State the main effect of a couple on mechanical systems.

(iii) Name one laboratory device that satisfies the conditions of stability.

Question 2

(a)



You are provided with a regular prism, a drawing board, four optical pins, drawing papers and other necessary apparatus.

(i) Pin the drawing paper on the board. Trace the outline *ABCD* of the rectangular prism on the drawing paper.

(ii) Remove the prism. Measure and record the width, W, of the prism.

(iii) Select a point N on *AB* such that *AN* = 2 cm and draw the normal *QR* through N.

(iv) Draw a straight-line MT through N such that the angle i = 20°. Fix two pins at P_1 and P_2 on *MN*.

(v) Replace the prism on its outline.

(vi) Look through the side *DC* of the prism and fix two other pins at P_3 and P_4 such that they appear to be in straight line with the images of the pins at P_1 and P_2.

(vii) Remove the prism and the pins. Draw a line *OY* through P_3 and P_4.

(viii) Draw the line *NO*.

(ix) Measure and record the angle θ.

(x) Evaluate (i – θ), sin (i – θ), cos θ and $V = \frac{sin\ (i - \theta)}{(\cos \theta)}$.

(xi) Draw the line OE perpendicular to NT. Measure and record the length d = OE.

(xii) Repeat the procedure for four other values of i = 30°, 40°, 50° and 60°. In each case, evaluate (i – θ), sin (i – θ), cos θ), *V* and then measure and record *d*.

(xiii) Tabulate the results

(xiv) Plot a graph with *d* on the vertical axis and V on the horizontal axis.

(xv) Determine the slope, *s*, of the graph

(xvi) State two precautions taken to ensure accurate results

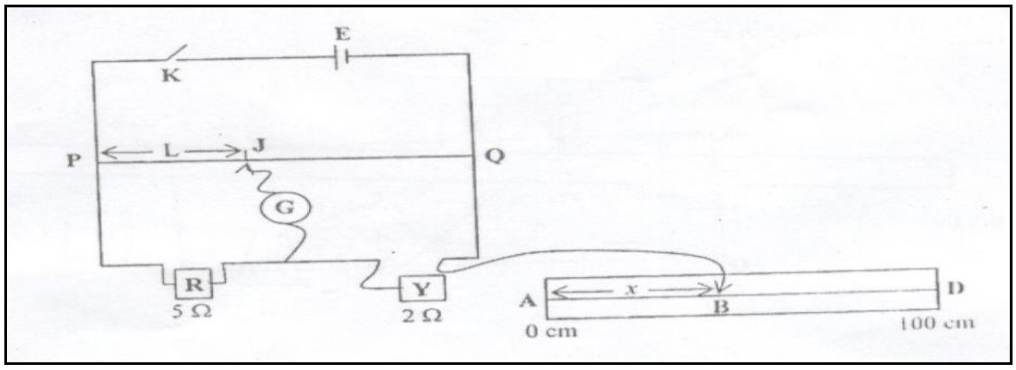
[Attach your traces to your answer booklet]

(b) **(i)** State one of the *laws of refraction*.

(ii) The absolute refractive indices for crown glass and water are 1.52 and 1.33 respectively. Calculate the refractive index when light moves from water to crown glass.

Question 3

(a)



You are provided with a cell of emf E, key k, two standard resistors R = 5 Ω and Y = 2 Ω, galvanometer G, crocodile clip B, jockey J, metre rule PQ, potentiometer AD, connecting wires and other necessary apparatus.

(i) Connect the circuit as shown in the diagram above, with the key open

(ii) Place the crocodile clip on the potentiometer at a distance x = AB = 20.0 cm

(iii) Close the key and obtain a balance point J on the metre bridge. Measure and record PJ = L.

(iv) Evaluate L^{-1}.

(v) Repeat the procedure for five other values of x = 40 cm, 60 cm, 80 cm, 90 cm and 100 cm. In each case, measure and record L and evaluate L^{-1}.

(vi) Tabulate the readings

(vii) Plot a graph with L^{-1} on the vertical axis and x on the horizontal axis.

(viii) Determine the slope, s, of the graph

(ix) If $s = \frac{\sigma}{100R}$, calculate σ.

(x) State two precautions taken to obtain accurate results

(b) (i) A 12 V battery has a capacity of 60 A h. Calculate the amount of energy stored in it.

(ii) State the factors that affect the resistance of a wire.

Question 1

(a) The candidates recorded correctly the masses M_R, M_0 and G.

Correct balance lengths, x, were obtained by the candidates.

Other commendable skills exhibited by the candidates include:

(1) x^{-1} evaluated to 3 d.p;

(2) Data presented in a composite table;

(3) Graph drawn correctly with axes well labelled;

(4) Slope of the graph correctly computed using large right-angled triangle;

(5) At least one precaution necessary for ensuring accurate results correctly stated.

Weaknesses of the candidates include:

(1) W was not correctly evaluated;

(2) Precaution for obtaining accurate results for the experiment was poor.

(b) The principle of moments was wrongly stated by most of the candidates. They ignored the important fact that all the moments should be considered about the same point.

Question 2

(a) Strengths of the candidates

(1) Data collected summarized in a composite table

(2) Graph drawn correctly with axes well-labelled with correct scales

(3) Slope of the graph correctly computed using a large right-angled triangle

(4) At least one precaution correctly stated.

Weakness of the Candidates

The value of W not recorded

(b) The sub-question was correctly answered by the candidates

Question 3

(a) Strengths of the Candidates

(1) L^{-1} evaluated to at least 3 d. p.

(2) Data collected were summarized in a table

(3) Graph drawn with correct labels and scales for the axes

(4) Deduction correctly determined

(5) At least one precaution correctly stated

Weakness of candidates

None observed

(b) The sub-question was correctly answered by the candidates.