

# **SCIENCE SUBJECTS**

## **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 Chemistry, General Agriculture, Biology, Physics, Forestry, Crop Husbandry and Horticulture and Integrated Science was slightly better than the previous year. For Animal Husbandry, the performance was about the same as those of previous years.

The performance in General Agriculture and Fisheries were reported to be below that of the previous year.

### **3. CANDIDATES' STRENGTHS**

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

#### **Animal Husbandry**

Ways of controlling ecto-parasites in farm animals;  
Causes of mortality on sheep farm;  
Ways in which piglets are prone to chilling;  
Ways of preserving pork;  
Advantages of feeding livestock with balanced diet;  
Factors to be considered when formulating animal feed.

#### **Biology**

Basic ecological concepts;  
Dentition and care of the teeth in animals;  
Composition of human blood.

#### **Chemistry**

Distinction between atomic mass and atomic number;  
Calculation of volume of a gas at s.t.p;  
Distinction between structural formula and empirical formula;  
Fractional distillation of petroleum;  
Electron configuration;  
Use of Faraday's first law of electrolysis to calculate time for deposition;  
Building blocks of matter;

Factors that affect stability of radioactive nuclides and calculation of half life;  
Differences between nuclear fission and nuclear fusion;  
Purification of bauxite to obtain aluminium.

### **Crop Husbandry and Horticulture**

Identification of specimen;  
Advantages and disadvantages of timely harvesting of some stated crop plants;  
Effects of climatic conditions on crop production;  
Explanation of cultural practices;  
Importance of vegetables in the diets of humans.

### **Forestry**

Effects of deforestation on soil fertility, habitats of animals, national economy and the environment;  
Explanation of ecological terms such as saprophytes, decomposers, xerophytes and population;  
Forest based industries in Ghana;  
Non-insect arthropods found on the forest floor;  
Economic importance of grasscutter.

### **Fisheries**

Maintenance of fishing gear;  
Ways of maintaining fishing canoe;  
Distinction between active and passive gear;  
Nutrients found in fresh fish;  
Materials used for constructing fishing gear;  
Traditional and modern methods of preservation.

### **General Agriculture**

Wild life conservation;  
Agricultural development;  
Seed viability;  
Seed dormancy;  
Agricultural finance, credit and collateral;  
Biological and cultural methods of controlling crop pest;  
Explanation of husbandry and cultural practices.

### **Integrated Science**

Distinction between a pest and a parasite;  
Explanation of pure water;  
Definitions of weaning, brooding and mulching;  
Explanation of mechanical energy, metalloids and secondary colours;  
Scientific principle involved in the preparation of soap from cocoa pod.

### **Physics**

Examples of donor impurities;  
Principles of dimensions and analysis;  
Characteristics of laser light;  
Definition of work and potential energy;  
Distinction between mechanical waves and electromagnetic waves with examples.

## **4. CANDIDATES' WEAKNESSES**

Candidates were reported to have performed woefully in the following areas of the respective subjects.

### **Animal Husbandry**

Reasons for keeping records of animal feed;  
Routine management practices carried out on poultry farms;  
Types of cattle reared in West Africa;  
Ways in which pests could cause damage to animal farm;  
Ways in which pre-weaning mortality could be reduced on animal farm.

### **Biology**

Wrong spellings of technical terms;  
Poor knowledge in conservation of natural resources;  
Poor knowledge in distinction between test cross and back cross.

### **Chemistry**

Using bond dissociation energy to compare the acidity of HCl and HF;  
Organic compounds that could be cracked or undergo substitution reaction from among list of compounds;  
Why LiI does not conduct electricity;  
Using experimental data to explain rate of chemical reaction;  
Calculation of enthalpy for a reaction from thermo-chemical data;  
Identification of colours of precipitates, residues and solutions;  
Attaching correct state to species in chemical equations.

### **Crop Husbandry and Horticulture**

Explanation of cropping systems;  
Disadvantages of planting poor quality seeds;  
Correct spellings of horticultural terms, scientific and family names;  
Identification of N P K fertilizer and precautions to be taken when applying it.

### **Forestry**

Vegetation types in which Guinea grass could be commonly found;  
Economic importance of Guinea grass;  
Properties of rattan that make it suitable for its uses;

Explanation of forestry terminologies;  
Description of the organizational structure of the Forestry Commission;  
Advantages of leasehold land tenure system;  
Distinction of reforestation and reafforestation.

### **Fisheries**

Classification of tilapia;  
Ecological processes in a natural fish habitat;  
Explanation of the concept of inheritance of external characteristic of fish;  
Description of the process of gaseous exchange in bony fish;  
Advantages for using poultry manure in fish farming;  
Identification of fish diseases and their symptoms, and the causal agents of the diseases;

### **General Agriculture**

Functions of oxytocin and oestrogen;  
Causal agents of livestock diseases such as Anthrax and Coccidiosis;  
Distinction between *quantity of produce supplied* and *change in supply*;  
Explanation of 'quarantine';  
Economic uses of cashew;  
Equipment used in place of burdizzo;  
Classification based on mode of feeding of cotton stainer and grass hopper;  
Life cycle of grasshopper;  
Other fertilizers that can serve the same purpose as urea fertilizer;  
Methods of applying urea fertilizer.

### **Integrated Science**

Plotting of graphs;  
Adaptative features of bird which enable it to destroy crops;  
Basic scientific principles;  
Wrong spellings of technical and scientific names.

### **Physics**

Name of forces that act on a bead falling through a fluid;  
Sketching velocity-time graph to depict the motion of object;  
X-ray tube;  
Evaluation of derived quantities such as  $T$ ,  $T^2$ ,  $T^{-2}$  and  $I^{-1}$  to the required number of decimal places;  
Plotting the points on the graph sheet;  
Definition of focal length of a converging lens.

Furthermore, the Chief Examiners lamented that the responses of some candidates for Physics, Animal Husbandry, General Agriculture, Fisheries and Chemistry show that they were not adequately prepared for the examination.

The Chief Examiners were disappointed that candidates for Integrated Science, Forestry, Animal Husbandry, Crop Husbandry and Horticulture Chemistry and General Agriculture could not spell technical terms correctly and also had poor understanding of technical terms and concept.

## **5. SUGGESTED REMEDIES**

The Chief Examiners for the science subjects generally recommended that candidates should be taken through enough practical lessons to improve their performance. Candidates should adequately prepare for the examination and also read good books to improve their usage of the English Language.

The Chief Examiners also made the following suggestions.

Candidates should:

- (i) thoroughly read and understand questions before attempting them;
- (j) be taught the convention of writing scientific names;
- (2) adhere to rubrics;
- (3) be taken through calculations drills to improve upon their speed and accuracy
- (4) be taught how to draw graphs with correct values;
- (5) endeavour to understand scientific concepts and learn to spell scientific terms correctly;
- (6) be taught how to draw simple microscope and other ray diagrams;
- (7) be made to develop interest in the subject areas through organized field trips.

## ANIMAL HUSBANDRY 2

### 1. GENERAL COMMENTS

The standard of this paper was good for the level of candidates involved, and are comparable with previous years' papers. However, the performance of most of the candidates was not encouraging, as quite a number of them performed poorly. Spellings of one-word answers were very poor, thus scoring lower marks.

### 2. SUMMARY OF CANDIDATES' STRENGTHS

- i. A significant number of the candidates answered the questions in an orderly manner. This is commendable, because it made marking of scripts easier than it would have been if they had done otherwise. A good number of candidates answered different questions on different pages, as instructed on the answer booklets. This is commendable, and candidates are encouraged to keep it up.
- ii. Most of the candidates wrote the question numbers behind the answer booklets in the order in which they answered them.
- iii. All the candidates attempted to answer at least, some of the questions, even though some of them had little or no idea on the requirements of some questions.

Candidates had very little difficulties answering the following questions:

- Ways of controlling ecto-parasites in farm animals
- Causes of mortality on sheep farm
- Ways in which piglets are prone to chilling
- Ways of preserving pork
- Breeds of duck
- Advantages of feeding livestock with balanced diet
- Factors to be considered when formulating animal feed

### 3. SUMMARY OF CANDIDATES' WEAKNESSES

- i. Some of the candidates had difficulty in understanding some questions, thus, such questions were either left unanswered, or answers provided in some cases had no linkage with the questions under consideration.
- ii. ***Wrong spelling of essential key words*** and **one-word answers** to some questions were major problems encountered in this paper. This caused some candidates to lose points unnecessarily; a situation which could have been avoided. In addition, it appeared some ***candidates did not devote enough time to read over their answers to questions***, to enable them rectify issues with omissions and correct wrongly spelt words. Though it is possible the candidates did not know the correct spellings of such words, it is believed that reading over the answers could have drawn their attention to words that were ***mistakenly spelt wrongly***.

- iii. It was a common observation that some candidates provided more answers to a question, than were expected. This has been a general practice for some time now. In addition, others answered either **five** or **all the six** questions for this paper, instead of **four**, as indicated in the instructions. Though the current decision is that examiners should mark all and select the best four answers out of the total number of questions answered, candidates who do that in future might be penalized. The challenge here is that, instead of the candidates focusing and spending adequate time on only four questions, they end up answering parts of each of the six questions because of inadequate time. Remember the time allocated is just enough to answer four questions, but not six. In addition, the candidates would have limited time left to read over answers they had provided for possible correction of errors. Candidates might perform better, if they spent time focusing on four main questions they could answer best, rather than attempting all questions partially.
- iv. Some of the candidates also spent so much time to answer questions, and later cancelled them out, probably because they later realized those questions were not the easiest. This is time wasting, and it could be avoided if they devote the first 5 minutes of the time allowed, to read all the questions at the start of the exams, and decision taken on which ones to attempt or otherwise, before they start work.
- v. A good number of candidates were unable to form correctly, simple sentences to make meaning to readers. Consequently, they ended up bringing out expressions with different meanings from what they possibly intended to write.
- vi. Though this year's questions did not involve writing of scientific names, candidates who attempted to write the scientific names of some plant species, did so without adhering to the rules of presenting scientific names, hence in most cases they were marked down.

Areas that posed much problems to the candidates include:

- Reasons for keeping records of animal feed
- Routine management practices carried out on poultry farms
- Types of cattle reared in West Africa
- Ways in which pests could cause damage to animal farm
- Ways in which pre-weaning mortality could be reduced on animal farm

#### 4. SUGGESTED REMEDIES

- i. Candidates need to improve their reading skills, to enable them build more vocabularies for use under examination conditions.
- ii. At the start of a paper, candidates should be encouraged 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 work.
- 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 to provide additional answers* to some questions, which would eventually not add additional scores to them.
- iv. Decision must be taken to penalize candidates who answer more questions than is expected. This would possibly serve as deterrent to such practices in future.

- v. Candidates should be advised to convince themselves on which questions they wish to answer, before tackling 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) **Explain each of the following terms as used in animal nutrition:**

(i) **pasture;**

(ii) **roughage.**

(b) **State four qualities of a good hay.**

(c) **Explain four causes of mortality in lambs on a sheep farm.**

(d) **Explain four ways of controlling ectoparasites of farm animals.**

This was one of the popular questions among the candidates. About 80% of the candidates attempted this question, and the approach was quite good. However, most of the candidates could not answer properly, the causes of mortality among lambs, indicating that they had little or no knowledge in sheep production, or probably there is no sense of transfer of knowledge.

The expected answers were

(a) (i) Pasture:

A piece of land on which forage species grow naturally or artificially for feeding livestock

(ii) Roughage:

- The feed or feed component with high percentage of fibre and low protein content
- which is mainly fed to ruminants and pseudo-ruminants

(b) Qualities of well cured hay

The expected answers included:

- ability to store for a long period without deterioration
- low moisture content
- nutritious
- palatable / acceptable
- free from poisonous weeds and foreign materials
- free from dust
- high proportion of leaves to stems
- maintain some greenish colouration
- should have sweet fresh odor



(c) Causes of mortality in lambs

Candidates were expected to give responses including:

- Malnutrition: Feed deficient in nutrients and also feed not supplied in adequate quantities reduce resistance to diseases and could lead to mortality.
- Adverse environmental conditions / poor housing conditions: When animals are exposed to harsh environmental conditions e.g. high temperature/rainfall, it puts stress on them, leading to mortality
- Intake of contaminated feed: Feed contaminated with pathogens can cause infection and mortality
- Intake of contaminated water: Pathogens in the water can cause diseases and mortality
- Poor sanitation: Insanitary conditions provide breeding grounds for pathogens and parasites leading to diseases and mortality
- Pests and predators: Pests / parasites suck blood and feed on the animals, weaken them leading to ill-health and mortality. Predators may cause mortality through their bites, toxins etc
- Diseases: Various organisms gain entry into the body, weaken the animal, cause anorexia, destroy various organs and cause mortality
- Poor quality breeds: Some breeds are poorly adapted to the local environment and others are not resistant to diseases and could die
- Congenital abnormalities: These may not be detected in time and treated or they are untreatable, hence mortality
- Injuries from external sources could result in bleeding or infections, which could cause death of animals

(d) Methods of controlling ectoparasites on farm animals

Responses including the following were expected

- Ensure proper sanitation in the farmhouse
- Practice dipping on farm animals using appropriate pesticides
- Ensure proper stocking density
- Isolate / cull infested animal
- Practice rotational grazing
- Practice controlled burning of pasture
- Dust with recommended pesticides

**Question 2**

- (a) (i) **State five features of a farm animal house.**  
(ii) **Explain how each of the features stated in (i) contributes to increase in animal production**
- (b) **Name two pests of stored feed.**
- (c) **Give three reasons for keeping records of animal feed.**

This was another popular question, but performance was not up to standard. Candidates were not able to mention properly, the desirable features of animal houses, and their contribution to increased production. This indicates that the candidates were not knowledgeable in that aspect of animal science, or they did not take their time to read and understand the question before attempting to answer. If they don't have such structures in their schools, it is advised that field trips are organized to appropriate livestock farms to have hands-on experience in how animal structures look like.

Some of the candidates did not take their time to read the question 2 (c) properly, thus they were writing answers on **general farm records**, instead of **records on animal feed**. It is advised that they take their time to read the questions properly to understand, before attempting answers.

The expected answers were:

(a) (i) Desirable features of an animal house are:

- The housing should prevent entry of rain water
- It must have adequate space per animal
- The housing must have suitable roof/ use of durable, appropriate roofing materials to prevent excess sunrays
- Provide adequate ventilation for the animals
- The orientation of the house must be east-west.
- The floor should be suitable for its purpose
- Should be strong
- Additional space for emergency purposes
- Provide heating device where necessary

(ii) Effects of features on contribution to increased production are:

- Prevention of rainwater checks the incidence of diseases e.g. pneumonia. The rain water can cause cold stress in the animals
- Adequate space ensures that all animals get access to feed and water which are required for production. It minimizes the spread of diseases as well as stress. It enables them to exercise their bodies and checks vices
- Good roof prevents entry of rain water or vermins. Good roofing controls heat stress hence enhance productivity.
- Additional space: The housing must enable certain practices to be carried out which could control diseases e.g. isolating sick animals from healthy ones. It must enhance separation of males from females. i.e. groups into sexes for effective record keeping
- Adequate ventilation: Brings comfort to animals, it also minimizes the spread of diseases
- When the temperature is suitable, animals are comfortable, they eat and grow well
- Suitable floor designs ensure hygiene or proper sanitation/cleaning. Prevents injury to the animals
- Proper orientation of the house maintains a suitable temperature in the house to enhance production as the sun does not shine in the house excessively.

(b) Pests of stored feed

- rat
- hare
- birds
- mice, etc
- rice weevil
- bruchids / bean beetles
- grain borer
- termites
- stem borer
- maize weevil
- squirrel

(c) Reasons for keeping records of animal feed are

- Record keeping helps in budgeting
- For good management decisions e.g. to discontinue buying feed which animals do not accept readily
- Record keeping helps management to plan ahead effectively e.g. knowing the previous feed consumption rate, the farmer can predict and buy appropriate quantity of feed for a new batch of animals e.g. broilers
- To compare performance based on feed
- For consultants to give appropriate advice
- Contributes to income and expenditure accounts

**Question 3**

- (a) **Give three reasons why piglets are easily prone to chilling.**
- (b) **Explain five ways by which pre-weaning mortality could be reduced in pig production**
- (c) **Mention four ways of preserving pork.**

Question three (3) was the least popular among all. Only few candidates attempted answering this, and even that, the performance was not encouraging. They were only able to answer question 3(c) to an extent, but even that was not good enough. It was realized that they have little knowledge in pig production, and teachers should therefore improve that aspect of the curriculum.

The expected answers include

(a) Reasons why piglets are prone to chilling

- piglets have less fat deposits under their skin to insulate their bodies from cold condition
- Piglets have large surface area/small body size that facilitate heat loss leading to chilling
- Piglets have less hair cover to insulate them or keep them warm
- They cannot synthesize glycogen which could easily be converted to glucose to produce heat and get their bodies warm

- (b) Ways of reducing pre-weaning mortality in piglets
- Ensure proper sanitation to avoid infection
  - Provision of a source of heat to control chilling at farrowing
  - Ensure access to colostrum to provide immunity against diseases
  - Provision of iron dextran injection or sterile laterite soil to prevent piglet anaemia
  - Provide creep feed / balance diet to piglets for proper growth
  - Apply tincture of iodine to navel cord to prevent secondary infection
  - Foster orphaned piglets when the litter size is large than the number of functional teat/ when dam dies
  - Clip needle teeth to prevent injuries to other piglets
  - Vaccinate piglets against diseases like African swine fever
  - Deworm piglets regularly for better utilization of feed and prevent damage to internal organs
  - Use litter or no water in the farrowing pen during the first week of farrowing to prevent drowning and chilling
  - Remove mucus membrane from the face of new borns to avoid suffocation
- (c) Ways of preserving pig products
- salting / curing
  - freezing
  - smoking
  - processing into sausages/hamburgers
  - canning
  - drying

#### **Question 4**

- (a) **Explain five ways by which a poultry farmer could ensure the regular production of table eggs.**
- (b) **Mention six routine management practices carried out on a commercial poultry farm.**
- (c) **Name four breeds of duck.**

This question was also popular among the candidates. There were not much issues with the answers provided, aside the usual wrong spelling of some key words in some sentences.

The expected answers included

- (a) Ways of ensuring good quality table eggs production by a poultry farmer:
- The farmer must ensure that layers are properly vaccinated
  - Collect eggs frequently to prevent cracking and contamination by bacteria, dirt etc.
  - The farmer must buy high producing chicks or pullets from good laying breeds e.g. Rhode Island Red, light Sussex etc
  - Provide proper housing with adequate ventilation for comfort and good egg production
  - Avoid fertilization of eggs by male birds for longer egg shelf life

- Provide clean cool fresh water regularly
- Avoid stress factors such as rampant visits by strangers, frightening
- Provide adequate balanced diet
- Ensure appropriate stocking density
- Ensure regular deworming of birds
- Treat birds against diseases
- Avoid using very old birds
- Ensure adequate ventilation

(b) Routine management practices on commercial poultry farm

- Inspect flock to remove sick birds for quarantine or treatment or culling
- Provide adequate balanced feed for high productivity e.g. eggs and meat
- Provide clean water regularly
- Keep daily records of feed, medication, egg production
- Collect eggs frequently to prevent eggs breaking and egg pecking to control loss
- Empty, clean, disinfect feed and water troughs regularly
- Ensure proper litter management to control respiratory diseases and obnoxious smell in the coop due to high ammonia gas
- Stir and change litter regularly
- Ensure routine vaccination e.g. against Newcastle disease, Gumboro disease, fowl pox etc
- Practice good sanitation e.g. provision of footbath, clearing the bush around the coop to control pests, predators e.g. snake etc

(c) Breeds of ducks may include

- Muscovy
- White runner / Indian runner
- White Campbell
- khaki Campbell
- Peking
- Aylesbury

**Question 5**

- (a) **Name three types of cattle reared in West Africa.**
- (b) **Explain each of the following management practices carried out to ensure successful beef cattle production:**
- housing;**
  - feeding;**
  - sanitation;**
  - castration.**
- (c) **Mention four ways in which grazing cattle could loose heat.**
- (d) **State five ways in which pests could cause damage in animal farm.**

This question was also widely answered by a significant number of candidates. However, most of them did not understand the requirements of question 5 (b), thus management practices to ensure successful beef cattle production. Candidates were at a loss, as to define or state the features of the management practices. On question 5 (c), candidates were rather writing answers on oestrus in farm animals. Question 5 (d) posed some problems to the candidates as most of them were providing answers relating to the damage caused to farm animals, instead of animal farms.

The expected answers were:

(a) Types of cattle reared in West Africa

- Beef cattle
- Dairy cattle
- Dual purpose cattle
- Draught / traction / work cattle

(b) Management practices to ensure successful beef cattle production

(i) Housing

- Provide suitable house / kraal
- House must be spacious
- Easy to clean
- Prevent entry of predators / vermin
- Well-ventilated house
- Orient the house east-west direction
- Floor should be rough and not slippery
- Wall should be dwarf
- Foot bath should be provided
- Dwarf walls should have freight proof net on top

(ii) Feeding

- Provide adequate feed for the animals
- Ensure calves have access to colostrum
- Provide balanced diet
- Practice rotational grazing / paddocking
- Provide hay and silage during dry season
- provide sufficient fresh clean drinking water
- provide supplements when necessary

(iii) Sanitation

- Clean the external environment
- Clean / disinfect the pen
- Clear surrounding bushes
- Dispose off dead animals properly
- Provide foot bath

- Destroy rodents / predators / vermins
- Clean water and feed troughs
- Change litter regularly

(iv) Castration

- Removal of testes / crushing of spermatic chord
- Bulls which are not to be used for breeding should be castrated when young
- Apply tincture of iodine
- Helps control inbreeding
- Makes animal docile

(c) Ways in which grazing cattle lose heat

- Respiration
- Evaporation / Sweating
- Increased Water Intake
- Urination
- Defecation
- Wading in Water
- Resting undershade
- reduce walking

(d) Ways in which pest could cause damage in animal farm

- Destruction of wooden structures by rodent, termites etc
- Contamination of feed and water by faeces and urine of pests
- Invasion and killing of animal by soldier ants, rodents, snakes etc
- Transmission of pathogens
- Destruction of stored feed
- Reduction in market value of livestock/products
- Defoliation of pasture crops

**Question 6**

- (a) **Explain each of the following terms as used in animal production:**
- balanced diet;**
  - supplementary feed;**
  - gross energy.**
- (b) **State four advantages of feeding farm animals with balanced diet.**
- (c) **Explain five factors to be considered when formulating animal feed.**

This was another popular question. Candidates were able to handle most of the questions, except for the explanation of supplementary feed and gross energy, which were not properly dealt with.

The expected answers were:

(a) Explanation of terms

(i) Balanced diet

This is feed that contains all the nutrients in correct proportion and quantity for the type of animal and the purpose for which it is kept.

(ii) Supplementary feed

This is the additional feed which provides the missing / extra nutrients to support the main diet of the animal.

(iii) Gross Energy

- It is the total amount of energy in feedstuff.
- It is the sum of the digestible energy and faecal energy in feed.

(b) Advantages of feeding farm animals with balance diet

- For high yield of product e.g. milk, meat, egg etc
- For early maturity and high growth rate
- It is easily digested and assimilated
- Promotes high resistance to diseases
- Quality produce such as milk, meat are obtained
- Animals are not malnourished
- Reduces mortality
- Reduces cost of production

(c) Factors to be considered when formulating animal feed

- Cost of ingredients: Where alternatives are available, conventional or non-conventional feedstuff could be used to reduce cost
- Availability of ingredients: Non conventional feedstuff could be used where conventional ones are unavailable
- Age of the animal: Feeds are formulated based on age of animals because they have different nutrient requirements
- Purpose of production: e.g. meat production, milk production or drought, formulation is done to meet the nutrient requirement for the purposes of which the animal is being produced
- Physiological state of the animal e.g. lactation, pregnant or sick
- Composition of nutrients: It will determine the amount to be used
- Toxicity / Antinutritional factors e.g. cassava containing high amounts of hydrogen cyanide must be avoided
- Type of animal/ animal species: Different species of animals have their peculiar nutrient requirement.



## ANIMAL HUSBANDRY 3

### **1. GENERAL COMMENTS**

The standard of the paper was similar to those of previous years in terms of its reliability and validity. The performance of the candidates was about the same as those of the previous years.

### **2. SUMMARY OF CANDIDATES' STRENGTHS**

Candidates adhered to the rubrics of the paper. Their handwriting were also very clear and could easily be read. An average number of candidates were able to construct good sentences grammatically. Some were able to give answers which were very innovative and fit into the marking scheme. They were able to give short and concise answers.

### **3. SUMMARY OF CANDIDATES' WEAKNESSES**

Some candidates could not construct good sentences grammatically. Some of their spellings of technical words were wrong. They spell them just as they are pronounced. Eg 'thick' was spelt 'tick', 'claw' as 'craw'. When answers are cancelled, they do not indicate as such. Where answers are continued at a different page, they don't indicate the page where the answers to that question(s) is or are. They leave some two or three pages blank and continue at a far page.

### **4. SUGGESTED REMEDIES**

- i. Students should be encouraged to read a lot of literature or story books to polish their grammar.
- ii. Teachers should not only mark the required terms but also the grammar in the answered item
- iii. Teachers or resourced person should be made to take candidates through the way and manner items must be answered.
- iv. Teachers should take students through biological drawings and how to label.

### **5. DETAILED COMMENTS**

#### **Question 1**

- (a) State two functions of each of specimens A and B.**
- (b) Name three farm animals from which both specimens A and B could be obtained.**
- (c) State three characteristics of specimen A which enables it to perform its function effectively.**
- (d) Draw and label specimen B.**

- a. This part was well answered by almost all candidates. They were able to give the expected answers such as
- grinding of feed
  - churning of feed and
  - regulation of feed flow  
as functions of specimen A and
- 
- perching / standing
  - walking/ running
  - scratching the body
  - searching for food
  - defense  
as functions of specimen B
- b. This part was also well answered. Candidates were able to mention chicken, Duck and most of the animals in the poultry class. A few however mentioned the names for the gizzard only and the names for the leg instead of lumping them up as animals from which both could be found. Few also gave animals with gizzard only and went further to mention animals with legs to include, ‘goat’, ‘sheep’, ‘cattle’. The expected answers include:
- Domestic fowl/ chicken
  - Quail
  - Guinea fowl
  - Pigeon
  - Turkey
  - Duck
  - Geese
  - Ostrich
- c. Candidates were able to perform very well here. The setback for some was spelling of some words. Eg ‘thick as ‘tick, and ‘tough’ as ‘though’. Candidates were expected to give responses such as:
- has thick wall
  - is muscular in nature
  - contains grits / pebbles/ small stones/ gastrolitis
  - inside lined with tough corrugated membrane
- d. This part was poorly answered by almost all the candidates. Most of them could neither draw nor label. It cost them a lot of marks. Candidates were expected to label the thigh, drumstick, scales/scaly membrane, shank, spur, toe, claw. Some also indicated the spur close to the toe.

## Question 2

- (a) (i) State one method of propagating each of specimens C, D and E.  
(ii) State four practices that a farmer should adopt to ensure high productivity of specimen E in pasture production.
- (b) Mention the major nutrient found in each of specimens C, D and E.
- (c) (i) Name two storage pests of specimen C.  
(ii) State three harmful effects of the pests on specimen C.

a. (i) This part of question two (2) was well answered by most of the candidates. They were able to provide answers such as;

- Maize - seed
- Centrosema - seed
- Guinea grass - seed / vegetative part

Only a few lost marks for mentioning seed for all the three specimens without being specific hence attracting only one mark.

(ii) This part was also well answered by the candidates. They were able to state, irrigation, manuring, weeding and liming among other correct answers that were expected including

- interplanting with legumes
- thinning
- controlled burning
- disease control
- pest control
- rotation
- fertilizer application / manuring
- harvest at the right time to enhance tillering
- control soil erosion

b. This part was well answered by most candidates. However, a few lost marks by mentioning all the nutrients contained in feed without reference to the word **major nutrient**. They are expected to mention the following as the major nutrient present.

- Maize - carbohydrate
- Centrosema - Protein
- Guinea grass - carbohydrate

c. (i) This part was also well answered. Candidates mentioned mice, rats, weevils, termites and beetle. A few however, mentioned rats and rodents which made them attract only one mark as rats belong to the rodent's family.

- (ii) Candidates were able to mention:
- consume feedstuff / reduce quantity
  - reduce quality of feed
  - contaminate feed
  - reduce seed germination rate/non-germination of seeds/loss or reduction of viability

### **Question 3**

- (a) **State one use of each of specimens F and G.**
- (b) **Name one part of the body of a livestock where specimen F could be used.**
- (c) **State two precautions that should be taken when using specimen F.**
- (d) **The parameter measured by specimen F in a cow is found to be abnormally high, even though the weather remains the same and the cow is not on heat or in labour.**
- (i) **What does the abnormally high parameter signify?**
- (ii) **Outline the steps that should be taken to bring down the abnormally high parameter.**
- (e) (i) **Give three reasons why specimen G could be used in an animal farm.**
- (ii) **Mention three farm animals on which specimen G could be used.**

(a) It was well answered. Only a few were giving answers, like it is used to check body temperature instead of it is used to measure or determine the temperature of the body. A few also identified F as a room thermometer. F is a clinical thermometer while G is ear tag.

(b) Part of livestock where clinical thermometer is used.

An average number of candidates could not indicate the part of the body where the specimen is used. They are expected to mention the Rectum/Anus. Some mentioned the armpit, wing and mouth.

(c) Precautions to be taken when using the clinical thermometer.

An average number of candidates answered this part correctly. They were able to state Restrain the animal, Don't touch the bulb, Do not put it in boiling water, Sterilize before and after use, Shake the instrument vigorously before use among others.

(d) (i) abnormally high temperature

Almost all candidates were able to mention disease/infection/fever/sickness..

(ii) Steps to bring temperature down.

This part was also well answered. They were able to write, "isolate the animal, diagnose the disease, obtain appropriate drug, administer right dose of drug, observe/ monitor the response, provide clean adequate water."

(e) (i) Reasons for using ear tag on farm animal

This item was well answered by almost all the students. They mentioned "recordkeeping, Claim to ownership/ Avoidance of disputes, useful in breeding, helps in drug administration and culling.

(ii) Farm animals on which ear tag can be used

All candidates were able to answer this part of the question. They mentioned "Cattle, Sheep, Goat, Rabbit, and Pig".

#### **Question 4**

- (a) (i) **State four factors which could affect the yield of specimen H in animal production.**
- (ii) **Give two reasons for pasteurizing specimen H.**
- (iii) **Mention four products which could be obtained by processing specimen H.**
- (b) (i) **Mention the major nutrient present in specimen J.**
- (ii) **State four ways in which specimen J is important in animal feed preparation.**

(a) i. Factors affecting milk yield in animals

This part was poorly answered by most of the candidates because of the non directional nature of the question. The question did not ask for one direction of the milk yield. The factor could affect the yield positively or negatively therefore should neither be in the positive direction nor negative direction. Students were given answers such as Pests, diseases, young animals which all affects the yield but in a particular direction. Example, Pest and diseases will reduce the yield therefore it has a direction. Assuming the question was what factors would reduce the milk yield in a cow, then diseases, and pests can be mentioned. Since the question was non directional the candidates were expected to mention the non directional answers such as age, physiological states, health status, parity, frequency of milking, temperature, stage of lactation, nutrition / diet given the animal, genetics/breed of the animal and environmental temperature

If candidates state diseases they could state it as follows, the presence or absence of diseases.

(ii) Reasons for pasteurizing milk

This part was well answered by most candidates. They were able to mention to destroy most pathogenic organisms, improve consumption, safety, and improve shelf life among others.

(iii) Products obtained from processing milk

Candidates were able to mention the products which include butter, cheese, yoghurt, ice cream, whey and confectionaries.

(b) (i) Major nutrients obtained from palm oil

This part was well answered by almost all candidates. They mentioned fats and oils.

(ii) Importance of palm oil in feed preparation.

This item was also well answered by almost all the candidates. They mentioned that it serves as a binder / prevents dustiness of feed, adds flavor and serves as source of vitamins, source of energy, adds flavour to feed to increase acceptability / palatability, gives colour for attractiveness.

## **BIOLOGY 2**

### **1. GENERAL COMMENTS**

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

### **2. SUMMARY OF CANDIDATES' STRENGTHS**

- (1) Most candidates displayed some improvement in expressing themselves well in English.
- (2) Candidates exhibited satisfactory knowledge in the following questions: Components of human blood and its related; components; dentition and care of teeth in animals; Basic ecological concepts regarding autotrophs (producers), heterotrophs (consumers) and decomposers; the DNA structure with respect to name of bond and name of enzyme that breaks the bond during DNA replication; the concept of magnification as used in Biological drawing; generation time as used in bacterial culture in question and Biological fuel generation.
- (3) Many 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**

- (1) Candidates could not provide acceptable Biological diagrams to show the stages of white blood cell destroying a pathogen as in question 1 (e). The rubrics regarding biological drawings such as (i) clarity of lines which involves lines of drawing should not be wooly or broken at some points (ii) neatness of labels e.g. guidelines must be ruled using ruler, labels must be written horizontally, guidelines must not cross each other etc. and avoidance of shading drawings were all abused.
- (2) Technical terms were wrongly spelt e.g. names of blood components as in question 1(a, b & c);
- (3) Candidates could not appropriately describe the generalized structure of a tooth in animals.
- (4) Poor performance regarding the conservation of natural resources as in question 4 (a, b & c);
- (5) Candidates failed to name the: (i) components of the illustrated DNA molecule as in 5 (a), (ii) membrane covering each of the listed organs in humans as in 5 (d);
- (6) Candidates could not (i) distinguish between *test cross* and *back cross* as used in genetics in question 5 (e) and (ii) give causes of species extinction as in 5 (h).

### **4. SUGGESTED REMEDIES**

- (1) Candidates should read all instructions to the paper and follow them to the letter.
- (2) Tutors should take their students through spelling drills with respect to technical terms.
- (3) Tutors should encourage their students to work sufficient tutorials and assignments on how to provide concise and accurate answers.
- (4) Tutors should ensure that candidates know and understand the rubrics of Biological drawing.
- (5) Tutors should teach candidates techniques of answering questions bothering on description.

## 5. DETAILED COMMENTS

### Question 1

A sample of human blood was put in a test tube and allowed to spin in a centrifuge. The components of the blood sample were clearly separated.

- (a) Name the component of the blood that:
- (i) would form the top layer in the test tube;
  - (ii) destroys pathogens;
  - (iii) is biconcave in shape;
  - (iv) would be relatively low in a haemophilic condition;
  - (v) is produced in the bone marrow;
  - (vi) is a thrombocyte;
  - (vii) is nucleated.
- (b) Mention three chemical substances transported by the blood components in 1(a)(i).
- (c) List two diseases associated with blood.
- (d) Explain briefly why a disease of the blood could be dangerous.
- (e) Make three diagrams showing the stages of how the blood component named 1(a)(ii) destroys a pathogen and label fully.

Many candidates attempted the question. The performance of candidates was very good.

Candidates should note the following responses:

- (a) Name of component of blood that:
- (i) forms top layer in the test tube  
(Blood) plasma
  - (ii) destroys pathogens  
White blood cells/leucocytes
  - (iii) is biconcave in shape  
Red blood cells/erythrocytes
  - (iv) would be relatively low in a haemophilic condition  
Platelets (thrombocytes)
  - (v) is produced in the bone marrow
    - Platelets (thrombocytes);
    - White blood cells/leucocytes;
    - Red blood cells/erythrocytes.
  - (vi) is a thrombocyte  
Platelets
  - (vii) is nucleated  
White blood cells/leucocytes
- (b) Chemical substances transported by the blood component named in 1 (a) (i)/ blood plasma are as follows:
- Thyroxine/adrenaline/insulin/progesterone/hormones;
  - (digested) food substances/nutrients/glucose/amino acids/any correctly named digested food substance;
  - Antibodies/antigens;
  - Oxygen/carbon(IV) oxide/dissolved gases;

- Toxins;
  - Mineral salts/salt/magnesium/copper/potassium/zinc;
  - Urea/uric acid;
  - Water;
  - Vitamins.
- (c) Diseases associated with blood include:
- Anaemia;
  - Hepatitis;
  - Sickle cell anaemia;
  - Leukemia/leukaemia/blood cancer;
  - Haemophilia;
  - AIDS;
  - Malaria.
- (d) The reason a disease that attacks the blood is deadly is that:
- The blood circulates throughout the body or it is a medium of transportation in the body;
  - It makes contact with major organs of the body and makes it easy for a disease to be deadly;
  - Blood disease could attack any component of blood and threaten life.
- (e) Candidates were requested to make three diagrams showing stages of how the blood component named in 1 (a)(i) destroys a pathogen and label fully.

Below is the response:

Title (TL) Diagram of white blood cell destroying a pathogen

Quality (Q)

Neatness of labels (NL)

Details (D)

Two arrows shown between the three diagrams (AR)

White blood cell shown with nucleus (WN)

Pathogen fully engulfed in the third diagram (PE)

Labels (L)

Cell membrane, nucleus, cytoplasm, pathogen.

## **Question 2**

- (a) **What is *dentition* in animals?**
- (b) **Describe briefly the generalized structure of a tooth in animals.**
- (c) **State four ways of keeping the teeth of humans healthy.**
- (d) **List five materials needed for preparing a green leaf for testing the presence of starch in the laboratory.**
- (e) **List three food substances that plants manufacture from glucose.**



Most candidates answered this question satisfactorily.

- (a) Candidates were expected to give the meaning of dentition in animals as the type/shape, number, and arrangement of teeth in the mouth/jaws of animals.
- (b) In describing briefly the generalized structure of a tooth in animals, candidates must state the following:
- The tooth is made up of the crown, neck, root;
  - The visible part of the tooth is the crown;
  - And is covered by the hardest substances/enamel;
  - The neck of the tooth is surrounded by the gum;
  - While the root is embedded in the jawbone;
  - Beneath the enamel is the hard dentine;
  - Which forms the bulk of the tooth;
  - Containing sensory endings of nerves/blood capillaries;
  - In the pulp cavity;
  - The cement/periodontal membrane covers the root of the tooth in the jawbone.
- (c) Candidates were required to state ways of keeping the teeth healthy as presented below:
- Avoid eating hot/cold food;
  - Avoid consuming sweets/sugar/sticky foods;
  - Teeth must be brushed with tooth paste at least twice a day;
  - Food substances containing calcium/phosphorus should be eaten regularly to strengthen the teeth;
  - Fibrous/rough foods should be taken to massage the gum;
  - Visit a dentist regularly for check-ups;
  - Avoid picking the teeth with sharp objects;
  - Avoid using the teeth to open bottle tops.
- (d) Candidates were required to list materials needed for preparing a green leaf for test for starch as follows:
- |                        |                             |
|------------------------|-----------------------------|
| - Green leaf;          | - Tripod stand;             |
| - Alcohol;             | - Iodine solution/tincture; |
| - Water;               | - Dropper;                  |
| - Water bath;          | - White tile;               |
| - Beaker;              | - Petri dish.               |
| - Flame/Bunsen burner; |                             |
- (e) Food substances that plants manufacture from glucose include the following:
- Sucrose/maltose;
  - Starch;
  - Cellulose;
  - Oil;
  - Proteins.

### **Question 3**

- (a) **Complete the table by placing each of the following organisms under the appropriate heading.**  
**Algae, Bacteria, Dog, Water lettuce, Tadpole, Human, Lemna, Waterleaf, Rhizopus, Mushroom.**

Decomposer	Producer	Consumer

- (b) (i) Name four products of decomposition  
(ii) Mention three roles of decomposers on a refuse dump  
(iii) List three materials found in a refuse dump which would not be affected by the action of decomposers

Candidates provided satisfactory answers to this question. It is worth noting the following expected answers.

- (a) Candidates were expected to complete the table by placing each of the following organisms- Algae, Bacteria, Dog, Water lettuce, Tadpole, Human, Lemna, Water leaf, Rhizopus and Mushroom under the appropriate heading as follows:

Table

Decomposer	Producer	Consumer
Rhizopus	Algae	Dog
Bacteria	Waterleaf	Human
Mushroom	Water lettuce	Tadpole
	Lemna	

- (b)(i) Name of Products of decomposition include:

- Hydrogen sulphide;
- Carbon (IV) oxide;
- Ammonia;
- Water vapour/water;
- Mineral salt/plant nutrient;
- Heat/energy;
- Humus;
- Methane.

- (ii) The roles of decomposers on a refuse dump include:

- They feed on dead/decaying organisms;
- They form a link in a food chain;
- They form a link between biotic and abiotic factors in an ecosystem;
- They release inorganic components from organic materials;
- They facilitate the recycling of nutrients in the ecosystem;
- They reduce the bulky nature of debris/dump.

- (c) Materials in a refuse dump which would not be affected by the action of decomposers include:

- Plastics;
- Metals/iron/tin/zinc/aluminium;
- Glass/bottle;
- Nylon/polythene;
- Rubber/tyres;
- Stones;
- Ceramics.

#### Question 4

- (a) Complete the table below by naming five wildlife animals in West Africa and one body part each that makes them endangered because of the activities of humans.

Animal	One body part makes animal endangered

- (b) State three effects each of the following factors on the conservation of natural resources:
- overgrazing;
  - poaching;
- (c) State four roles played by the Government in conservation of natural resources.

Generally, candidates performed fairly in answering this question.

- (a) Candidates were required to complete the table below by naming five wildlife animals in West Africa and one body part each that makes them endangered because of the activities of humans as follows:

Table

Animal	One body part that makes animal endangered
Lion	canine tooth/teeth/skin/mane/fur/claws/bones
Peacock	feather
Crocodile	skin/flesh/meant/teeth
Zebra	skin/flesh
Elephant	tusk/flesh
Rhinoceros	horn/flesh
Tiger	skin/flesh
Parrot	red/feather
Snake	skin/flesh
Pangolin	skin

- (b) Effects of the following factors on the conservation of natural resources

(i) Overgrazing

- Disruption of natural habitat of species;
- Disruption of the food chain;
- Destruction of plant species;
- Compaction of soil/destruction of soil structure;
- Exposure of soil to erosion;
- Evaporation of soil water/decrease in water retention in the soil.

(ii) Poaching

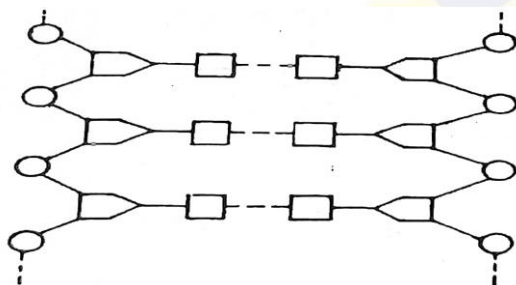
- Leads to the death of endangered species;
- Leads to reduced population/extinction of species;
- It affects tourism/economy of a nation
- It disrupts the natural food chain;
- Leads to spread of diseases from wildlife animals to humans.

(c) Roles played by the government in conservation of natural resources include:

- Enactment/enforcement of laws for conservation;
- Formulating policies against poaching/overgrazing/over fishing;
- Formulating policies to promote tree planting/campaign/protecting soil from erosion;
- Creating ranches to avoid overgrazing;
- Training officials to guard game reserves;
- Educating the general public on conservation of resources;
- Setting up surveillance equipment for security officers in game reserves;
- Setting up forest/game reserves/fish ponds;
- Encouraging regeneration of endangered species.

**Question 5**

The diagram below is an illustration of part of a DNA molecule. Study it and answer questions 5(a) and 5(b).



(a) Name the component which each of the following symbols represents

- (i) ○
- (ii) ◡
- (iii) □

(b) (i) Name the bond between two of the symbol in 5(a)(iii) as represent in the diagram.

(ii) Name the enzyme that breaks the bond named in 5(b)(i) during DNA replication.




(c) What is *magnification* as used in biological drawing?

(d) Name the membrane covering each of the following organs in humans:

- (i) brain;
- (ii) heart;
- (iii) lung;
- (iv) kidney.

- (e) **Distinguish between *test cross* and *back cross* as used in genetics.**
- (f) **What is generation time as used in bacterial culture?**
- (g) (i) **What is *biofuel*?**
- (g) (ii) **Name two types of biofuel.**
- (h) (i) **Give four causes of species extinction.**
- (h) (ii) **State five ways by which species extinction can be reduced.**

The performance of candidates was quite good.

- (a) Candidates were provided with an illustration of part of a DNA molecule required to name the component which each of the following symbols represents as follows:
  - (i)  = Phosphate/phosphate group;
  - (ii)  = Deoxyribose sugar;
  - (iii)  = Nitrogenous base;
- (b) (i) The name of the bond between two of the symbol in 5(a)(iii) as represented in the diagram is:  
Hydrogen
- (b) (ii) The name of the enzyme that breaks the bond named in 5(b)(i) during DNA replication is:  
(DNA) Helicase
- (c) Candidates were required to give the meaning of Magnification as used in Biological drawing. Candidates should note that magnification is how much a drawing is larger/smaller; than the actual size of a given specimen.

OR

Linear dimension/size of drawing  
Linear dimension/size of actual object/specimen

- (d) Candidates were required to name the membrane covering each of the following organs in humans as:
  - (i) brain:  
Meninges
  - (ii) heart:  
Pericardium
  - (iii) lung:  
Pleura
  - (iv) kidney:  
Capsule
- (e) Candidates could not provide satisfactory distinction between test cross and back cross. Candidates should note that Test cross is a cross between an individual showing a dominant phenotype with a homozygous recessive individual to determine the genotype of the individual while a back cross is a cross between an offspring/individual and one of its parents.
- (f) Candidates were expected to give the meaning of generation time in bacterial culture as:  
The average time/ duration between two consecutive generations in the lineage of bacterium  
OR  
the time /duration it takes a bacterial cell to double.
- (g) (i) Candidates were required to give the meaning of Biofuel as:  
Fuel/energy produced from biomass/material derived from living organisms/plants/animals or their wastes/manure/faeces/sawdust.

- (ii) Types of biofuel include the following:
  - Bioalcohol / ethanol / methane;
  - Biodiesel;
  - Biogas;
  
- (h) (i) The causes of species extinction include the following:
  - Habitat destruction;
  - Urbanization;
  - Climate change/global warming;
  - Commercial hunting/collection of animals;
  - Poaching;
  - Sports hunting;
  - Pollution;
  - Indiscriminate felling of trees/deforestation;
  - Overgrazing;
  - Bush fire/bush burning.
  
- (ii) Ways by which species can be reduced include:
  - Capture breeding/relocation/monitoring of endangered species;
  - Restoring/regenerating habitats;
  - Establishment of zoos/botanical gardens/games reserves;
  - Establishment of protected areas/National parks/RAMSEYER/RAMSAR site;
  - Establishment of seed/sperm bank;
  - Habitat protection;
  - Public education on conservation;
  - Enforcement of existing laws.

## **BIOLOGY 3**

### **1. GENERAL COMMENTS**

The questions set were within syllabus. The standard of the paper compared favourably well with the previous years. The performance of candidates was slightly better than last year.

### **2. SUMMARY OF CANDIDATES' STRENGTHS**

- (1) Candidates showed appreciable strength in the area of classification;
- (2) With respect to adaptation of organisms to life processes, candidates were able to provide appropriate responses;
- (3) Candidates observed the requirement to tabulate differences while a good number of candidates considered the matching features of the organisms to state the differences;
- (4) Candidates showed improvement in the spelling of scientific terms;
- (5) It was clear that candidates had not done enough exercises on biological drawing. Requirements for title, quality, and details were not observed by many candidates.

### **3. SUMMARY OF CANDIDATES' WEAKNESSES**

- (1) Candidates showed obvious weakness in the area concerning specific habitats which required candidates to relate adaptive features of organisms to their habitats. Candidates could not provide the expected adaptive features of plants that naturally grow in deserts and savanna;
- (2) Candidates were ill-prepared for report writing based on biological experiment. A number of students could not distinguish steps involved in observation and conclusion.

### **4. SUGGESTED REMEDIES**

- (1) Instructors should include biological drawing of organisms in the practical lessons on classification. Attention of students should be drawn to the four dimensions which are used to assess biological drawing.
- (2) Instructors should observe that the topic ecology is a key pillar in the subject Biology, and therefore due attention should be given to this aspect. Ecological trips to ponds to study hydrophytes; to rain forest to study epiphytes, to savanna to look at geophytes, will expose students to vegetation of these habitats. Arid zone conditions, to study xerophytes, can be obtained at the splash zones of seashores or some area at the fringes of savanna. Xerophytes can also be obtained at botanical gardens.
- (3) There are a number of simple physiological processes that can easily be demonstrated in practical lessons for students to appreciate the stages of report writing and also learn to make appropriate observation. These include enzyme activities under different conditions; water-culture experiments, osmosis using tissue in-solutions of different conc. of plants at different densities or involving inter specific competition.

## 5. DETAILED COMMENTS

### Question 1

*Study specimen A and answer questions 1(a) to 1(e).*

- (a) **Name the class of specimen A.**
- (b) **State four observable features of the Class named in 1(a)**
- (c) **Name two other members of the Class mentioned in 1(a)**
- (d) **Describe briefly how the limbs of specimen A are adapted for movement:**
  - (i) **on land;**
  - (ii) **in water;**
- (e) **Make a drawing, 8 cm to 10 cm long, of the lateral view of specimen A and label fully.**

### Question 1

- (a) This question is based on classification. It requested candidates to state the class of a toad. Good majority of candidates correctly stated class including the correct spelling of the taxon.
- (b) The question is a follow-up to question 1(a) and requested for observable features of the taxon. A good number of candidates provided appropriate features. However a few candidates merely stated presence of forelimbs or hind limbs instead of a pair of forelimbs or a pair of hind limbs being the standard features. Such candidates lost the required marks.
- (c) This question is also a follow-up to question 1(a) and asked for two other members of the class. A large majority of candidates name the frog, Newt, salamander and a handful mentioned caecilian. Many candidates lost the marks for wrong spelling particularly salamander.
- (d)
  - (i) The question was based on features that adapt the toad for movement on land. They were expected to mention the long/muscular hind limbs as the feature that stretch to lift the toad when hopping, short and stout forelimbs that are used for landing and for absorption of shock, and the digits for crawling on land. A good number of candidates identified the expected features and correctly related them to their roles in movement on land.
  - (ii) This question also demanded mentoring of adaptive feature of toad for swimming. A good number of candidates correctly mentioned the hind limbs with webbed digits for swimming; the streamlined body for smooth swimming and the forelimbs for steering in water.
- (e) The question asked candidates to make drawing of the lateral view of a toad. Drawing of the toad was poorly done. Many candidates wrongly presented dorso-lateral view, yet others presented the dorsal view. The title, in many, cases did not specify the view of drawing. Clarity of the outlines was confused. Many candidates did not disclose magnification. Clearly the candidates were not aware of the four dimensions for assessment of drawings. Again there were scripts in which a guideline points to a single feature but the label is written in the plural form. In such areas of the subject, Biology also cares about grammar. Scripts showed that candidates were not mindful of details, the shape, position and relative sizes of features. Candidates did not clearly represent the bulging eyes, with swollen poison gland behind the eyes. The wide terminal mouth and the webbed hind limb digits are obvious characteristics of toad but these were shown in the drawings.



## Question 2

Beakers C, D, E and F contain seeds that have been sown for seven days. Carefully remove one seed/seedling from each of the beakers labelled C, D, E and F and place each on the corresponding white tile labelled C, D, E and F. study them and answer questions 2(a) to 2(c).

- (a) Observe the soils and seed/seedling then record the observation and result on the table below.

Soil/seed/seedling in beaker	Two observations	Result
C		
D		
E		
F		

- (b) (i) Name one condition for germination that was likely absent in the beakers labelled D, E and F.  
D:  
E:  
F:
- (ii) Give two reasons for the result in beaker C.
- (c) Make a drawing, 8 cm to 10 cm long of one seed/seedling obtained from the beaker labelled C and label fully.

## Question 2

- (a) This question examines the steps of report writing and the conditions for germination of seeds. Candidates were provided with four seven days old set-ups, C, D, E and F, of an experiment on conditions for germination of been seed. The preamble gave the procedure leading to the four set-ups. The candidates were then asked to make observations and conclusion on each set-up in a table provided.

A number of candidates entered the appropriate observations and conclusions but a good number of candidates drew the required conclusions but failed to record any of the wide range of expected observations strangely, some candidates repeated the conditions present or absent for observation the concept of observation is not well understood by a good number of candidates.

For set-up C the observations should include:

- Cotyledons split open;
- Seedling present/cotyledon above soil;
- Emergence of radicle/presence of root/epicotyl;
- Presence of foliage leaves/stem/hypocotyl/ and epicotyl;
- Moist soil;

For set-up D:

- Cotyledons are separate/split;
- The seed/cotyledon are brown;
- The seed/cotyledon are decaying;
- The seeds have no testa;
- No embryo;
- Moist soil.

For set-up E:

- The seeds are brown;
- Seed/Testa intact;
- The seeds are soft;
- Smell of Kerosene in soil;
- Moist soil.

For set-up F:

- The seeds are intact;
- The seeds have brown/white testa;
- The seeds are hard;
- Dry soil.

- (b) (i) This question is a follow-up to the question 2(a), and requesting the candidates to identify the conditions for germination that was likely absent in set-ups D, E, and F. The candidates were expected to indicate for set-up D: Viable seed; for set-up E oxygen and for set-up F, water or moisture. A good number of candidates gave the expected answers.
- (ii) This question asked candidates to explain the result in set-up C. The candidates were expected to state that. All the conditions necessary for germination were present/ oxygen, water, warmth and viable seeds present and set-up C is a control set-up.
- (c) This question asked candidates to draw and label a seedling from set-up C. A few candidates considered the four dimensions required in biological drawing and therefore obtained good marks.

### **Question 3**

**Study specimens G, H and J and answer questions 3(a) to 3(f).**

- (a) (i) **Describe the stem of specimen G.**  
(ii) **State two ways by which specimen G is of biological significance.**
- (b) **Explain briefly how specimen H survives a fire outbreak.**
- (c) **Explain briefly how three features of specimen J enable it to survive drought.**
- (d) (i) **Name one habitat of specimens G and J.**  
(ii) **List three abiotic factors in the habitat of specimen J.**
- (e) **In the table below, state three observable differences each between specimens:**  
(i) **H and J.**  
(ii) **J and K.**
- (f) **State two observable similarities each between specimens:**  
(i) **H and J;**  
(ii) **J and K.**

### **Question 3**

It featured questions based on adaptations to habitats.

- (a) (i) This question asked candidates to describe the adaptive features of an organism *Opuntia* stem from an arid zone. A good number of candidates mentioned the obvious features like the green colour, the flat nature and the spines. Few candidates recognized the succulent stem and shiny waxy cuticle which are the critical features of plants of arid zone.

- (ii) This question asked candidates to explain the significances of the features identified in (a)(i). Few candidates related the features to their role in the survival of the plant in the arid zone. The candidates were expected to explained that succulent stem stores water; the leaves reduces to spines cut down transpiration, the waxy cuticle reduce water loss; Green, Chlorophyll, for photosynthesis.
- (b) This question examined the adaptations of plants in savanna. Candidates were asked to mention ways by which onion plants survive fire outbreak, an important factor in savanna. Majority of candidates could not identify the close as they mentioned that part of the plant is hidden in the soil and failed to recognized the bulb enclosing the buds while in the soil. The buds escape the burning and produce new shoots when conditions are favourable. That the aerial leaves contain water which minimizes burning.
- (c) This question examines another plant of savanna habitat, the grass and asked candidates to explain how features of grass enable it survive drought. Only a handful of candidates gave any meaningful answers. Clearly this area of the syllabus has not been treated by the candidates. The expected answer should touch on the following features of grass:
- Rolled up leaves reduce transpiration;
  - Hairs on grass reduce water loss;
  - Waxy cuticle of leaves reduce transpiration.
  - Lots of leaves or tuff of grass maintain moisture among leaves.
- (d) (i) This question asked candidates to identify the possible habitats of onion plant and grass. A number of candidates surprisingly correctly mentioned savanna or desert. However, a few candidates lost the allocated mark for reason of wrong spelling.
- (ii) Majority of the candidates did not find it difficult to list: water/rainfall, Temperature, Humidity, sunlight and wind as the abiotic factors associated with the habitat of the Organisms.
- (e) This question asked candidates to give observable structural differences between the onion plant and the grass. A good number of scripts showed good answers, with matching features considered. Despite the clear restriction of answers to structural features, some candidates presented functional differences.
- (f) This question asked candidates to give structural similarities between the onion plant and the grass. This question was the most popular question. Most candidates obtained all the marks allocated.

## CHEMISTRY 2

### 1. GENERAL COMMENTS

The standard of the paper was good and compared favourably well with those of previous years. The questions were well constructed and within the general scope of the teaching curriculum and the examinations syllabus.

The general structure of the paper has improved with more organic chemistry spread over all the sections and also the individual questions.

This is commendable as organic chemistry is a huge section of the syllabus and goes on to help the candidates as they progress to the tertiary level where it is needed most.

### 2. SUMMARY OF CANDIDATES' STRENGTHS

The responses given by the candidates that need commendations are:

- (1) ability to distinguish between atomic mass and atomic number;
- (2) calculation of volume of a gas at s.t.p given other conditions of temperature, pressure and volume it occupied;
- (3) distinction between structural formula and empirical formula;
- (4) what valency is, and the laws of chemical combination especially "law of conservation of matter";
- (5) liquid fractions obtained from the fractional distillation of petroleum;
- (6) writing of electron configuration given atomic numbers;
- (7) use of Faraday's first law of electrolysis to calculate time for deposition;
- (8) processes of converting ethanol to ethene, bromoethane and ethane;
- (9) the use of electron box configuration to interpretate the rules in filling electrons into orbitals in an atom;
- (10) building blocks of matter;
- (11) factors that affect stability of radioactive nuclides and calculation of half life;
- (12) what isotopes are and the differences between nuclear fission and nuclear fusion; (13) purification of bauxite to obtain aluminium;
- (14) definition of pH and calculations of  $[\text{OH}^-]$  and  $[\text{H}^+]$ ;

### 3. SUMMARY OF WEAKNESSES

The few weaknesses identified were:

- (1) understanding the demand of the questions;
- (2) lack of adequate knowledge of the chemical concepts, such as inductive effect and electrophiles;
- (3) exhibition of poor communication skills in the delivery of answers;
- (4) could not use bond dissociation energy to compare the acidity of HCl and HF;
- (5) could not select organic compounds that could be cracked, undergo substitution reaction from among a list of compounds;
- (6) could not explain why  $\text{LiI}_{(l)}$  does not conduct electricity,
- (7) use experimental data to explain rate of chemical reaction;

- (8) calculation of enthalpy for a reaction from thermo-chemical data, define lattice energy and factors affecting it.

#### 4. SUGGESTED REMEDIES

- (1) Identification of the basic requirements of each question before answering;
- (2) endeavour to use appropriate term of the subject when required;
- (3) improvement of their communication skills;
- (4) state correct and full definition of terms when required;
- (5) learn how to explain concepts using the appropriate technical terms of the subject;
- (6) start the study of organic chemistry on time;
- (7) improve their study habits and behaviours.

#### 5. DETAILED COMMENTS

##### Question 1

- (a) Consider the following acidic solutions:

$\text{HCl}_{(\text{aq})}$  ,  $\text{HF}_{(\text{aq})}$ ;

(i) State which of the solutions would have higher pH;

(ii) Give a reason for the answer stated in (i)

- (b) Distinguish between atomic mass and atomic number.

- (c) Consider the following organic compounds:

$\text{C}_3\text{H}_7\text{OH}$ ,  $\text{C}_2\text{H}_2$ ,  $\text{CH}_3\text{COOH}$ ,  $\text{C}_3\text{H}_6$ ,  $\text{C}_{17}\text{H}_{36}$

State which of them:

(i) can be cracked;

(ii) undergoes substitution reaction only

- (d) A gas occupies  $2.0 \text{ dm}^3$  at  $300 \text{ K}$  and  $1.0 \times 10^5 \text{ N m}^{-2}$ . What volume would it occupy at s.t.p. [standard pressure =  $1.015 \times 10^5 \text{ N m}^{-2}$ ]

- (e) Distinguish between structural formula and empirical formula.

- (f) Explain each of the following terms:

(i) valency;

(ii) electrovalency.

- (g) State one of the laws of chemical combination.

- (h) Calculate the oxidation number of sulphur in the following compound:

$\text{Al}_2(\text{SO}_4)_3$ .

- (i) State two liquid fractions obtained from the fractional distillation of petroleum.

- (f) Explain why molten lithium iodine does not conduct electricity.

Majority of the candidates scored low marks for this question because they did not understand the demands of the question.

(a) The candidates were to state which of the two solutions,  $\text{HCl}_{(\text{aq})}$  and  $\text{HF}_{(\text{aq})}$  would have the higher pH or is more acidic and why? The acidity is due to the ease of release of  $\text{H}^+$  into solution. This depended on the strength of the bond between HCl and that of HF. The higher the bond dissociation energy, the weaker the acid.

(b) The task here was the distinction between atomic mass and atomic number. The mass of an atom is concentrated in the nucleus which depends on the number of protons and neutrons (nucleus). Whereas the atomic number is the number of protons only in the nucleus / number of electrons an atom has. If it were the atomic mass of an element, relative atomic mass of an element, then it becomes the weighted average of masses of all the isotopes of the element.

- (c) Given the following compounds:  $C_3H_7OH$ ,  $C_2H_2$ ,  $CH_3COOH$ ,  $C_3H_6$  and  $C_{17}H_{36}$ , the one that can be cracked, is the one with a long chain. Therefore,  $C_{17}H_{36}$  fits the answer.

Again, the one that can undergo substitution reaction only, should be an alkane which is  $C_{17}H_{36}$ .

- (d) This section of the question was well answered by majority of the candidates. Given the standard pressure, they knew the general gas law applies i.e.

$$\frac{P_1 V_1}{T_1} = \frac{P_{stp} V_{stp}}{T_{stp}}$$

However, some few candidates used 298 K instead of 273 K as the standard temperature.

- (e) Most of the candidates were able to distinguish between structural formula and empirical formula.  
 (f) Majority of the candidates could state that valency is the combining power of an element but could not state what electrovalency was. Electrovalency being the actual charge on an ion.  
 (g) The demand of this question was the statement of one of the laws of chemical combination. Although majority stated the law of conservation of mass, others just mention the law without stating.  
 (h) Most of the candidates were able to calculate the oxidation number of Sulphur in  $Al_2(SO_4)_3$ . Few of them failed to indicate the sign of the number which is very important. i.e. either +6 or -6 and not just 6.  
 (i) Few of the candidates could not state two liquid fractions obtained from the fractional distillation of petroleum i.e. petrol / gasoline, diesel / gas oil, kerosene, naphtha, lubricating oil / engine oil.

## Question 2

The following results were obtained during an experiment to measure the change in mass of a reaction flask for the reaction between excess dilute hydrochloric acid and marble chips at 25°C.

Time (min)	1	2	3	4	5	6	7
Loss in mass (g)	0.26	0.46	0.60	0.69	0.73	0.73	0.76

- (i) Write an equation for the reaction.  
 (ii) Give a reason why the mass of the flask changed with time.  
 (iii) Explain briefly why it is not advisable to use dilute tetraoxosulphate (VI) acid in this experiment.  
 (iv) What would happen if the experiment was carried out at 35°C?  
 (v) What would be the effect on the results if the marble chips were replaced with the same mass of marble powder.
- (b) (i) Outline the manufacture of aluminium from purified bauxite.  
 (ii) State two use of aluminium.
- (c) An element Y has atomic number 12.  
 (i) Write the electron configuration of Y.  
 (ii) How many electron pairs are there in the second energy level of Y?  
 (iii) How many electrons are present in the ions of Y?  
 (iv) Write the formula of the chloride of Y.  
 (v) State the type of bond present in the chloride of Y.
- (d) How long will it take to deposit 5.4 g of silver when a current of 10 A is passed through a silver voltmeter?

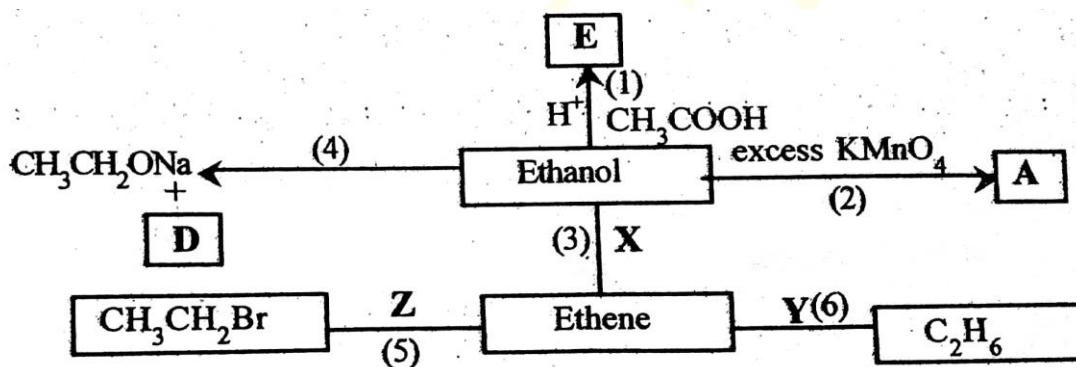
$$[Ag = 108, IF = 96500 C]$$

Majority of the candidates attempted this question. Of this number, about 50% could not answer 2(a) because they probably did not understand the question. An experimental results on an experiment to measure the rate of the reaction between marble ( $\text{CaCO}_3$ ) and dilute HCl was given.

- (i) the equation for the reaction was between  $\text{CaCO}_3$  and HCl  
i.e.  $\text{CaCO}_{3(s)} + 2\text{HCl}_{(aq)} \rightarrow \text{CaCl}_{2(aq)} + \text{H}_2\text{O}_{(l)} + \text{CO}_{2(g)}$
- (ii) the loss in the mass of the flask was as a result of the production and escape of  $\text{CO}_2$ . Yet the candidates could not express themselves.
- (iii) Not being advisable to use dil.  $\text{H}_2\text{SO}_4$  for the experiment was as a result of the formation of insoluble  $\text{CaSO}_4$  which coats the surface of the  $\text{CaCO}_3$  and prevent further reaction. However, some candidates said that dil  $\text{H}_2\text{SO}_4$  will cause explosion.
- (iv)&(v) As to what would happen when the temperature is increased from  $25^\circ\text{C}$  to  $35^\circ\text{C}$ , it bothered on the factors that affects the rate of a reaction i.e. increase in temperature increases the rate of the reaction. Also using powdered marble implies increase in surface area which again is on the factors affecting rate of a reaction.
- (b)(i) Most of the candidates misconstrued the manufacture of aluminium from purified bauxite (alumina) from purification of bauxite. They therefore failed to address the task involved. They could not outline how alumina and molten cryolite are mixed and electrolyzed using carbon electrodes. That the aluminium produced at the base of the cell is removed.
- (c) This section of the question was well answered by the candidates who understood the question. Some of them identified the element Y with atomic number 12 as Mg. Hence, all their responses were centred on Mg instead of Y.
- (d) Most of the candidates were able to calculate the time taken for the deposition of 5.4 g of Ag when a current of 10 A was passed through a silver voltameter. The only challenge was that they failed to write the reduction equation for silver ions;  
i.e.  $\text{Ag}^+_{(aq)} + \text{e}^- \rightarrow \text{Ag}(s)$ .

### Question 3

- (a) Study the following reaction scheme:



- (i) Name each of the substances A, D and E.  
 (ii) Name each of the reagents X, Y and Z.  
 (iii) Explain briefly how substance D could be tested in the laboratory.  
 (iv) Name processes 1, 2 and 6.  
 (v) State the process used in converting ethene to plastic.

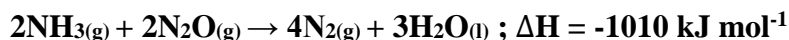
- (b) Consider the following equation:  
 $2\text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + \text{H}_2\text{O}$   
 What mass of  $\text{Na}_2\text{SO}_4$  would be formed if  $1000 \text{ cm}^3$  of  $0.10 \text{ mol dm}^{-3}$   $\text{NaOH}$  solution is neutralized by  $0.10 \text{ mol dm}^{-3}$   $\text{H}_2\text{SO}_4$ .  
 [ $\text{Na}_2\text{SO}_4 = 142$ ]
- (c) Consider the following electron configuration:
- |      |      |        |        |        |
|------|------|--------|--------|--------|
| ↑↓   | ↑    | ↑↑     | ↑      |        |
| $1s$ | $2s$ | $2p_x$ | $2p_y$ | $2p_z$ |
- (i) State which rules have been violated by the model.  
 (ii) Give a reason for each of the answers stated in (i).  
 (iii) Write the correct electron configuration.
- (d) Name two building blocks of matter.

Some candidates avoided this question because there were some aspects of organic chemistry.

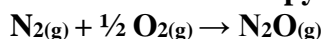
- (a) (i) Those who understood the question and had read enough organic chemistry were able to answer this question by providing the appropriate responses. Substances A, D and E were identified as Ethanoic acid, Hydrogen and Ethylethanoate respectively. However, few candidates wrote their formulae instead of names as demanded of the question.
- (ii) The names of reagents X, Y and Z were given and their alternatives, in case the arrows were in the opposite direction. So either way the candidate provides the answer, he/she will score. However, most of them considered it the way expected and not the reverse.
- (iii) Substance D was identified as Hydrogen hence the test for the gas. Only few candidates could provide the test for hydrogen as giving a pop sound with a lighted / glowing splint.
- (iv) Name of processes, 1, 2 and 6 were clearly provided.
- (v) The process of converting ethene to plastics was well answered by all the candidates as polymerization.
- (b) Almost 90% of the candidates who attempted this question were able to provide the correct answer. This shows that their understanding in the test of practical / volumetric analysis is good.
- (c) Again, most of the candidates who attempted this question performed very well. They were able to state the rule that was violated. However, as to the reason for their answer, about half of them just quoted the rules without using the given electron configuration as their reference.
- (d) Most of the candidates were able to state the building blocks of matter as atoms, ions and molecules. Few were mentioning electrons, protons and neutrons.

#### Question 4

- (a) Consider the following reaction equations:



Calculate the enthalpy change for the reaction:



- (b) (i) State two factors that affect the stability of a nuclide.



- (ii) **If the half-life of polonium -214 is  $1.6 \times 10^{-4}$  seconds, how long would it take for polonium to undergo a 10% decay.**
- (c) (i) **Explain why the reaction of alkenes are described as electrophilic addition reactions.**
- (ii) **State which of the following species are electrophiles:**  
 $\text{AlCl}_3, \text{OH}^-, \text{H}_2\text{O}, \text{Br}^+, \text{NH}_3$
- (d) (i) **Define the term lattice energy.**
- (ii) **State two factors that can affect the lattice energy of an ionic compound.**

About 50% of the candidates attempted this question but performed poorly in sections (a) and (c).

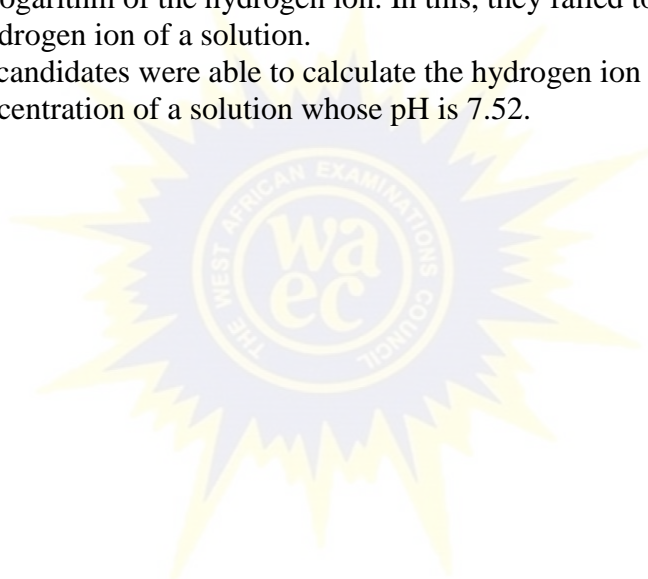
- (a) Only few candidates were able to calculate the enthalpy change for a reaction given the enthalpies of the various reaction steps for the overall reaction.  
The task involved in this question was the use of the Hess's law of constant heat summation. When a reaction is reversed, it's enthalpy also reverses in sign, when the reaction is multiplied by an integer, the value of the enthalpy is also multiplied in the same manner.  
These operations are carried out and the manipulations done to achieve the given reaction of interest.
- (b) (i) Almost all the candidates were able to state the factors that affect the stability of a nuclide.
- (ii) Again, candidates were able to calculate the time taken for a radioactive nuclide to decay given the half life by using the rate law for the first order reaction. This is a commendable feature identified.
- (c) Candidates could not explain why alkenes are described as electrophilic addition reaction. The candidates did not understand the term electrophilic addition. Therefore, they could not select species that are electrophiles from the list:  $\text{AlCl}_3, \text{OH}^-, \text{H}_2\text{O}, \text{Br}^+$  and  $\text{NH}_3$ .  
The requirement was that, the alkene double bond can be splitted for other groups / atoms to add on which is addition reaction. Because the bond is splitted, it serves as an electron rich site, making it vulnerable to attack by electron – loving reagents (electrophiles).  
Hence, electron deficient species are electrophiles; species with empty orbital to accommodate electrons are electrophiles.
- (d) Most candidates were able to define lattice energy but could not state the factors that affect it. Most of them used atomic size instead of ionic size.

### **Question 5**

- (a) (i) **What is inductive effect?**
  - (ii) **Explain briefly why chloroethanoic acid is a stronger acid than ethanoic acid.**
  - (b) (i) **What are isotopes?**
  - (ii) **Why does Uranium-238 atom split up?**
  - (iii) **State one difference between nuclear fission and nuclear fusion.**
  - (c) **Outline the process for the purification of bauxite.**
  - (d) (i) **Define pH.**
  - (ii) **A solution has a pH of 7.52.**  
**Calculate its:**
    - ( $\alpha$ ) **hydrogen ion concentration;**
    - ( $\beta$ ) **hydroxide ion concentration.**
- $[\text{K}_w = 1.0 \times 10^{-14} \text{ mol}^2 \text{ dm}^{-6}]$**

About 90% of the candidates attempted this question and performed well on sections (b) (c) and (d).

- (a) (i) Most of the candidates were able to explain what inductive effect is. However, they were missing the electron pulling ability of an atom or group of bonded atoms relative to the hydrogen atom.
- (ii) Only few candidates were able to explain why chloroethanoic acid is stronger acid than ethanoic acid. They failed to recognize that the chlorine atom is electron withdrawing and pulls / attracts electrons in the O – H bond of the – COOH more towards the oxygen thereby facilitating the easy loss / production of  $H^+$  into solution.
- (b) Candidates were able to state what isotopes are, why uranium -238 atom split up and the differences between nuclear fission and nuclear fusion. This again is a commendable feature identified.
- (c) Candidates misconstrued the purification of bauxite for extraction / manufacture of aluminium. Candidates were talking about electrolysis of alumina with molten cryolite. Candidates were talking about electrolysis of alumina with molten cryolite. In the outline, most of the candidates failed to mention the seeding of the filtrate of the aluminate with  $Al(OH)_3$  to precipitate all aluminium in the form of  $Al(OH)_3$ .
- (d) (i) Majority of the candidates were able to define pH. However, few of them defined it as negative logarithm of the hydrogen ion. In this, they failed to mention ions of the hydrogen ion of a solution.
- (ii) Almost all the candidates were able to calculate the hydrogen ion concentration and hydroxide ion concentration of a solution whose pH is 7.52.



## CHEMISTRY 3

### 1. GENERAL COMMENTS

The standard of the paper compared favourably with the previous years. The candidates performed better this year.

In some cases candidates performed tests that were not required  
Regrettably many of the candidates wrote the formulae of reagents stated in the questions wrongly.

### 2. SUMMARY OF CANDIDATES' STRENGTHS

The responses given by the candidates that need commendations are:

- (1) they drew the titration tables, qualitative analysis tables very well and neat
- (2) stated mole ratios correctly;
- (3) there is an improvement in writing of values / figures of concentrations to 3 significant figures;
- (4) correct units were also stated;
- (5) colours and type of precipitates were stated;
- (6) candidates followed instructions well and did the tests as demanded by the questions;
- (7) correct inferences and observations were stated by most candidates except few who jammed things up;
- (8) improvement in the use of concordant titre for averaging;
- (9) performance for qualitative analysis in general was encouraging this year.

### 3. SUMMARY OF WEAKNESSES

- (1) Candidates failed to acknowledge that a figure 0 after the decimal point does not count in writing significant figures but can only be included if it appears after a number e.g. 1, 2, 3 etc 0.037 is not 38 g figures but 0.0370.
- (2) They also failed to state clearly when a precipitate is formed in drops of reagents and whether the precipitate dissolved in excess or not.
- (3) They did not know the reactions of dilute acids on salts, that they either evolve gas, dissolve precipitate or have no reaction on the salts.
- (4) They lack experience on practical activities which help them answer question 3 of the alternatives.
- (5) Many of the candidates cancelled table of titre values and made new ones.
- (6) Some candidates also tabulated their titre values in pencil before converting to ink.
- (7) In some cases candidates performed tests that were not required.
- (8) Regrettably many of the candidates wrote the formulae of reagents stated in the questions wrongly.

#### 4. SUGGESTED REMEDIES

- (1) Teachers should do more hands on activities with their candidates, explain chemical terms and concepts to the students. They should not wait until examination instructions are sent before they start to perform practical with their students.
- (2) Teachers should collect practical exercise books from the students, mark and discuss their strengths and weaknesses with them and advise them to work independently.
- (3) Heads of schools must ensure that the schools have well equipped science laboratories with the materials for practical work. They must also endeavour to motivate the science teachers.
- (4) Teachers on their part must make time to cover all the topics including practical activities in the syllabus.
- (5) Students must also be encouraged to attend practical classes.

#### 5. DETAILED COMMENTS

##### ALTERNATIVE A

##### Question 1

**A is a solution containing 2.03 g of hydrochloric acid per 500 cm<sup>3</sup> of solution.**

**B is 0.12 mol dm<sup>-3</sup> solution of an alkali.**

- (a) **Put A into the burette and titrate it with 20.0 cm<sup>3</sup> or 25.0 cm<sup>3</sup> portions of B using methyl orange as indicator.**

**Repeat the titration to obtain concordant titre values.**

**Tabulate your results and calculate the average volume of A used.**

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

- (i) **concentration of A in mol dm<sup>-3</sup>,**
- (ii) **number of moles of acid in the average titre;**
- (iii) **number of moles of alkali in the volume of B pipetted;**
- (iv) **mole ratio of acid to base in the reaction.**

**[H = 1.0, Cl = 35.5]**

##### Question 2

**C is a mixture of two inorganic salts. 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 beaker and add about 10 cm<sup>3</sup> of distilled water. Stir well and then filter. Keep both the filtrate and the residue.**
- (b) (i) **To about 2 cm<sup>3</sup> of the filtrate, add aqueous NaOH in drops and then in excess.**
- (ii) **Warm the mixture in (b)(i).**

- (iii) To another 2 cm<sup>3</sup> portions of the filtrate, add few drops of BaCl<sub>2</sub> solution and then add HCl<sub>(aq)</sub> in excess.
- (c) (i) Put all the residue into a clean test tube and add HNO<sub>3(aq)</sub>.  
(ii) To a portion of the solution from (c)(i) add aqueous ammonia in drops and then in excess.

### Question 3

- (a) A student obtained an average titre value of 23.50 cm<sup>3</sup> after three sets of titrations. The students then carried out a fourth titration, but added about 15 cm<sup>3</sup> of distilled water to the base before titration.
- (i) State how this would affect the new titre value.  
(ii) Give a reason for your answer stated in (i).
- (b) State what would be observed when:
- (i) copper turnings are added to ZnSO<sub>4</sub> solution with stirring;  
(ii) some pellets of KOH are exposed for two hours in a watch glass;  
(iii) few drops of phenolphthalein solution are added to the content of the watch glass in (ii).
- (c) When a few drops of NaOH<sub>(aq)</sub> is added to a solution of Zn<sup>2+</sup> ions, a precipitate forms but on adding excess of the reagent the precipitate dissolves. Explain briefly this observation.

### ALTERNATIVE A

#### Question 1

Performance was quite good. The following points must however be noted.

Q1(b) Quite a number of the candidates assumed the alkali to be NaOH. Hence used mole ratio of acid to base (1:1) to calculate the concentration of A in mol dm<sup>-3</sup>.

However, question expects candidates to use information provided to calculate mass concentration and molar mass of A (HCl) before proceeding to calculate the con. Of A in mol dm<sup>-3</sup>.

#### Question 2

This question was not handled satisfactorily by a significant number of candidates. Precipitates were incorrectly described, gases were wrongly identified and inferences did not correspond to the recorded observations.

#### Question 3

Candidates performed poorly in this question.

- (a) Candidates were asked to explain effect of adding water to the base before titrating. It was to test candidates' knowledge on properties of water and its effects on dilution of solution. Almost all the candidates failed to answer and bring out the effect of water on the titre value which is neutral but rather focused on the reason. That is it will have no effect on the titre value. The concept in respect of moles of base remain unchanged in the exercise of this nature should be explained to students.

- (b) This part was somehow done quite well by the candidates:
- Copper –  $\text{ZnCO}_3$  will give no reaction;
  - KOH absorbs water and dissolves to form a solution. Many of the candidates described KOH as hygroscopic instead of deliquescent;
  - this was correctly stated that it is pink whilst some stated that it will be purple which is wrong.
- (c) Most of the candidates were able to state the precipitate formed as  $\text{Zn(OH)}_2$  but were confused with the complex salt formed i.e.  $\text{Na}_2\text{ZnO}_2$ .

## ALTERNATIVE B

### Question 1

**D** is a solution containing  $x \text{ g dm}^{-3}$  of ethanedioic acid.

**E** is  $0.100 \text{ mol dm}^{-3}$  sodium hydroxide.

- (a) Put **D** into the burette and titrate it against  $20.0 \text{ cm}^3$  or  $25.0 \text{ cm}^3$  portions of **E** using phenolphthalein as indicator.  
 Repeat the titration to obtain concordant titre values.  
 Tabulate your results and calculate the average volume of acid used.  
 The equation for the reaction is:  

$$\text{H}_2\text{C}_2\text{O}_4(\text{aq}) + 2\text{NaOH}(\text{aq}) \rightarrow \text{Na}_2\text{C}_2\text{O}_4(\text{aq}) + 2\text{H}_2\text{O}(\text{l})$$
- (b) From your results and the information provided, calculate the:
- concentration of **D** in  $\text{mol dm}^{-3}$ ;
  - value of  $x$ ;
  - volume of solution **D** that would neutralize a solution containing  $0.025$  moles of sodium hydroxide.  
 [H = 1.0; C = 12.0; O = 16.0]

### Question 2

**K** is a solution of an inorganic salt

**L** is a solution of a trioxonitrate (V) salt

Carry out the following exercises on **K** and **L**

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

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

- (a)
- To about  $2 \text{ cm}^3$  of **K**, add  $\text{NaOH}(\text{aq})$  in drops and then in excess
  - To another  $2 \text{ cm}^3$  of **K**, add  $\text{AgNO}_3(\text{aq})$  followed by  $\text{HNO}_3(\text{aq})$  and then  $\text{NH}_3(\text{aq})$  in drops and then in excess
- (b)
- To about  $2 \text{ cm}^3$  portion of **L**, add  $\text{NH}_3(\text{aq})$  in drops then in excess
  - To another  $2 \text{ cm}^3$  portion of **L**, add about  $2 \text{ cm}^3$  of **K** boil the mixture and then allow to cool.

- (c) (i) State two reagents that could be used to identify the anion present in L.  
(ii) State what would be observed on addition of the reagents stated in (i).

### Question 3

- (a) (i) What are acid-base indicators?  
(ii) Name a suitable indicator for titrating a weak acid against a strong base.  
(iii) Give a reason for your answer in (ii).
- (b) Give a reason for each of the following laboratory practices:  
(i) The first jar of hydrogen gas collected during its preparation is discarded.  
(ii) Why the conical flask is not rinsed with the solution to be put in it during titration.

### ALTERNATIVE B

#### Question 1

Candidates did quite well. The following points must however be noted. Q1(a) Few of the candidates could not write the formula of ethanedioic acid correctly. All the same, they used the mole ratio correctly to calculate the conc. of D in  $\text{mol dm}^{-3}$ . Unfortunately, many of them attached unit to the value of X in b(ii) and lost the mark.

- (b) Many of the candidates wrote:  
(i)  $\text{FeSO}_4$  instead of freshly prepared  $\text{FeSO}_4$   
(ii) Formation of brown gas instead of brown ring
- (c)(i) A number of the candidates gave the answer as: Jar contains 'a mixture of air and oxygen' instead of 'a mixture of air and hydrogen'.  
(iii) The question was answered fairly but most candidates lost some marks because they were confused about the unit of the volume either in  $\text{dm}^3$  or  $\text{cm}^3$ . Any of the unit is correct.

#### Question 2

The question was poorly answered by some candidates leading to loss of vital marks. Some candidates did not follow instructions. They messed up doing wrong tests. Some of them were reporting on solution C and not L and K. It will be good if candidates report correctly what they observe in order to give correct inferences

This part especially was not answered well. Candidates were expected to add L + K and heat then cool. Some stated that gas evolved. When L is added to K, a white precipitate is formed which dissolves on heating and reappears on cooling i.e.  $\text{PbCl}_2$ .

#### Question 3

This question was answered well by most candidates.

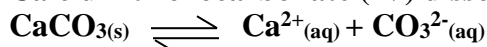
- (i) The definition of acid-base indicators was well stated. They are organic acids or bases or dyes and change colour in acidic or basic medium.  
(ii) It was well answered; most of them stated phenolphthalein as the indicator.

- (iii) It was not well explained. They failed to mention that slightly alkaline solution is formed at the end point, and the indicator that can change colour in the alkaline region is phenolphthalein. They were talking about hydrolysis to form basic solution so phenolphthalein is used.
- b(i) A number of the candidates gave the answer as jar contains a mixture of air and oxygen instead of a mixture of air and hydrogen.

## ALTERNATIVE C

### Question 1

Calcium trioxocarbonate (IV) dissociates in water as follows:



The solubility product,  $K_{sp}$ , of  $\text{CaCO}_3$  at a given temperature is given by the expression  $K_{sp} = [\text{Ca}^{2+}][\text{CO}_3^{2-}]$ . Therefore the value of  $K_{sp}$  can be calculated if the concentrations of  $\text{Ca}^{2+}$  and  $\text{CO}_3^{2-}$  are known.

G is  $0.100 \text{ mol dm}^{-3}$  HCl.

H is a saturated solution of calcium trioxocarbonate (IV) in water at  $30^\circ\text{C}$ .

- (a) Put G into the burette  $20.0 \text{ cm}^3$  or  $25.0 \text{ cm}^3$  of H into a conical flask.  
Titrate H against G using phenolphthalein as indicator.  
Repeat the titration to obtain concordant titre values  
Tabulate your results and calculate the average volume of G used.
- (b) From your results and the information provided:
- calculate the concentration in  $\text{mol dm}^{-3}$  of  $\text{CaCO}_3$  in H.
  - deduce the concentration of  $\text{Ca}^{2+}$  and  $\text{CO}_3^{2-}$  ions in  $\text{mol dm}^{-3}$ .
  - calculate the solubility product,  $K_{sp}$ , of  $\text{CaCO}_3$  at  $30^\circ\text{C}$ .
  - If the  $K_{sp}$  of  $\text{CaCO}_3$  at  $50^\circ\text{C}$  is higher than at  $30^\circ\text{C}$ , state whether the solubility of  $\text{CaCO}_3$  in water increases or decreases with increasing temperature.

The equation of the reaction is:



### Question 2

J is a mixture of two compounds. Perform the following exercises on J.

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

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

- (a) Dissolve all of J in about  $10 \text{ cm}^3$  of distilled water. Stir the mixture and filter.  
Keep both the filtrate and the residue.
- (b) (i) To about  $2 \text{ cm}^3$  portion of the filtrate, add  $\text{BaCl}_{2(aq)}$  followed by dilute HCl.  
(ii) To another  $2 \text{ cm}^3$  portion of the filtrate, add acidified  $\text{K}_2\text{Cr}_2\text{O}_7$  solution.
- (c) Put all the residue into a clean test tube and add about  $5 \text{ cm}^3$  of dilute  $\text{H}_2\text{SO}_4$  and warm the mixture. Divide the resulting solution into two portions.
- to the first portion add  $\text{NaOH}_{(aq)}$  in drops and then in excess.
  - to the second portion add  $\text{NH}_3(aq)$  in drops and then in excess.



### Question 3

- (a) State what would be observed on carrying out each of the following exercises:
- adding a few drops of methyl orange indicator to lime juice;
  - adding dilute  $\text{H}_2\text{SO}_4$  to  $\text{Pb}(\text{NO}_3)_2$  solution;
  - exposing a fresh precipitate of silver chloride to sunlight for 30 minutes;
  - adding few drops of concentrated  $\text{HNO}_3$  to acidified  $\text{FeSO}_4$  solution.
- (b) When aqueous  $\text{HCl}$  is added to the deep blue solution obtained on adding excess aqueous ammonia to a solution of  $\text{Cu}^{2+}$  ions, the solution becomes pale blue. Explain briefly this observation.
- (c) State a reagent that could be used to distinguish between  $\text{CaCl}_2(\text{aq})$  and  $\text{CuCl}_2(\text{aq})$ .

### ALTERNATIVE C

#### Question 1

General performance of candidates in this question was good. The concentration of the  $\text{CaCO}_3$  in H was calculated well and the concentration of the  $\text{Ca}^{+2}$  ion and  $\text{CO}_3^{2-}$  were equated to the concentration of the  $\text{CaCO}_3$  in the equation of the reaction.

The solubility product of the  $\text{CaCO}_3$  was also calculated by using the equation. Few of them could not deduce the correct unit for the  $K_{sp}$  which is  $\text{mol}^2 \text{dm}^{-6}$ .

(iv) This part of the question on the effect of temperature on solubility of  $\text{CaCO}_3$  was misunderstood by several candidates or got confused. Those who had the explanation correct explained that the solubility of  $\text{CaCO}_3$  will increase with increasing temperature whereas those who did not understand the question wrote that the solubility will decrease with increase in temperature.

#### Question 2

This question was done fairly well by majority of the candidates who answered it. Candidates were able to state both observations well and the inferences e.g. when the filtrate was used with  $\text{K}_2\text{Cr}_2\text{O}_7$  they brought out the correct initial colour of orange and the final colour which is green, however some stated that it will change from yellow to green which is wrong. They stated the type of reagent that is reducing agent but failed to name the anion present which is  $\text{SO}_3^{2-}$ . They could not relate the anion to the inference in (b)(i).

Residue +  $\text{H}_2\text{SO}_4(\text{aq})$  + warm. Majority observed the dissolution of the residue to form a blue solution whilst others were observing a gas. I think they only know that a dilute acid will always give off gases when added to a salt or precipitate. There was no evolution of a gas.

Again, some candidates could not identify a precipitate in the addition of drops of  $\text{NH}_3(\text{aq})$  but in the excess alkali were able to see precipitate dissolved to form deep blue solution. Teachers must teach candidates what a drop of reagents is and how to add excess. These tests are different and the observations are also different.

#### Question 3

(a) (i) & (ii) These questions were answered correctly by the candidates. The change of the colour to pink/red when methyl orange is added to lime juice and when  $\text{H}_2\text{SO}_4$  is added to  $\text{Pb}(\text{NO}_3)_2$  it forms a white precipitate.

- (iii) The exposure of freshly prepared  $\text{AgNO}_3$  to sunlight for 30 minutes. Almost all candidates score zero. The answers they gave were the colour will change from colourless to pink grayish white to orange etc. the correct answer turns grey then to black.
- (iv) The change of colour of  $\text{FeSO}_4$  when Conc.  $\text{H}_2\text{SO}_4$  is added. Though some candidates got the green colour they stated a gas will be evolved, the colour will change from green to reddish brown, a brown precipitate will be formed, and many of the candidates simply gave the answer as solution changes to brown instead of solution changes from (pale) green to brown.

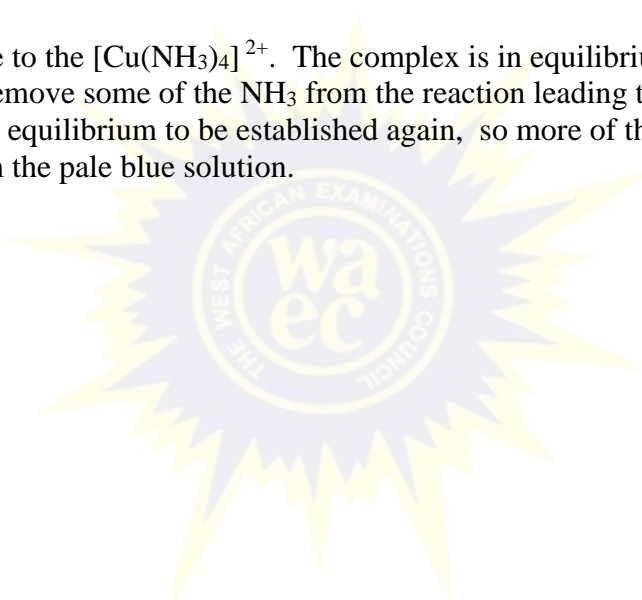
- (b) This question was poorly answered revealing that most candidates did not understand the concept of solubility and equilibrium reactions.

From the knowledge of Equilibrium reactions, candidates could have known the effect of adding a reagent that will remove or reduce any of the reactant or products from the reaction. The deep blue colour suggest a complex ion is formed that is  $[\text{Cu}(\text{NH}_3)_4]^{2+}$  and the pale blue colour means  $\text{Cu}^{2+}$  ions is formed.

When  $\text{HCl}$  is added it will react with  $\text{NH}_3$ . This is an equilibrium reaction.

$\text{Cu}^{2+}_{(\text{aq})} + 4\text{NH}_{3(\text{aq})} \rightleftharpoons [\text{Cu}(\text{NH}_3)_4]^{2+}$  and the reaction will move backwards that is the equilibrium will shift to the left or backwards.

The blue colour is due to the  $[\text{Cu}(\text{NH}_3)_4]^{2+}$ . The complex is in equilibrium with  $\text{NH}_3$ , which means it will remove some of the  $\text{NH}_3$  from the reaction leading to a backward shift for the equilibrium to be established again, so more of the  $\text{Cu}^{2+}$  will be in the solution to form the pale blue solution.



## CROP HUSBANDRY AND HORTICULTURE 2

### 1. GENERAL COMMENTS

The standard of the paper in terms of both level of difficulty and syllabus coverage compares favourably with those of previous years. However, candidates' performance was generally lower than last year.

### 2. SUMMARY OF CANDIDATES' STRENGTHS

The Chief Examiner commended candidates for the following features noticed in their scripts:

- (1) Most candidates obeyed the rubrics of the paper including answering one question only on a page.
- (2) Good number of candidates exhibited adequate knowledge of the principles and advantages of crop rotation, importance of nursery in crop production.
- (3) Some candidates satisfactorily discussed characteristics of weed dispersal by wind and characteristics of crop improvement program.

### 3. SUMMARY OF CANDIDATES' WEAKNESSES

The Chief Examiner notices the following weaknesses in the scripts of candidates:

- (1) A number of candidates could not spell technical terms and scientific words correctly.
- (2) Most of the candidates could not adequately explain the following horticultural terms; inter cropping, relay planting and phase planting.
- (3) Candidates' knowledge of weed dispersal by animals and cultivation of sugar cane was poor.

### 4. SUGGESTED REMEDIES

The Chief Examiner made the following suggestions meant to remedy the weaknesses of candidates:

- (1) Teachers should periodically use question and answer to drill students on scientific words and technical terms.
- (2) Concerted efforts should be made by students to cover the entire syllabus especially in the area of Horticultural terms and Quality and Safety Standards in food industry.
- (3) Candidates should cultivate the habit of articulating their views correctly and concisely using good language.

### 5. DETAILED COMMENTS

#### Question 1

- (a) (i) Explain four principles that are considered when practicing crop rotation.  
(ii) State four advantages of crop rotation.
- (b) Explain each of the following cropping systems:
  - (i) Intercropping;
  - (ii) Phased planting;
  - (iii) Relay planting.
- (c) State two advantages of intercropping.

Many candidates dealt with this question quite admirably as it was a popular option for many candidates. They presented their responses as expected in the way and manner that was required as shown below.

(a) (i) Principles of Crop Rotation

- **Crops from the same family:** Crops from the same family should not follow each other in sequence since they are attacked by same pests/diseases.
- **Inclusion of fallow periods or legumes:** This facilitate fixing of atmospheric nitrogen into the soil
- **Feeding at different levels:** Shallow rooted crop should follow deep rooted crop in a rotation whiles deep rooted crop should follow shallow rooted crop to make nutrient available for crop growth and development
- **Degree of nutrient uptake:** Crops that feed heavily from the soil should follow those that feed lightly from the soil
- **Duration of growth/similarity of life cycle:** Crop being used should have similar life cycle or duration of growth

(ii) Advantages of crop rotation

- It helps to reduce application of chemicals/ it is environmentally friendly
- Crop rotation increases soil fertility
- It increases soil organic matter contributed by left over plant materials
- Crop rotation results in increased crop yield
- It reduces soil erosion
- It controls pests
- Helps to control weeds on crop
- It improves soil structure
- It controls diseases
- The farmer gets different crops from the same piece of land

(b) Explanation of cropping system

(i) Intercropping: It is a type of mixed cropping in which short term annuals or quick growing crops are planted through long term annuals or slow growing crops. **OR**

It involves cultivating two or more crops in a field simultaneously.

(ii) Phased planting: It is a type of mixed cropping in which planting dates are systematically arranged to ensure continuous sequence of growth and harvesting.

(iii) Relay planting: It is a type of intercropping which involves following one crop with another immediately before harvesting the first crop. **OR**

Is the growing period of two crops overlaps.

(c) Advantages of intercropping

- It provides insurance against crop failure
- The farmer harvest different crops at different times to ensure continuous food supply over a long period of time/ensures food security
- It protects the soil from erosion since different crops grown, grow at different levels that checks erosion.
- Weed build up associated with a particular crop can be minimised
- Nutrients in the soil is judiciously utilised

- It results in higher crop yield
- When legumes are involved in the intercropping, atmospheric nitrogen is fixed into the soil.

## **Question 2**

- (a) **Discuss the cultivation of sugar cane under each of the following headings:**
- (i) **Soil and climatic requirement;**
  - (ii) **Land preparation;**
  - (iii) **Planting materials.**
- (b) **Name four diseases that attack sugar cane plants.**
- (c) **Describe the steps involved in the processing of sugar cane into white sugar.**

Candidates who selected this question were not able to properly discuss the cultivation of sugar cane under the selected thematic areas. There was a general malaise in how many of them elaborated the points that were required to score the Marks allotted to the question.

Diseases that attack sugar cane plants were well stated by many candidates.

The steps involved in processing of sugar cane to white sugar was not stated in chronological or sequential order by many students. The expected responses to the question is shown below

(a) Cultivation of Sugarcane

(i) Climatic requirement/soil

- Optimum temperature of between 32°C - 40°C.
- A total rainfall between 1,100 and 1,500mm.
- Grown in clayey/ marshy/waterlog/muddy/high water table areas.

(Any soil with some amount of clay is correct)

(ii) Land preparation

- Clearing of land.
- Ploughing of land to a depth of 30cm.
- Incorporate thrash into the soil.
- Making of raised beds/ ridges/ furrows.

(iii) Planting materials

- Short setts.
- Long setts.
- Soldier setts.
- Mini setts.

(b) Diseases of Sugarcane plant

- Red rot.
- Chlorosis.
- Gummosis.
- Ratoon Stunting.
- Sugarcane smut.

- (c) Description of steps involved in processing sugarcane into white sugar
- **Crushing:** Freshly harvested sugarcane is sent to the factory, weighed and fed into a crushing machine which squeezes out the juice leaving the bagasse.
  - **Clarification:** The juice collected is mixed with  $\text{Ca(OH)}_2$  to settle particles. They are then heated to obtain a precipitate called filter cake which is also filtered out leaving clear liquid..
  - **Concentration:** The clear liquid is evaporated by heating to give a thick liquid called massequite, containing sugar and molasses.
  - **Crystallization:** The massequite is centrifuged to separate the sugar from the molasses.
  - **Refining:** The sugar obtained is then refined to make it white.

### Question 3

- (a) (i) **State four ways in which nursery is important in crop production.**  
(ii) **Mention two activities that are carried out during hardening-off of seedlings at the nursery.**
- (b) **Explain three good quality attributes of vegetables that are demanded by consumers.**
- (c) (i) **List four diseases of okra.**  
(ii) **State four symptoms of gummosis in citrus.**

Candidates who attempted this question were able to outline satisfactorily the importance of nursery in crop production, however candidates' could not list activities that are carried out during hardening-off of seedlings but instead provided the reasons for carrying out hardening-off of seedlings. Candidates performed creditably well in listing the attributes of good quality vegetables, diseases of okra and symptoms of gummosis in citrus. The expected responses are provided below.

- (a) (i) Importance of nursery in crop production
- To promote conditions favourable for growth of seedlings
  - To give seedlings a good start.
  - To ensure that only good proven seedlings are transplanted.
  - To prevent wasting of planting materials.
  - Some seeds can only be propagated when nursed since they are too small or fragile to be planted at stake or directly..
- (ii) Activities during hardening-off
- Gradually remove shade/ gradual exposure to sunlight.
  - Gradually withdraw water or reduce the rate of frequency of watering / irrigation.
  - Gradually expose seedlings to high temperature.
- (b) Good quality attributes vegetables demanded by customers
- Colour: Should exhibit the true colour of the type of vegetable and should be uniform.
  - Freshness: Vegetables should be firm, crispy devoid of wringles and should be tender.
  - Ripeness: Should not over ripe though it should ripe or moderately ripe.

- Flavour: The taste of the vegetable should be good and give normal scent.
- Chemicals: Free from any harmful chemicals.
- Free from diseases: Vegetables should be free from diseases.
- Free from pests: Vegetables should be free from pests.
- Cleanliness: Vegetables should not be dirty.
- Nutritive value: Vegetables should have high nutritive value.
- Shape/size: Should show the normal shape and size.

(c) (i) Diseases of Okra

- Charcoal rot;
- Fusarium wilt;
- Powdery mildew;
- Southern blight;
- White mould;
- Leaf curl;
- Yellow vein mosaic .

(ii) Symptoms of Gummosis

- New shoots and leaves of affected plants may turn yellow.
- Sunken lesions develop on the bark of affected plants.
- Curly threads may grow on the bark as the diseases progresses.
- Leaves of affected plants turn brown and drops.
- Premature fruit drops off affected plants.
- The disease kills the wood underneath/cankers often cause whole branch to die.

**Question 4**

- (a) (i) **Explain the term *crop improvement* as used in crop production.**  
 (ii) **State four objectives of crop improvement programme.**
- (b) **State four disadvantages of planting poor quality seeds.**
- (c) **Explain each of the following terms as used in crop production.**  
 (i) **scion;**  
 (ii) **rootstock;**  
 (iii) **apomictic seed.**
- (d) **Give the main difference between budding and grafting.**

This question was not very popular amongst candidates, candidates struggled to explain the term crop improvements but were able to outline the objectives of crop improvement satisfactorily.

Candidates struggled to list the disadvantages of planting poor quality seeds as well.

In explaining the terms stated in the question, Candidates could not define the terms satisfactorily, Few candidates were able to mention that the “scion” is the detached portion of a plant joined to a root stock.

Candidates could not explain the term rootstock with most candidates referring to it merely as the “down” part of a plant without relating it to grafting or budding.

In explaining the term “apomictic seed”, many candidates did not add that ‘it is formed from cells of the maternal ovule.

The differences between budding and grafting was not well articulated from the responses provided. The expected responses are as follows:

(i) Explanation of term

Crop improvement: It is the genetic manipulation of plants to produce enhanced characteristics of existing plants/offspring.

(ii) Objectives of crop improvement

- To improve the nutritive value of produce.
- To increase yield of crops.
- To improve quality of crops – It covers all. Therefore it scores only when no other point is made.
- To meet and satisfy the needs of consumers in terms of taste, flavour, colour etc..
- To promote early maturity.
- To improve the shelf life of produce.
- To increase resistance to pests and diseases.
- To produce crops that can adapt to varied climatic conditions.
- To produce crops with the desired morphological characteristics.
- To increase resistance to disease.

(b) Disadvantages of planting poor quality seeds

- Uneven maturity dates.
- Low yield.
- Poor quality farm produce.
- Uneven germination of seeds leading to poor crop cover.
- Seedlings are easily susceptible to pests and diseases..
- May be sources of disease pathogens and pests.
- Seedlings are easily susceptible to diseases.

(c) Explanation of terms

(i) Scion – It is a detached living portion of a plant such as bud/shoot joined to a stock in grafting/budding. OR

The part of graft union that grows to become the shoot.

(ii) Rootstock – It is the part of the graft union that grow to become the root.

(iii) Apomictic seed – Is the type of seed that are not derived from sexual process involving pollination and fertilization, but are formed from cells of the maternal ovule.

(d) Difference between budding and grafting

In budding, the scion is just a single detached bud **while** in grafting, the scion is a piece of detached shoot with a number of buds.



## Question 5

- (a) State three characteristics each of weed dispersed by each of the following agents:
- (i) wind;
  - (ii) animals.
- (b) Give four reasons why weeds are difficult to control on the farm.
- (c) Mention three examples each of the following types of ornamental plants:
- (i) hedging plants;
  - (ii) lawn grasses.

This was a very popular question amongst candidates, candidates answered satisfactorily the characteristics of weed dispersed by wind but were unable to deliver required accurate responses for weed dispersed by animals, they only considered that it passes through the digestive system of animals without stressing on an important feature of a hard seed coat.

Candidates gave acceptable reasons why weeds are difficult to control and provided adequate examples required in examples of hedging plants and lawn grasses.

Overall, this question received very good responses. Expected responses are shown below.

### Characteristics of weed seed dispersed by

#### (i) Wind

- Some are tiny/small/flat;
- Some are light in weight/powdery;
- Some possess parachute-like structures/ winged/hairs;
- Some are surrounded by thin papery membrane.

#### (ii) Animals

- are sticky;
- have hairs/hooks;
- have spines;
- have hard seed coat which pass through digestive system undigested;
- the seed should be in tasty/attractive fruit.

### (b) Reasons why weeds are difficult to control

- Ability to establish very fast from root, stem and seed.
- Produce large numbers of seeds per plant and colonise new areas very fast.
- Have an efficient dispersal mechanism e.g. wind, water etc.
- Have a wide range of adaptation.
- Can survive competition.
- Have a long period of dormancy and longevity.
- Some have structures that repel/ irritate herbivores/man.

### (c) Examples of ornamental plants

#### (i) Hedging plants

- Black eyed Susan - Thunbergia erecta
- Hibiscus (Chinese rose) – Hibiscus rosa-sinensis
- Duranta – Duranta plumier

- Lantana/mountain sage – Lantana camara
  - Ice plant – Breynia nivos
  - Bougainvillea, Purple bougainvillea, Bougainvillea glabra
  - Pride of Barbados – Caesalpinia pulcherrima
  - Ixora – Ixora spp
  - Yellow Bauhinia – Bauhinia tormentosa
  - Acalypha – Acalypha spp
  - Croton – Codiaeum variegatum
  - Madras thorn – Pithecellobium dulce
  - Plumbago – Plumbago carpensis
  - Milkbush/Yellow Oleander – Thevetia Peruviana
- (ii) Lawn grasses
- Paspalum – Paspalum conjugatum
  - Bahia grass – Paspalum notatum
  - Bahama grass/ Bermuda grass/doob grass/Indian couch/Devil grass – Cynodon dactylon
  - Carpet/Savannah grass – Axonopus compressus
  - Love/Tuttiri/Tafo grass- Chrysopogon aciculatus
  - St. Augustines grass/Bufallo grass – Stenotaphrum secundatum
  - Centipede grass – Eremochloa ophuroides
  - Japanese lawn grass/Japanese cushion grass – Zoysia japonica
  - Variegated stenotaphrum - Stenotaphrum secundatum var variegatum

### **Question 6**

- (a) **Outline the steps involved in preparing fresh pineapple fruits for export.**
- (b) **Describe the process of curing hot pepper.**
- (c) **State six in which horticultural plants are important**
- (d) **Mention four methods of preserving vegetables.**

Candidates who attempted this question struggled to respond accurately to the demands of the question. In outlining the steps involved in preparing fresh pineapple for export, many candidates stated assembling, cleaning, grading and packaging but failed to state them on sequential order hence they got it wrong. Many candidates could not adequately provide the process of curing pepper, most candidates only listed boiling and drying without stating the other important processes. Candidates also performed creditably well in outlining the importance of horticultural plants and hence scored high marks.

Responses on methods of preserving vegetables was below par with the most notable accurate responses being canning, drying and refrigeration but many candidates listed only one accurate method.

The expected responses to this question are shown below:

- (a) Steps involved in preparing fresh pineapple fruits for export
- harvest fruits when half ripe with about 2 cm to 3 cm stalk attached to the base;
  - transport to cleaning shed/Assembling;
  - separate/sort/remove bad fruits/rotten fruits/fruits with double crowns;

- grade fruits into sizes;
- pack into ventilated boxes;
- convey into storage depot;
- store fruits in cool stores/ environment to maintain their freshness for export.

(b) The process of curing hot pepper

- harvested fruits whether fully or half ripe are placed in a heap;
- cover with jute sack or bag, and leave to ripe fully;
- put them into boiling water for three to five minutes;
- remove fruits from boiling water;
- dry in the sun by spreading on concrete floor.

(c) Importance of horticultural plants

- Ensuring safety/prevention of accident
- Beautification of the environment
- Provide shade
- Research/scientific research purposes
- Purification of air
- Absorption of noise
- Medicinal purposes
- Recreational/social function
- Source of food
- Sold for income
- Screening off unsightly views
- Demarcation of lands
- Provision of privacy
- Soil bioremediation/soil enrichment
- Soil conservation/erosion control
- Reduction of soil moisture loss
- Direction of movement of people/pedestrians
- Direction of movement of vehicles
- Highlighting architecture/enhancing the beauty of architecture

(d) Methods of preserving vegetables

- Refrigeration/storing in low temperature environment
- Curing
- Pickling
- Drying
- Canning
- Milling and bottling/bagging

## **CROP HUSBANDRY AND HORTICULTURE 3**

### **1. GENERAL COMMENTS**

The standard of the paper in terms of both level of difficulty and syllabus coverage compares favourably with those of previous years.

However, candidates' performance is generally lower than last year.

### **2. SUMMARY OF CANDIDATES' STRENGTHS**

The Chief Examiner observed the following as some of the strengths of candidates:

- (1) Most of the candidates worked according to the rubrics of the paper.
- (2) A good number of candidates exhibited fairly good knowledge about the operation carried out on budded citrus seedling and reasons for carrying out budding.
- (3) Majority of the candidates were able to correctly identify a hand trowel and rake.

### **3. SUMMARY OF CANDIDATES' WEAKNESSES**

The Chief Examiner identified the following as weaknesses exhibited by candidates:

- (1) A number of candidates lacked understanding on correct uses of horticultural terminologies
- (2) Majority of the candidates could not write scientific names in the correct manner.
- (3) Some candidates could not state satisfactorily the difference between poultry manure and NPK fertilizer.

### **4. SUGGESTED REMEDIES**

The Chief Examiner recommended the following remedies:

- (1) Scientific words and horticultural terminologies should be carefully taught;
- (2) Concerted efforts should be made by students to cover the entire syllabus especially in the area of budding and grafting;
- (3) Practical lessons should be organized more frequently, supervised and discussed.

### **5. DETAILED COMMENTS**

#### **Question 1**

- (a) Give the scientific and family names of specimen A.
- (b) State three signs of maturity of specimen A on the field.
- (c) Give three reasons for timely harvesting of specimen A when it is matured.
- (d) A farmer planted specimen A at a spacing of 40 cm by 40 cm with one plant per stand. Determine the plant population per hectare.

- (a) A greater number of candidates could not write the scientific name and family name of specimen A. Only a handful of candidates scored a point. These names are Latin names and should therefore be underlined, the Genus starts with a capital letter while species name starts with a small letter; then they are underlined separately as shown below.

<u>Specimen</u>	<u>Scientific name</u>	<u>Family Name</u>
A	<i>Brassica oleracea</i> <i>var capitata</i>	<u>Cruciferae</u> <u>Brassicaceae</u>

- (c) Many candidates answered this question correctly. Some examples are given as follows  
Signs of maturity on the field

- the head becomes hard or firm/compact;
- the head becomes light green;
- no new leaves develop;
- the head grow large in size.

The remaining parts of this questions were also well answered by candidates and presented accurately as shown below:

- (c) Reasons for timely harvesting of Specimen A

- to maintain its freshness;
- to avoid rotting/reduce diseases;
- to avoid attack by insects / pests;
- to store well;
- to avoid the tendency of the head to burst.

- (d) Determination of plant population

$$\text{Planting population} = \frac{\text{Area}}{\text{Planting distance / spacing}}$$

$$\begin{aligned} \text{Spacing} &= 40 \text{ cm} \times 40 \text{ cm} \\ &= 0.4 \text{ m} \times 0.4 \text{ m} \\ &= 0.16 \text{ m}^2 \end{aligned}$$

$$1 \text{ ha} = 10,000 \text{ m}^2$$

$$\begin{aligned} \therefore \text{No. of plants needed per hectare} &= \frac{10,000 \text{ m}^2}{0.16 \text{ m}^2} \\ &= 62,500 \end{aligned}$$

$$\begin{aligned} \therefore \text{No. of plants needed for hectare} \\ &= \underline{62,500 \text{ plants}} \end{aligned}$$

## Question 2

- (a) State two observable differences between specimens B and C.

- (b) Give three benefits of applying specimen B on a farm.  
 (c) State three disadvantages associated with the use of specimen C on a farm.  
 (d) Mention three precautions that should be taken when applying specimen C on the farm.  
 (e) A vegetable farmer requires 200 kg of specimen C to apply on one-hectare farmland. Estimate the quantity of specimen C required for a farmland measuring 50 m by 40 m.

- (a) A greater number of candidates failed to score good marks for this part of the question. Few candidates were able to state that B is organic while C is inorganic.

Expected responses are as follows:

Observable difference between specimens

	<b>B (Poultry Manure)</b>	<b>C (NPK fertilizer)</b>
Colour	Brown / dark / mixture range of colour	grey / pale / whitish
Structure/shape	Amorphous / irregular / shapeless	granular
Consistency	Amorphous / irregular	uniform
Composition	Mixture/Heterogeneous	Homogeneous

- (b) Majority of candidates answered this question accurately. Popular responses include:

Benefits of B on a farm

- improves nutrient retention in the soil/it has low leach potential in the soil / nutrient do not leach easily/improves action and capacity;
- releases micro and macro nutrients over a long period of time upon decay;
- improves the water holding capacity of the soil;
- adds up to the organic matter conservation in the soil;
- binds soil particles together / improves soil structure;
- regulates soil temperature;
- buffers the soil / regulates soil pH;
- improves soil aeration.

- (c) This question was not well answered by candidates who attempted it. Expected responses include:

Disadvantages of using C (NPK fertilizer)

- it may cause excessive vegetative growth of the crop;
- it causes soil acidity if over applied;
- it causes excessive growth of weeds;
- it may destroy soil micro organisms;
- it may contaminate underground water;
- it destroys the soil structure;
- it releases of nutrients very fast and easily leading to fast loss of nutrients;
- it affects the shelf lives of some crops;
- it weakens stalk/stems of cereals if applied excessively;

- (d) Candidates considered mainly their body protection without thinking about the plant's protection as well when answering this question. Precautions to be taken when applying C include:

- avoid chemical coming into contact with the wet leaves of plants
- avoid chemical dropping in the funnel of plant

- avoid application very close to the base of plants
- ensure chemicals are incorporated into the soil
- apply on wet soils
- ensure uniform spread of fertilizer across the farm
- apply at the recommended stage of plant growth
- the farmer has to wear protective clothing

(e) Many candidates struggled to convert between hectare and m<sup>2</sup> which led to a zero score for many candidates who attempted this question. The expected response is:

Estimation of fertilizer required

Quantity per hectare = 200 kg  
 10,000 m<sup>2</sup> = 1 ha

Area to apply = 50 m x 40 m  
 2,000 m<sup>2</sup>

10,000 m<sup>2</sup> = 200 kg  
 $\therefore 2,000 \text{ m}^2 = \frac{200 \text{ kg} \times 2,000 \text{ m}^2}{10,000 \text{ m}^2}$   
40 kg

**Question 3**

- (a) **Identify specimens D, E and F by their common names.**
- (b) **State one method of propagation of each of specimens D, E and F.**
- (c) **State two ways by which specimen D is of economic importance.**
- (d) **Mention the class of ornamental plants to which each of specimens D, E and F belong.**
- (e) **State one external feature of each of specimens D, E and F.**
- (f) **Give one major reason for planting specimen F on a school compound.**

(a) Many students were able to answer this part of the question satisfactorily, however some candidates failed to write Amaranthus and Bryophyllum correctly. For specimen F, milk bush was a very popular response and an accurate one as well.

(b) This question was also very popular amongst candidates. They presented responses that met the demand of the question as shown below;

Method of propagating specimens

D	-	seeds
E	-	leaf/leaf cuttings
F	-	seed/stem cutting

(c) This section also adds to the increasing number of popular questions answered by candidates because the specimen D is a very popular vegetable in many homes in Ghana and many students may have seen in practical terms and or real life, livestock feeding on specimen D.

- (d) Candidates who attempted the question failed to meet the requirements required to score this section. The expected responses are as shown below:

Class of ornamental plants

Specimen D	-	Bedding plant
Specimen E	-	House plant / Bedding
Specimen F	-	Hedging plant

- (e) Candidates who attempted this question did not stick to the demands of the question. Many candidates presented responses on general features of the listed specimen failing to focus precisely on the external features leading to loss of marks for most candidates that attempted this question. The expected responses were:

D	-	Numerous seeds
	-	Coloured flowers
	-	Broad and fleshy leaves
	-	Fleshy stem
E	-	broad and fleshy leaves
	-	leaves with cerrated edges
	-	succulent leaves
	-	succulent stem
F	-	woody stem
	-	narrow leaves
	-	white sticky sap / milky sap
	-	yellowish funnel shaped flowers

- (f) This question was well answered by many candidates with the main response being “to beautify the school compound” However, it could also be planted to serve other purposes like:
- demarcation of plots;
  - beautification;
  - screening;
  - direction of students/pupils and vehicular movement.

**Question 4**

- (a) **State one function of each of specimens G, H and J.**
- (b) **Mention one other tool that could be used to perform similar operations as each of specimens G, H and J.**
- (c) **Draw and label fully specimen H.**
- (d) **State four ways in which specimen J could be maintained after use.**

- (a) Many candidates were able to identify specimens with their functions. However some students could not properly state the function of specimen H. The expected responses are as shown below:



## Function of Specimens

### G (Hand trowel)

- for transplanting seedlings
- for filling (plastic) pots with soil
- for spreading manure on seedbeds
- for digging shallow holes on beds

### H (Mattock)

- for digging and uprooting small stumps
- for removing stones
- for breaking hard pans when making seedbeds

### J (Rake)

- for breaking clods of soil
- for spreading manure
- for gathering rubbish / mulch
- for levelling the soil
- for removing small stones and weeds

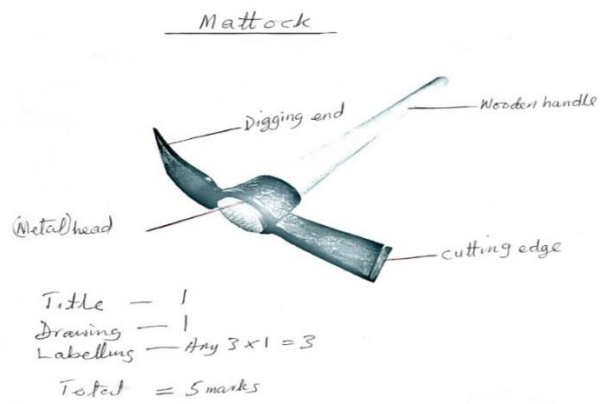
- (b) Many candidates struggled to state correct substitutes for the three tools. Other tools used to perform similar operations are

Specimen G - shovel, spade

Specimen H - Pickaxe, fork, hoe, foot fork

Specimen J - spring wire, handfork

- (c) The drawing of the mattock by most students was very poor, The diagram had no title and the label lines were not properly extended to named parts. Generally candidates scored low marks for the diagram. The expected diagram is as shown below



(d) The question was well answered however there were a few spelling mistakes. The expected answer to the question is as follows:

- wash/clean and dry after use
- oil/grease the metal parts
- replace damaged/broken parts
- store in cool/dry and termite free environment



## **FISHERIES 2**

### **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 slightly lower than the previous year.

### **2. SUMMARY OF CANDIDATES' STRENGTHS**

- (1) Majority of the candidates made judicious use of the time as they were able to answer the five questions within the stipulated time.
- (2) Candidates had good knowledge of :
  - wild life conservation
  - agricultural development
  - seed viability
  - seed dormancy
- (3) Candidates also had good knowledge of:
  - agricultural finance
  - credit
  - collateral
- (4) Good knowledge was also expressed on:
  - biological method of controlling crop pest;
  - cultural method of controlling crop pest;
  - explanation of cultural practices.
- (5) Candidates also expressed good knowledge of husbandry practices such as:
  - flushing
  - creep feeding
  - castration
  - dehorning
- (6) Precise and adequate information on the causes of decline on egg production in layer birds were provided.
- (7) Effects of ectoparasites on farm animals were effectively stated by most candidates.

### **3. SUMMARY OF CANDIDATES' WEAKNESSES**

- (1) Candidates still could not spell correctly technical words and scientific names.
- (2) Poor selection of questions.  
Some candidates selected questions they did not have idea about.
- (3) Two or more questions were answered on the same page which made marking difficult.
- (4) Candidates could not state the functions of oxytocin and oestrogen.

- (5) Most of the candidates could not state the causal agents of livestock diseases such as Anthrax and Coccidiosis.
- (6) Majority of the candidates could not distinguish between *quantity of produce supplied* and *change in supply*.
- (7) Most of the candidates could not explain the word 'quarantine'.

#### 4. **SUGGESTED REMEDIES**

- (1) There should be effective teaching on agricultural terminologies and scientific names.
- (2) Economics, soils and animal sections of the syllabus must be treated well with students.
- (3) Teachers should organize regular practical lessons to enable students develop skills in description and explanations of agricultural terminologies.
- (4) Teachers should educate candidates on how to answer questions in examination; reading of instructions, selection of questions and organization of ideas.

#### 5. **DETAILED COMMENTS**

##### **Question 1**

- (a) **How does a bony fish maintain an internal balance of salt and water in the following environment?**
  - (i) **Freshwater;**
  - (ii) **Marine water.**
- (b) (i) **Name two excretory products of fish.**  
(ii) **State four advantages of fish preservation.**
- (c) **State three uses of fish entrails.**
- (d) **State three ways in which fish products could be contaminated.**

##### **Question 1**

- (a) (i) Maintenance of balance of salt and water in freshwater (osmo regulation)  
**Expected responses**
  - Fish takes in a lot of water
  - Fish excretes a large amount of water/dilute urine
  - Fish loses salts in urine
  - Gills absorb salts from water to compensate for salt loss in urine
  - Water is absorbed through the skin
- (ii) Maintenance of balance of salt and water in marine water (osmo regulation)  
**Expected responses**
  - Marine fish loses water
  - Excretes concentrated salty urine
  - Fish carries out osmo-regulation by taking in water continuously to replace water lost
  - Excretes salt by gills
  - Gets rid of salt taken when taking in water

- (b) (i) Excretory products of fish  
**Expected responses**
- Water
  - Carbon dioxide
  - Ammonia
  - Urea
  - Salt
- (ii) Advantages of fish preservation  
**Expected responses**
- It prolongs shelf life
  - It enhances fish taste
  - It adds flavour
  - It adds nutritional value
  - It maintains texture
  - It reduces waste
  - It facilitates packing and marketing
- (c) Uses of fish entrails  
**Expected responses**
- Animal feed ingredient
  - For fertilizer
  - Bait for fishing
  - For human consumption
- (d) How fish products are contaminated  
**Expected responses**
- Contact with pathogenic organisms/bacteria/fungi
  - Infestation with insects
  - Poorly processed fish products
  - Addition of harmful chemicals

**Question 2**

- (a) **Describe the process of gaseous exchange in bony fish.**  
 (b) **State four general principles of fish canning.**  
 (c) (i) **Copy and complete the table below:**

Fishing gear	Advantage	Disadvantage
Trap		
Gill Net		
Trawl		

- (ii) **State two ways of maintaining fishing gear.**
- (a) The process of gaseous exchange in bony fish  
**Expected responses**
- The process is one way

- Water enters through the mouth
- Water flows over the gill filament
- Gill filaments have very tiny/ thin walls
- With CO<sub>2</sub> collected from the fishes by blood, there is exchange of gases between the water and the blood
- Oxygen diffuses from the water into the blood
- CO<sub>2</sub> diffuses from the blood into the water
- Oxygen is carried from the blood to the rest of the body
- Blood flows through filaments

(b) General principles of fish canning

**Expected responses**

- Removal of water
- Denaturing of enzymes
- Removal of microbes
- Slowing down of bacterial activities
- Preventing fat oxidation

(c) (i) Completion of table

**Expected responses**

<b>Fishing gear</b>	<b>Advantages</b>	<b>Disadvantages</b>
Trap	<ul style="list-style-type: none"> <li>- low unintended catch</li> <li>- less labour</li> <li>- Environmentally friendly</li> <li>- Catch are alive</li> <li>- Juvenile could be returned</li> </ul>	<ul style="list-style-type: none"> <li>- Few fish caught at a time</li> <li>- species specific</li> </ul>
Gill net	<ul style="list-style-type: none"> <li>- Less negative impact</li> <li>- Very selective</li> <li>- Large catch at a time</li> </ul>	<ul style="list-style-type: none"> <li>- It is labour intensive</li> <li>- Caught fish is subject to injury</li> <li>- Can engage in ghost fishing</li> </ul>
Trawl	<ul style="list-style-type: none"> <li>- Very efficient</li> <li>- Good return on investment</li> </ul>	<ul style="list-style-type: none"> <li>- It is expensive</li> <li>- Not selective</li> <li>- Destroys the habitat</li> </ul>

(ii) Maintenance of fish gear

**Expected responses**

- Replace worn out parts
- Repair damaged gear
- Wash after use
- Dry after washing
- Store in appropriate place

### Question 3

- (a) Explain the following terms as used in fisheries:  
(i) Genotype;  
(ii) Phenotype.
- (b) State five ways of maintaining fishing canoes.
- (c) (i) Give three differences between *active* and *passive fishing methods*.  
(ii) Name two nutrients in fresh fish.
- (d) Explain the concept of inheritance of external characteristics of fish.

- (a) (i) Explanation of genotype

**Expected responses**

- It is the total set of genes or genetic constitution of a cell of an organism
- It also refers to as a set of alleles that expresses a particular character
- It may be homozygous (AA/aa) or heterozygous (Aa)
- It may be dominant or recessive

- (ii) Explanation of phenotype

**Expected responses**

- It is the physical appearance of an organism
- It is also the observable characteristics of an organism
- It is influenced by both the genotype and environment
- Examples of observable characteristics are skin colour, fin shape and variation

- (b) Maintenance of fishing canoes

**Expected responses**

- Replacement of damaged parts
- Caulking
- Puttying
- Nailing
- Painting
- Oiling metal parts
- Use of sand paper/ sanding
- Wash after use
- Keeping out of water when not in use

- (c) (i) Difference between passive and active fishing methods

**Expected responses**

<b>Active method</b>	<b>Passive method</b>
- Move along to catch fish	- Stationery
- Requires more human labour	- Less labour intensive
- Fish caught is usually fresh	- Fish caught is often dead/stale
- Requires skilled labour	- Requires less skill

(ii) Nutrients in fresh fish

**Expected responses**

- Protein
- Fats/ lipids
- Mineral salt
- Vitamins
- Carbohydrates
- Water

(d) Explanation of the concept of inheritance

**Expected responses**

- An individual's trait are determined by a pair of alleles
- Each allele is from one parent which is passed on to the offspring
- If the two alleles received by the offspring are identical, the individual offspring is homozygous
- If the alleles are different, the offspring is heterozygous
- The inheritance of the allele/gene is independent of each other
- The inherited genes are influenced by the environment
- The gene that is expressed externally is dominant
- The gene that is not expressed is recessive

**Question 4**

(a) **Name two materials for constructing each of the following fishing gear:**

- (i) **Trap;**
- (ii) **Gill net;**
- (iii) **Hook and line.**

(b) **Give two examples of each of the following methods of fish preservation:**

- (i) **Traditional methods;**
- (ii) **Modern methods.**

(c) **Explain each of the following terms as used in aquaculture:**

- (i) **Partial harvesting;**
- (ii) **Total harvesting.**

(d) **List four facilities for growing fish.**

(a) Materials for constructing fishing gear

(i) **Expected responses**

Materials for constructing a trap

- |             |                    |
|-------------|--------------------|
| - Bamboo    | - Palm fronds      |
| - Cane      | - Wire             |
| - Plastic   | - Rope             |
| - Wire mesh | - Netting material |



- (ii) **Expected responses**  
Materials for constructing Gill Net
- Netting material
  - Float
  - Sinkers
  - Twine
  - Rope

- (iii) **Expected responses**  
Material for preparing Hook and Line
- Hook
  - Rope
  - Twine
  - Weight
  - Float
  - Pole

- (b) (i) Examples of traditional methods of fish preservation  
**Expected responses**
- Smoking
  - Boiling
  - Salting
  - Drying
  - Frying

- (ii) Examples of modern methods of fish preservation  
**Expected responses**
- Freezing
  - Canning
  - Irradiation
  - Use of chemicals e.g. pickling
  - Marinating

- (c) (i) Explanation of partial fish harvesting  
**Expected responses**
- This is the harvesting where some of the fish stocks are removed from the pond and the rest are allowed to continue growing
  - It requires partial draining
  - Requires seine net/ scoop net/cast net

- (ii) Explanation of total harvesting of fish  
**Expected responses**
- This method of harvesting involves the complete removal of all the fish stocked in a growing facility
  - It requires/ involves total draining of the water from the facility
  - It may require, sieving, scooping or hand picking

(d) Facilities for growing fish

**Expected responses**

- Earthen ponds
- Cages
- Concrete tanks
- Race ways
- Fish pens
- Plastic tanks

**Question 5**

(a) **State characteristics of semi-intensive fish farming system.**

(b) **List four protein yielding feed ingredients that could be used to prepare fish feed.**

(c) **Name four fish species that are culturable in Ghana.**

(d) **Classify the following fishing communities in Ghana into freshwater or marine community:**

- (i) **Abotoase;**
- (ii) **Shama;**
- (iii) **Chorkor;**
- (iv) **Kwamikrom.**

(e) **What are the three types of fish farming?**

(a) Characteristics of semi-intensive fish farming system

**Expected responses**

- It involves the use of both natural and artificial feed
- Natural feed is generated for utilization
- Stocking rate of pond is usually between 5 – 10 fish/m<sup>2</sup>
- Flushing of pond is occasionally carried out
- Aeration of water is allowed
- It involves moderate input and output

(b) Protein yielding feed ingredient

**Expected responses**

- Fish meal
- Groundnut cake
- Soya bean cake/meal
- Copra cake
- Palm kernel cake
- Cotton seed cake
- Pigeon pea cake

(c) Culturable fish species in Ghana

**Expected responses**

- Clarias
- Tilapia
- Heterotis
- Lates

- Chrysichthys

(d) Classification of fishing communities

**Expected responses**

Marine communities	Freshwater communities
Chorkor	Abotoase
Shama	Kwamikrom

(e) The three types of fish farming

**Expected responses**

- Monoculture
- Polyculture
- Integrated fish culture

**Question 6**

- (a) (i) **Name two paired fins of fish.**  
 (ii) **State one function each of the paired fins named in (a)(i).**
- (b) **Name four parts of fish that are removed before canning.**
- (c) **Classify Tilapia under the following headings:**  
 (i) **Kingdom,**  
 (ii) **Phylum;**  
 (iii) **Class.**
- (d) **State four characteristics of cartilaginous fishes.**
- (e) **State five ecological processes in a natural fish habitat.**

- (a) (i) Paired fish fins

**Expected responses**

- Pectoral fins
- Pelvic fins

- (ii) Function of pectoral fins

**Expected responses**

- For steering
- For balancing

Function of pelvic fins

**Expected responses**

- For changing positions/ up and down movement
- For steering

- (b) Parts of fish removed before canning

**Expected responses**

- Entrails
- Head
- Fins
- Scales

(c) Classification of Tilapia

**Expected responses**

- (i) Kingdom - Animalia
- (ii) Phylum - Chordata
- (iii) Class - Osteichthyes

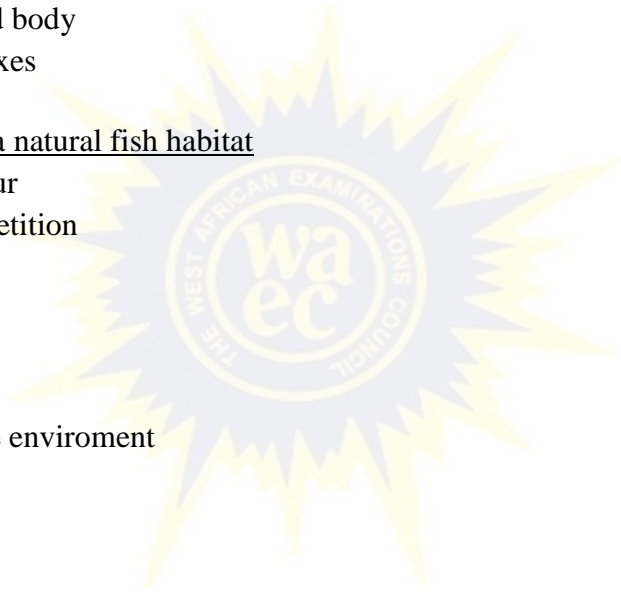
(d) Characteristics of cartilaginous fishes

**Expected responses**

- Live in aquatic habitat
- Retain gill slits for respiration
- Possesses cartilaginous skeleton
- Body divided into head, trunk and tail
- Possess fins for swimming
- Have ventral mouth
- Have lateral line
- Have streamlined body
- Have separate sexes

(e) Ecological processes in a natural fish habitat

- Feeding behaviour
- Predation, Competition
- Food pyramid
- Fish mortality
- Food chain
- Food web
- Adaptation to the environment



## **FISHERIES 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 most of the candidates was not encouraging, as quite a large number of them scored lower marks as compared to the previous year.

### **2. SUMMARY OF CANDIDATES' STRENGTHS**

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.

Every candidate attempted to answer all the questions,

Candidates had very little difficulties answering the following questions:

- identification of thorn cast net and gill net
- naming components of cast net and gill net
- identification of sandy soil, clayey soil and clayey loam
- suitability of sandy soil, clayey soil or clayey loam for fish pond construction
- characteristics of sandy soil, clayey soil and clayey loam

### **3. SUMMARY OF CANDIDATES' WEAKNESSES**

- (i) Some of the candidates had difficulties in understanding some of the questions, thus providing answers which were wrong. .
- (ii) Some of the candidates spent so much time to answer questions, and later cancel them out, probably because they later realized their friends had provided different answers to those questions. These could have been avoided if they spent about a minutes to read all the questions at the start of the examination.
- (iii) Errors associated with spellings of technical words were very common, and this caused candidates to lose precious points.

Areas that posed much problems to the candidates include:

- (i) causes of thorn net;
- (ii) naming the various forms of poultry manure;

- (iii) reasons why fish farmers would use poultry manure/ advantages for using poultry manure in fish farming;
- (iv) structural difference between Specimen D (cast net) and Specimen E (Gill net);
- (v) identification of fish diseases and the causal agents of the diseases ;
- (vi) identification of the symptoms of fish diseases.

#### 4. **SUGGESTED REMEDIES**

- (1) There should be effective teaching on fisheries terminologies and scientific names
- (2) Teachers should organize regular practical lessons to enable students develop skills in description and explanations of fisheries terminologies.
- (3) Teachers should educate candidates on how to answer questions in examination

#### 5. **DETAILED COMMENTS**

##### **Question 1**

- (a) **Name four various forms of specimen A from various sources that could be used in fishing farming.**
- (b) **Give four reasons why a farmer would use specimen A in fish farming.**
- (c) (i) **State five uses of specimen B.**  
(ii) **State two ways in maintaining specimen B.**
- (d) **Mention five factors that could cause the condition in specimen C.**

- (a) Various sources of specimen A (Poultry manure)

In this sub question, candidates were to provide various sources of poultry from which this type could be obtained. Some candidates rather mention sheep goats and other livestock. which were wrong.

##### **Expected responses**

- Chicken/fowl
- Duck
- Turkey
- Guinea fowl
- Goose/gander
- Ostrich
- Commercial poultry farms
- Backyard poultry farms

- (b) Reasons for using specimen A (Poultry manure)in fish farming

Candidates who attempted this sub question could only mention that 'it is cheaper' and 'environmentally friendly' but not the other reasons.

**Expected responses**

- decomposes to release CO<sub>2</sub> necessary for photosynthesis
- digested and undigested food particles may be directly consumed by fish
- encourages growth of phytoplankton
- cheaper than inorganic fertilizer
- environmentally friendly
- releases nutrients slowly

(c) (i) Uses of specimen B (mending needle)

Candidates had little idea about the use of mending needle. The common answers that run through their scripts were ' for mending net' and ' for fixing lead (weight)' They could not mention the other uses of the mending needle.

**Expected responses**

- for mending nets
- for fixing of lead (weight) on the lead line
- for fixing float on the float line
- for construction of net
- for holding lead line on the net
- for holding float line on the net

(ii)

Ways of maintaining specimen B (mending needle)

This was well answered by most of the candidates who attempted it.

**Expected responses**

- smoothen surface
- keep dry when not in use
- store in termite free environment

(d)

Factors causing condition in specimen C (Torn cast net)

In this question, candidates were to mention some of the conditions or situations that can cause the cast net to get torn. Candidates were only able to mention that the nets get torn when they are old

**Expected responses**

- when net is old
- eaten by rodents
- when net is entangled by an obstacle
- a cut by a diver to release entangled net
- poor storage
- poor washing method

## Question 2

- (a) (i) Identify each of the specimens labelled D and E.  
(ii) State three structural differences between specimens D and E.
- (b) Name three components that could be found in specimens D and E.
- (c) (i) Identify Specimens G and H.  
(ii) Which of the specimens F, G and H is most suitable for fish pond construction?
- (d) State two characteristics each of the specimens F, G and H.

- (a) (i) Identification of Specimen  
Candidates had no difficulty in identifying specimens D and E

### **Expected responses**

D = cast net  
E = Gill net

- (ii) Structural difference between Specimen D (cast net) and Specimen E (Gill net)  
Candidates could not state the structural difference between Specimen D (cast net) and Specimen E (Gill net) hence the low marks.

### **Expected responses**

<b>Cast net</b>	<b>Gill net</b>
- Conical in shape	- Rectangular in shape
- Has only foot rope	- Has both head rope and foot rope
- Foot rope is circular	- Foot rope is straight
- Has no float	- Has floats

- (b) Components found in both specimen D and E  
Candidates could mention 'netting' and 'weight' as answers to this sub question but not the 'foot rope'.

### **Expected responses .**

- weight / sinkers/ lead
- foot rope
- netting

- (c) (i) Identification  
Candidates could easily identify clayey soil and clayey loam.

### **Expected responses**

Specimen G = Clayey soil  
Specimen H = Clayey loam

### **Expected responses**

- (ii) Suitable specimen for fish pond construction  
- Specimen H (Clayey loam)



(d) **Expected responses**

Characteristics of soil samples

Candidates could easily mention the characteristics of sandy soil, clay soil and clayey loam.

Characteristics of Specimen F (Sandy soil)

**Expected responses**

- has more air spaces/good aeration
- large particle sizes
- very porous / low water holding capacity
- not compact
- not sticky when wet

Characteristics of Specimen G (Clay soil)

**Expected responses**

- fine particle sizes
- little air spaces
- very sticky when wet
- cracks when dry
- high water holding capacity

Characteristics of Specimen H (Clay loam)

**Expected responses**

- average particle sizes
- mixed soil particles
- hold water
- moderate air spaces

**Question 3**

- (a) (i) **Identify the fish disease in each of specimens J and K.**  
(ii) **Name the causal organisms that could be responsible for the disease in each of specimens J and K.**
- (b) (i) **State two possible symptoms each of the diseases in specimens J and K.**  
(ii) **State two possible ways of controlling the diseases identified in J and K.**
- (c) (i) **State the method used to preserve each of the specimens L, M and N.**  
(ii) **Name three other methods that could be used to preserve fish**  
(iii) **State four quality and safety standards that could be observed for specimen M.**

(a) and (b)

Candidates had difficulty in identifying the fish diseases and their causal organisms. It could be deduced that candidates had no idea about the fish diseases, their symptoms and organisms that cause the diseases and ways of controlling the diseases.

(i) Identification of fish diseases

**Expected responses**

Specimen J = Gill rot  
Specimen K = Ich

(ii) Causal organisms of diseases

**Expected responses**

Specimen J (Gill rot) = Fungus  
Specimen K (Ich) = Protozoa

(b) (i) Symptoms of Disease

Symptoms of Disease in Specimen J (Gill rot)

- Red / whitish spots on gills
- gills appear swollen and covered with mucus

Symptoms of Disease in Specimen K (Ich)

- white spots on skin and fins
- blister-like raised lesions on skin

(ii) Ways of controlling diseases on specimen J and K

**Expected responses**

- avoid overfeeding of fish
- minimal handling of fish
- balanced diet
- avoid pollution of water

(c) In question 3(c) (i), candidates could mention the method used for preserving specimens L, M and N and other methods of preservation 3(c) (ii), without difficulty. In question 3(c) (iii), candidates were required to mention some quality standards of specimen M (Smoke dried fish) This was quite challenging for the candidates who attempted it.

(i) Method used for preservation

**Expected responses**

Specimen L (boiled/ steamed fish) - boiling/ steaming  
Specimen M (smoked dried fish) - smoke-drying  
Specimen N (frozen fish) - Freezing

(ii) Other methods of preservation

**Expected responses**

- canning
- pickling
- sun drying
- chilling
- irradiation
- fermentation

(iii) Quality standards of specimen M (Smoke dried fish)

**Expected responses**

- absence of bad odour / scent
- absence of living organisms/insects
- absence of dead organisms
- absence of foreign matter
- absence of mould

## FORESTRY 2

### 1. GENERAL COMMENTS

The level of quality of the paper was sustained as compared to previous years. Performance of candidates has improved slightly. However, few candidates performed poorly. This drums home, the need for candidates to motivate themselves to work harder and in groups to assist the very poor candidates to better their lot. Forestry teachers and candidates should do good research from the very few forestry textbooks as well as search from the Internet to enhance teaching and learning.

### 2. SUMMARY OF CANDIDATES' STRENGTHS

During the marking exercise, the following observations were made that could be esteemed as candidates' strength:

- a) Orderly presentation of answers.
- b) No candidates copied questions before answering.
- c) Most candidates demonstrated clear handwriting
- d) The aspects of the paper that were answered well were the:
  - i. Explanation on timber utilisation permits.
  - ii. Effects of deforestation on soil fertility, habitats of animals, national economy and the environment.
  - iii. Explanation on the ecological terms such as saprophytes, decomposers, xerophytes and population.
  - iv. Naming of four forest based industries in Ghana.
  - v. Mentioning of products of the forest based industries.
  - vi. Naming of non-insect arthropods that could be found in the forest floor.
  - vii. Stating of the functions of the Divisions of the Forestry Commission and
  - viii. Naming of insects that could be found in the forest environment in Ghana.

### 3. SUMMARY OF CANDIDATES' WEAKNESSES

Candidates struggled with:

- i. English language expressions.
- ii. Getting clarity on explanation of forestry technologies.
- iii. Spelling mistakes such as "regelete" instead of "regulate", "atiptation" instead of "adaptation", "sustainabil" instead of "sustainable", "pieces" instead of "process" and "magnition" instead of "migration" among others.
- iv. Poor handling of some definitions of technical forestry terms.

The topic that were casually dealt with were the, description of the organisational structure of the Forestry Commission, advantages of leasehold land tenure system and distinguishing between reforestation and reafforestation.

#### 4. **SUGGESTED REMEDIES**

The following remedies were considered relevant to inspire improvement in candidates performance column:

- Reading of good English story books to enhance answering of questions;
- Spelling rules of English words and forestry technical terminologies would go a long way to polish candidates communication skills;
- Candidate need to study past questions and their expected responses;
- Candidates should read questions carefully and understand them before attempting to answer them.

#### 5. **DETAILED COMMENTS**

##### **Question 1**

**(a) Explain each of the following ecological terms:**

- (i) Saprophytes**
- (ii) Decomposers**
- (iii) Xerophytes**
- (iv) Population**

**(b) (i) Name four forest based industries in Ghana.**

**(ii) Mention one product of each of the industries named in (i)**

**(c) Name four non- insect arthropods that could be found on the forest floor.**

Question one (1) was one of the preferred aspects of the paper. A good number of candidates did very well in handling the question. Very few candidates did not perform creditably on the question or ignored it. The question was generally very clear, friendly to candidates and therefore attractive. The expected answers were:

(a) (i) Saprophytes

These are organisms that feed on dead and decaying organic matter causing it to decompose completely. They secrete enzymes to digest the food outside before absorbing it.

(ii) Decomposers

These are organisms that cause the disintegration of organic matter. The main decomposers are bacteria and fungi.

(iii) Xerophytes

These are plants which grow in arid areas. They are adapted to such condition by developing structures which can retain water, reduce water loss or obtain water from a difficult source.

(iv) Population

A group of individuals of the same species living within a given area at a particular time.

- (b) (i) Forest based industries in Ghana
- Eco-tourism industry
  - Crafts and furniture industry using cane and rattan
  - Saw milling industry
  - Plywood manufacturing industry
  - Fuel wood industry
  - Bee keeping industry
  - Pharmaceutical industry
  - Dyes industry
  - Bush meat industry
  - Packaging industry
  - Alcoholic beverages industry
- (ii) Products of forest based industries
- Furniture
  - Baskets/cages
  - Boards/scantlings/off-cutrs/peeled barks
  - Ply wood/round core poles/peeled barks
  - Charcoal/fire wood
  - Honey/wax
  - Meat
  - Wrappings
  - Palm wine/local gin/Odoka
  - Dye
  - Medicines
- (c) Non – insect arthropods found on the forest floor
- Spider
  - Scorpion
  - Millipede
  - Centipede
  - Woodlouse

## **Question 2**

- (a) Give three reasons for the reservation of traditional protected areas.
- (b) Explain how each of the following protective measures reduces the over- exploitation of forest resources
- (i) Ban on log export
- (ii) Participatory forestry
- (c) Explain the term forest reserve
- (d) State four features of each of the following types of forest.
- (i) Virgin forest
- (ii) Coniferous forest

Most candidates could not answer this question of the paper. It clearly showed that, candidates did not have in depth technical knowledge in forestry to cope with the requirements of the question.

(a) The reasons for the reservation of traditional protected areas baffled many candidates and insignificant number of candidates had a good handle on it. Candidates surprisingly could not produce answers such as:

- for conservation of ecological integrity of the traditional area;
- for protecting water bodies or watersheds;
- for preservation or spaces for rituals or worship;
- for serving as breeding grounds for plant and animal species among others.

(b) The explanation on the protective measures such as ban on log exports in participatory forestry puzzled majority of the candidates. It took only a few candidates to produce the expected responses that point to processing to add value and create jobs/ income sources and promote ownership of forest respectively.

(c) A large number of the candidates who chose this question and for that matter how to deal with this session did well with explanation of the term forest reserve. The expected response was “A large area of land covered with trees which is often set aside by law (gazetted) in order to be managed for human benefits”.

(d) In providing answers for the features of virgin forest and coniferous forest, many candidates gave wrong answers instead of responses such as;

(i) Features of Virgin forest

- Presence of multi-layered canopy
- Minimal sign of human disturbance
- Mixed age stands
- Presence of canopy opening due to tree fall
- Pit and mound topography
- Intact soils
- Stand snags (dead trees)
- Presence of lianas and climbers
- Multi-species composition of forest
- Forest floor covered with thick litter

(ii) Features of Coniferous forest

- Composed primarily of cone bearing needle-leaved/ scale leaved evergreen trees
- Found in areas that have long winter and moderate high annual rainfall/precipitation
- Pines, spruces, larches and firs are the dominant trees
- Trees often form nearly uniform stand with a layer of low shrubs or herbs beneath
- Mosses, liverworts and lichens cover the forest floor
- Soils are light-coloured and acidic
- Trees are similar in shape and height

### **Question 3**

- (a) (i) **Describe the organisation structure of the Forestry Commission.**  
(ii) **State four forestry related functions of the ministry in charge of the Forestry Commission.**

**(b) State three functions of each of the following divisions of the forestry Commission:**

- (i) **Forest Services Division;**  
(ii) **Wildlife Division;**  
(iii) **Timber Industry Development Division.**

- (a) This was the most popular question among candidates. However candidates did not perform appreciably. This was due to the fact that candidates did not study the question critically. With respect to nearly all the answers provided by the candidates it became obvious that candidates did not know or understand the part of the question on the (i) description of the organization structure of the Forestry Commission and (ii) the forestry related functions of the ministry of lands and natural resources. The (a) (i) part of the question required knowledge in organizational chart from the top with the Board of Commissioners, the Chief Executive, The Deputy Chief Executive on the same level of the Executive Directors of the Forest Services Division, Timber Industry Development Division and the Wildlife Division. It was not required of candidates to provide some of the latest directorates of the Forestry Commission. Most candidates that attempted answering this part of the question scored almost zero and therefore those candidates that had a good handle on the part (b) had low scores on the entire question. Candidates that attempted the (a) (i) parts of the question could not bring out the forestry ministerial functions such as planning, monitoring, coordination, evaluation, and policy formulation.
- (b) On dealing with the functions of the divisions of the Forestry Commission, most candidates did fairly well. The expected responses included:
- (i) Forest-Services Division (FSD)
- Regulating the harvesting of timber from both forest-reserves and off reserves
  - Vetting and registering a timber contractor for exploitation of timber
  - Allocation of timber concessions and Timber utilization contract
  - Promoting environmental quality by public tree planting programmes
  - Management of the forest estates on behalf of the community and the state
  - Development of forest plantations for the restoration of degraded forest areas
- (ii) Wildlife Division
- Regulation of the utilization of wildlife resources
  - Promote public awareness on wildlife management
  - Develop wildlife breeding facilities for the general public

- Promoting environmental quality by public tree planting programmes

- Promote Ecotourism

(iii) Timber Industry Development Division

- Regulate lumber exportation
- Regulate plywood exportation
- Promote timber trade in internal market
- Maintain uniformity of prices of timber products
- Quality control of exported wood

#### Question 4

- (a) **Name four insects that could be found in the forest environment in Ghana.**
- (b) **Explain four ways in which insects could be beneficial to the forester.**
- (c) **Explain four ways in which insects could cause problems in plantation establishment.**

This was quite a popular question. Some candidates did very well on the question while others performed rather poorly. The question on the whole appears simple but a good number of candidates ignored it.

(a) This part did not require deep technical knowledge to answer it. However, candidates failed to provide the expected answers such as , Tsetse flies, Grasshoppers, Butterflies, Crickets, Weevils, Wasps, Moths, Fruit flies, Beetles, House flies, Ants/white ants, Blow flies, Aphids, Praying mantis, Bees

(b) This session on the question was tackled very well by some candidates but others could not handle it satisfactorily even though it appears simple and attractive. Candidates were expected to bring out answers such as

- Pollination of plants/trees
- Production of honey by bees
- Decomposition of organic matter to enrich soils
- Decomposition of organic matter by insects generate space for forest development
- Some insects serve as food to foresters e.g. winged termites and crickets

(c) This required of candidates to bring out all the negative things about insects. The expected answers are

- Insects may attack young seedlings by eating up their shoots or leaves
- Insects may attack seeds the moment they are planted in polypots or in the seed bed
- Insects may attack nursery tools with wooden parts such as handles and destroy them
- Insects may attack foresters at the nursery or in the field.
- Termitarium might create problems within plantations such as losing planting
- Insects could attack seeds stored at nursery and thus may lead to losses at nursery.



## **Question 5**

- (a) Explain the term timber utilisation permits.
- (b) States two effects of deforestation on each of the following
- (i) soil fertility;
  - (ii) habitat of animals;
  - (iii) national economy;
  - (iv) environment.
- (c) Distinguish between reforestation and reafforestation.
- (d) State five advantages of leasehold land tenure system

This was one of the preferred questions among candidates. Again, performance on this question was not as good as expected. Very few candidates scored good marks on the question.

- (a) Quite a good number of candidates were able to manage the question and got maximum marks for the explanation. However, a few candidates attempted to deal with the question and flopped. Some candidates got confused and provided answers that define timber utilisation contracts. This suggests that candidates must be prepared to clearly note the difference between timber utilisation contracts and timber utilisation permit. Candidates were expected to explain *timber utilization permit* as a small scale permit to harvest a defined number of trees for social or community purposes signed by the Forestry Commission.
- (b) A lot of candidates found this segment of the question difficult as the sub-sections (i) to (iv) required some good amount of thinking to cope with them. However quite a number of candidates perform excellently on this session. The expected response are as follows
- (i) Effects of deforestation on soil fertility
    - Deforestation may lead to erosion of topsoil and reduce soil fertility.
    - Deforestation could lead to destruction of micro and macro organisms that breakdown organic matter to enrich the soil.
    - Deforestation may lead to soil compaction and reduce soil aeration to lower soil productivity.
  - (ii) Effects of deforestation on habitats of animals
    - Deforestation may lead to the destruction of the habitats of various animals.
    - Deforestation may expose animals to harsh environmental conditions when habitats are destroyed.
    - Deforestation may lead to removal of food and water sources when habitats are destroyed.
    - Deforestation may lead to loss of social organization when habitats are removed or destroyed.
  - (iii) Effects of deforestation on National Economy
    - Deforestation may lead to unemployment.
    - Deforestation may lead to poverty.

- Deforestation may lead to loss of productivity due to poor health as a result of lack of medicines.

(iv) Effects of deforestation on the Environment

- Discomforting general rise in temperature.
- Drying up of water bodies.
- Disastrous changes in rainfall pattern.
- Destruction of community buildings by strong winds.

(c) Majority of candidates could not handle this part of the question. A few persons were able to manage reforestation but not reafforestation. To distinguish between reforestation and reafforestation, candidates needed to point out that reforestation is the act of renewing forest cover through natural seeding or by the artificial planting of seeds or seedlings while reafforestation is the act of regrowing a plantation after harvesting.

(d) This sub-question was tough for most candidates. Candidates were expected to provide responses such as

- Leasehold property is cheaper
- Gives alternative finance option
- Helps to own home
- Rent is continuously re-assessed
- Higher deposits, difficult to gain finance
- No benefit from increase in land value

### **Question 6**

**(a) Give the reason why each of the following processes is carried out in mushroom production:**

- (i) Incubation;**
- (ii) Composting;**
- (iii) Sterilization;**
- (iv) Harvesting by hand**

**(b) Mention four items that are required in bagging substrates for mushroom production.**

**(c) Mention four ways in which mushroom is preserved.**

**(d) Mention four non-timber forest products that could be taken as food.**

This question is one of the least attractive among candidates. The fewer number of candidates who chose the question performed from excellent to average and very poorly for some minute number of candidates.

(a) For the subsections (i) to (iv), candidates managed it very well. Answers were provided by the candidates with relative ease. The reasons why incubation, composting, sterilisation and harvesting by hand are carried out in mushroom production were vividly provided by candidates to show their depth of knowledge on the subject matter. The expected answers were:

- (i) Incubation  
This is done to allow the spawn to grow through the substrate compost under optimum conditions.
- (ii) Composting  
This is to convert the raw materials of the substrate into a highly selective and nutritious medium for the growth of mushrooms
- (iii) Sterilization  
This is done to kill any micro-organism that may be present in the compost bag.
- (iv) Hand – picking during harvesting  
This is done to ensure every part of the harvested mushroom is pulled out of the compost, since the base, if left on the compost, could rot and become a source of infection.

(b) (c) and (d) Answers to these sections were provided excellently for most candidates who selected the question. Very limited number of candidates attempted to handle the question and ended up not writing anything at all. This observation indicated that, those candidates never got tutorials on the subject area or might have ignored learning the topic. The expected answers were:

(b) Items required in bagging mushroom substrate

- Cotton wool plug
- Paper or newsprint
- Rubber bands
- 2cm thick PVC pipe/ bamboo stick
- Heat resistant polypropylene bag

(c) Ways of preserving mushroom

- Canning
- Salting
- Freezing
- Smoking
- Roasting
- Drying

(d) NTFPs that could be taken as food

- Honey
- Fruits
- Wild yam
- Eggs
- Snails
- Crabs
- Bush meat
- Mushroom

## FORESTRY 3

### 1. GENERAL COMMENTS

The standard of the paper as usual, was comparable to the previous ones. There has been a little improvement in the performance of this year's paper over that of last year. This might be due to the popularity of the questions.

### 2. SUMMARY OF CANDIDATES' STRENGTHS

The following strengths were observed by the Chief examiner

- i. The writing of the candidates was legible.
- ii. With the exception of about two candidates, every student answered all the four questions.
- iii. Aspects of the paper which were well answered include:
  - members of the bee colony
  - ways in which grasscutter is of economic importance
  - uses of wheel barrow

### 3. SUMMARY OF CANDIDATES' WEAKNESSES

- i. There were a lot of grammatical errors especially in the use of tenses.
- ii. There were also many spelling mistakes in the technical terms and in the names of some animals like lizard in which a number of students spelt it "lizard". Photosynthesis which was spelt photosizing. Basket as busket and bucket as buket. Cassia as Casia and others.
- iii. Some of the students found it difficult in the drawing of the wheel barrow.
- iv. Aspects of the paper which was poorly answered include:
  - Ways in which guinea grass is of economic importance.
  - Observable differences between guinea grass and *Cassia siamea*.
  - Reasons why epiphytic orchid is able to survive its habitat.
  - Properties of rattan that make it suitable for its uses.

This year only few candidates mixed up question numbers and answers. For example, answers which were supposed to be the solution for 2(a) were given to 2(c).

### 4. SUGGESTED REMEDIES

- i. Candidates should cultivate the habit of reading good books to correct deficiencies in English language.
- ii. Candidates should familiarise themselves with technical terms.

- iii. Candidates should try to get through past WASSCE questions to know the nature of the questions and what is expected of them.
- iv. Candidates should read good books to improve on their expressions and spelling skills.

## 5. DETAILED COMMENTS

### Question 1

- (a) List three vegetation types in which specimen A could be commonly found.
- (b) Mention five ways in which Specimen A is of economic importance.
- (c) Give two uses of a matured plant of Specimen B.
- (d) Give five observable differences between Specimens A and B.

Question 1 was unpopular with the candidates and the general performance was poor.

- (a) Most candidates could not mention the vegetation types where Guinea grass could be commonly found. Most of the candidates mentioned the forest types instead. Since it is a grass plant, it should be very popular with the Savannah types like Guinea Savannah, Sudan Savannah, and Coastal Savannah. Dry semi deciduous forest could also be mentioned. Tall grass Savannah, short grass Savannah and costal scrub could also be the answers.
- (b) This question was poorly answered. The economic importance of Guinea grass could have been the following:
  - It is a weed in plantation.
  - It serves as forage for livestock.
  - It is used for roofing in villages.
  - It serves as habitat for wildlife.
  - It is used in making hats, mats, bags and others.
  - It is used to control erosion.
  - It is used as a mulching material in forest nursery.
  - It is used for composting.
- (c) This question was also answered poorly. Most of the candidates gave the answers as it is used for furniture making which is not true. Matured plants of Cassia Simea could be used as poles, fuel wood, and as stakes. It is also used for roofing, fencing, charcoal production and the leaves as forage for livestock.
- (d) The candidates surprisingly demonstrated their poorest performance in all the sub questions. The candidates gave differences which did not correspond. For example, leaves of Guinea grass are long while leaves of Cassia are broad. In another wrong comparison the candidate stated that the leaf of grass is simple while that of Cassia is large. This term of grass is soft while that of Cassia is woody. The expected answers were

<b>Guinea grass</b>	<b><i>Cassia Siamea</i></b>
- fibrous root system	- taproot system
- leaf surface is rough and hairy	- leaf surface is smooth
- simple leaves	- compound leaves
- no definite stem	- definite stem present
- leaves have parallel venation	- leaves have net venation
- leaves are long and narrow	- leaves are short
- herbaceous	- woody
-has leaf sheath	- has leaf stalk

### **Question 2**

- (a) Name the three members of the colony in which Specimen C is found.**
- (b) Name four natural enemies of specimen C in its colony.**
- (c) States two precautions that should be taken when harvesting the product obtained from specimen C.**
- (d) State three observable signs that could be used to detect the presence of specimen D in the ecosystem.**
- (e) State three ways in which specimen D is of economic importance.**

Question two (2) was comparatively the most popular question attempted by the candidates.

(a) Over 95% all the candidates got this question correct. The members of the big colony are the:

- Queen
- Worker
- Drone

(b) This question was not badly answered except that some candidates added snakes, frogs and some, scorpions. Candidates were expected to state natural enemies of honey bee as:

- Man/human being
- Wax moth
- Fire/smoke
- Alpine swift bird
- Bee pirate
- Lizard
- Bee louse.

(c) Precautions to be taken when harvesting honey are:

- Controlling fire to prevent fire outbreak.
- Wearing of protective clothing to avoid stings.
- Avoid strong scented chemicals or perfumes on the body.
- Avoiding red, blue, and black clothing.
- It should not be done in the afternoon or hot sunny day.

Some candidates mentioned only one colour like red, black or blue. No candidate could score if only one colour is mentioned. All the colours should be mentioned. In the same way some students wrongly stated that wellington boots or hand gloves could be worn. The whole protective clothing should be worn including the boots and gloves.

- (d) This question was also not answered to satisfaction because about a third of the candidates could not provide all the three answers. The expected answers were:
- Footprint.
  - Fur or hair
  - Left over feed example pieces of grass or palm nut.
  - Droppings
  - Trail or trucks
  - Burrowing activities or destruction of roots of plants.
- (e) This question was answered properly. Candidates were expected to give the following as the economic importance of grasscutter:
- It is used as food or meat.
  - It destroys farm and farm produce.
  - Its faeces or droppings serve as manure.
  - It is a source of income or employment.

### **Question 3**

- (a) **Mention the vegetation zone in which the plant from which specimen E was obtained is found.**
- (b) **Give five uses of specimen E.**
- (c) **State two properties of specimen E that make it suitable for its users.**
- (d) **Mention the habitat in which specimen F could be found.**
- (e) **Give two reasons why specimen F is able to survive in its habitat.**
- (f) **State two ways in which specimen F is important.**

This question was not popular among candidates.

- (a) The candidates did not know the difference between vegetation zones and vegetation types. Most of the students gave the answers as vegetation types. The expected answer was forest zone.
- (b) On the use of rattan, no student was able to give all the five uses. The expected answers are:
- Furniture
  - Roofing
  - Palanquin construction
  - Traps making
  - Basket and crafts
  - Strengthening walls of wooden building.

- (c) On the properties that make rattan suitable for its uses, less than a sixth of the candidates could get the two properties correct. The expected answers are:
- Its flexibility.
  - It has high or good tensile strength.
  - Its light nature.
- (d) The habitat of epiphytic orchid is arboreal.
- (e) The expected answers for the reasons for the survival of epiphytic orchid in its habitats are:
- It possesses long spongy roots for absorbing moisture.
  - It has got leaves for photosynthesis.
  - It has spreading roots for anchorage.
- (f) The importance of epiphytic orchid are:
- It purifies the air.
  - It serves as medicinal plants.
  - Its flowers do not wilt easily and they are used for decoration.

#### **Question 4**

- a) **Draw and label specimen G.**
- b) **State three uses of specimen G.**
- c) **Mention three tools that may be needed when using specimen G.**
- d) **Give three precautions that should be taken when using specimen G.**
- e) **Name the tool that could be used in place of specimen G which is a wheelbarrow.**

Generally, the question was popular among the candidates

- a) Most of the students were able to draw the specimen with most of the labeling. The labeling were the handle, bucket, stand and tyre or wheel.
- b) On the use of wheel barrow, most of the candidates did well. Candidates wrote expected responses such as:
- For carrying seedlings during out planting.
  - For conveying soil during bed construction.
  - For transporting pegs and other materials in the nursery.
  - For carrying out civil works at the nursery.
- c) On the tools needed when using wheel barrow, most of the students answered it better. The expected answers are: shovel, spade, pick axe or mattock, cutlass or machete, spanner and screwdriver.
- d) Precautions taken when using wheel barrow.

This question was not answered as expected. The expected answers are:



- It should not be overloaded.
- Loading must be done evenly to enhance balancing.
- Handles must be held firmly to avoid losing grip.
- Tyres should be properly inflated.
- Bolt and nut should be tightened regularly.

e) On tools that could be used in place of the wheel barrow, the candidates performed satisfactorily. The expected answers are:

- Head pan
- Bucket
- Basket
- Basin



## **GENERAL AGRICULTURE 2**

### **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 slightly lower than the previous year.

### **2. SUMMARY OF CANDIDATES' STRENGTHS**

- (1) Majority of the candidates made judicious use of the time as they were able to answer the five questions within the stipulated time.
- (2) Candidates had good knowledge of:
  - wild life conservation
  - agricultural development
  - seed viability
  - seed dormancy
- (3) Candidates also had good knowledge of:
  - agricultural finance
  - credit
  - collateral
- (4) Good knowledge was also displayed on:
  - biological method of controlling crop pest
  - cultural method of controlling crop pest
  - explanation of cultural practices
- (5) Candidates also expressed good knowledge of husbandry practices such as:
  - flushing
  - creep feeding
  - castration
  - dehorning
- (6) Precise and adequate information on the causes of decline on egg production in layer birds were provided.
- (7) Effects of ectoparasites on farm animals was effectively stated by most candidates.

### **3. SUMMARY OF CANDIDATES' WEAKNESSES**

- (1) Candidates still could not spell correctly technical words and scientific names.
- (2) Poor selection of questions.  
Some candidates selected more than one question from a section while others also selected questions they did not have idea about.
- (3) Two or more questions were answered on the same page which made marking difficult.

- (4) Candidates could not state the functions of oxytocin and oestrogen.
- (5) Most of the candidates could not state the causal agents of livestock diseases such as Anthrax and Coccidiosis.
- (6) Majority of the candidates could not distinguish between *quantity of produce supplied* and *change in supply*.
- (7) Most of the candidates could not explain the word 'quarantine'.

#### 4. **SUGGESTED REMEDIES**

- (1) There should be effective teaching on agricultural terminologies and scientific names.
- (2) Economics, soils and animal sections of the syllabus must be treated well with students.
- (3) Teachers should organize regular practical lessons to enable students develop skills in description and explanations of agricultural terminologies.
- (4) Teachers should educate candidates on how to answer questions in examination; reading of instructions, selection of questions and organization of ideas.

#### 5. **DETAILED COMMENTS**

##### **Question 1**

- (a) (i) **What is wildlife conservation?**  
(ii) **State three problems facing wildlife conservation in West Africa.**
- (b) (i) **What is agricultural development?**  
(ii) **Explain three factors that contribute to the development of agriculture in West Africa.**
- (c) **State three problems associated with the use of manual power on the farm.**

##### **Question 1**

- (a) (i) In explaining what wildlife conservation is, most candidates left out the salient point such as "in their natural habitats".

##### **Explanation of wildlife conservation**

##### **Expected Response**

It is the management and sustainable use of plant and animal species in their natural habitats in order to meet the needs of present and future generations.

- (ii) This sub question was well answered by the candidates who attempted it.

Problems facing wildlife conservation

**Expected Responses**

- poaching
- bush fires
- encroachment of conserved forests
- inadequate enforcement of laws
- poor public attitude towards wildlife conservation
- inadequate number of trained personnel
- inadequate scientific research on wildlife
- inadequate funding of conservation programmes
- inadequate forest guards
- changes in climate

- (b) (i) This sub question was answered well by the candidates

Explanation of agricultural development

**Expected Response**

It is the improvement of traditional ways of farming by adoption of modern/better methods that result in optimum production of agricultural goods and services

- (ii) This sub question was poorly answered by the candidates. They gave factors that do not allow for development of agriculture such as lack of funds and inadequate social amenities.

Factors that contribute to agricultural development

**Expected Responses**

- availability of agricultural input e.g. improved breeds of animals, seeds, machines
- access to market
- better agriculture training for farmers / extension services
- establishment of agriculture research centres
- incentives to farmers e.g. credit, subsidies, awards etc
- construction of irrigation channels
- good road network/transportation system
- good land tenure systems
- adequate social amenities e.g. Schools
- adequate storage facilities
- adequate processing facilities

- (c) This was well answered by candidates.

Problems associated with the use of manual farm power

**Expected Responses**

- power output is generally low/limited
- output of work is reduced when fatigue and exhaustion set in
- human beings are susceptible to diseases
- human beings are susceptible to pest e.g. snake bite
- human beings could be injured

## Question 2

- (a) Give five reasons for storing farm produce.
- (b) Name four storage structures for agricultural produce.
- (c) Name four reasons why farmers will prefer the freehold land tenure system.
- (d) State three disadvantages of the freehold land tenure system.

- (a) Most of the candidates who attempted this sub question were able to provide at least three reasons for storing farm produce. eg as planting materials, as buffer, etc.

### Reasons for storing farm produce

#### **Expected Responses**

- as a buffer on which to fall during shortage / food security
- to synchronize ripening of some fruits e.g. banana
- for movement to areas of high demand/better price
- to use for planting
- to protect produce from physical damage
- to await processing
- to prevent produce from getting rotten

- (b) The candidates who attempted this sub question confused storage structures with methods of storage. those who had them right had issues with spellings. For example, silos instead of silo, bans instead of barns, sucks instead of sacks.

### Storage structures for agricultural produce

#### **Expected Responses**

- silos
- barns
- cribs
- refrigerators / deep freezers
- bins
- baskets
- storage pits
- kitchen hearths/fire place
- sacks/Jute bags

- (c) and (d)

Candidates were required to understand the freehold land tenure system to be able to answer sub questions (c) and (d) correctly.

Most of those who attempted the sub question did not understand the freehold land tenure system hence their inability to answer the question.

It should be noted that freehold involves personal ownership of land either outright purchase or gift from another person.

### Reasons for preferring freehold land tenure system

#### **Expected Responses**

- encourages large scale farming
- trees/perennial crops could be grown
- it provides investment and developmental drive in Agriculture
- land can be used as collateral to acquire loans
- permanent structures could be built on such lands
- may develop the land since he has its full ownership
- user can also plan for long term agricultural enterprises

#### (d) Disadvantages of freehold land tenure system

#### **Expected Responses**

- land acquired through this system is expensive
- there are issues of land litigation
- farmer may not have access to the required land size
- possibility of falling into the hands of illegal sales agents

### Question 3

#### (a) **State three ways in which each of the following soil properties is of importance in agriculture:**

- (i) **soil consistency;**
- (ii) **soil structure;**
- (iii) **soil texture.**

- (b) (i) **Give four reasons for composting organic materials.**
- (ii) **Give three reasons why turning is important in composting.**

Generally those who attempted question 3 performed poorly.

- (a) Part (a) was poorly answered by most of the candidates. The question expected of the candidates to state the importance of the terms and accurate understanding of the terms was required to answer the question correctly.

#### (i) Importance of soil consistency in agriculture

##### **Expected Responses**

- helps the farmer to determine the type of crop to plant
- helps the farmer to select the right implement to use
- helps the farmer to know when to till the land
- gives the farmer an idea of the soil moisture content/aeration/drainage
- helps the farmer to determine the textural class of the soil

#### (ii) Importance of soil structure in agriculture

##### **Expected Responses**

- helps the farmer to determine the type of crop to grow on the soil
- gives an idea of the distribution of water, air, and drainage

- gives an idea of the extent to which the soil could resist erosion
- gives an idea of exchange of carbon dioxide and oxygen exchange in the soil
- determines the degree of root penetration
- structureless soils lead to nutrient lock up and water-logging

(iii) Importance of soil texture in agriculture

**Expected Responses**

- helps to select the type of implement to use
- gives farmer an idea of the ability of roots to penetrate the soil/type of crop to plant
- helps farmer to select the right management practices
- helps farmer to have an idea of the amount of air, that can penetrate a soil to support proper growth
- gives farmer the idea of the level of water infiltration into the soil

(b) Understanding what composting is was necessary to answer this sub question. Composting entails exposing organic materials to conditions that bring about decomposition.

(i) Reasons for composting

**Expected Responses**

- to kill harmful micro organisms
- to kill weed seeds
- to obtain humus
- to make nutrients in organic matter readily available to plants
- to manage organic waste

(ii) Importance of turning in composting

**Expected Responses**

- it facilitates decomposition
- it facilitates early maturation
- it introduces air / improve aeration
- for thorough mixing of organic materials
- it controls temperature within the pit/heap

**Question 4**

- (a) **State two ways in which each of the following factors could contribute to weathering of rocks:**
- (i) **Temperature;**
- (ii) **Living organisms.**
- (b) **State four characteristics of a clayey soil.**
- (c) **Outline four economic importance of soil erosion to the farmer.**
- (d) **State four functions of soil water to plants.**

- (a) Candidates were familiar with how temperature contribute to weathering of rocks. Temperature variation causes expansion and contraction leading to cracks.

(i) Contributions of temperature to rock weathering

**Expected Responses**

- exfoliation
- rocks crack due to continuous expansion and contraction
- very cold temperatures can cause water collected in crevices to expand and force rocks to disintegrate

(ii) Contributions of soil living organisms to rock weathering

Living organism contribute to weathering through the following activities:

**Expected Responses**

- bore holes in the rock through their feeding habit
- tree roots grow into cracks and crevices widening the cracks which eventually break the rock apart
- bacteria cause decay of fossils within rocks

- (b) Candidates have little difficulty in answering this sub question.

Characteristics of clayey soils

**Expected Responses**

- sticky when wet
- smooth when felt between fingers
- have good water retaining capacity hence easily become waterlogged/poor drainage
- have good anchorage for plants
- contain very small air spaces
- crack when dry
- very low porosity
- good nutrient retention

(c) Economic importance of soil erosion to farmers

Some of the candidates who attempted this sub question answered it well. Others also failed to relate the economic importance to the farmer and gave the effects of erosion generally.

**Expected Responses**

- destruction of farm land/high cost of controlling erosion
- top soil is lost / washed away
- loss of plant nutrients/use money to buy fertilizer
- there is destruction of vegetation cover
- causes lodging of crops/reduce yield/low income
- destruction of water bodies due to siltation
- spread of pests and diseases from one farm to the other
- destruction of farm structures



- (d) In this sub question, candidates rather wrote about the use of water in agriculture.  
Functions of soil water to plants

**Expected Responses**

- helps to distribute nutrients to all parts of the plant
- helps in the decomposition of organic matter
- makes plants turgid and fresh
- serves as natural solvent which dissolves nutrients for plants use
- cools and regulates crop temperature through transpiration
- distributes photosynthesized food
- serves as a medium for enzymatic reaction
- raw material for photosynthesis
- for germination of seeds
- moistens soil for easy penetration of plant roots

**Question 5**

- (a) **State four ways of controlling weeds on a maize farm.**
- (b) **State three ways in which each of the following practices in crop production are important.**
- (i) **Seedbed preparation;**
- (ii) **Nursing of seedlings.**
- (c) **Explain each of the following terms as used in crop production:**
- (i) **seed viability;**
- (ii) **seed dormancy.**
- (d) **Explain the *biological method* of controlling crop pest.**

- (a) In answering this sub questions , some candidates failed to focus on maize farm and gave answers 'like grazing', 'flooding' and 'burning' which are not applicable here.

Ways of controlling weeds on maize farm

**Expected Responses**

- use of hoe / cutlass
- use of farm machinery
- use of herbicides
- mulching
- hand picking of weeds
- proper spacing of maize on the farm
- biological control

- (b) Candidates provided some correct answers for this sub question.

- (i) Importance of seedbed preparation

**Expected Responses**

- improves soil aeration
- improves water infiltration into the soil
- exposes harmful organisms to the sun
- enhances germination of seeds

- reduces seed wastage
- enhances vigorous growth of seedlings
- makes transplanting of seedlings easy
- enhances easy penetration of roots
- makes planting at stake easier
- checks soil erosion
- controls weeds

(ii) Importance of nursing seedlings

In providing the answers for this sub question, candidates should have noted that nursing of seedling means management or care of seedlings and not planting of seedlings as noted from some of their responses.

**Expected Responses**

- reduces wastage of seeds
- allows selection of healthy seedlings for transplanting
- ensures uniformity of growth of seedlings
- allows for transplanting pest free seedlings/prevent pests attack
- allows for transplanting disease free seedlings/controls of diseases

(c) Explanation of terms:

The terms 'seed viability' and 'seed dormancy' were explained very well but a few of the candidates omitted the salient points.

(i) Seed viability

**Expected Response**

it is the ability of a seed to germinate into a seedling in the presence of favourable environmental conditions.

(ii) Seed dormancy

**Expected Response**

it is the inability of a viable seed to germinate under favourable environmental conditions.

(d) Explanation of biological method of controlling crop pests

This was well answered by the candidates who attempted it.

**Expected Response**

This involves the use of living organisms or their products to manage crop pest.

**Question 6**

(a) **Explain the term *cultural practice* as used in crop production.**

(b) **State four advantages each of undertaking the following agronomic practices in crop production:**

(i) **Staking;**

(ii) **Pruning.**

(c) **Give three reasons for carrying out each of the following activities:**

(i) **fermentation of cocoa;**

(ii) **parboiling of rice.**

(a) Explanation of the term cultural practice

A few of the candidates who attempted this sub question had it right. Most of them mention activities like planting and harvesting, forgetting that the activities should be between planting and harvesting.

**Expected Responses**

These are farm activities carried out on the permanent field between planting and harvesting.

(b) Advantages of agronomic practices

This was straight forward and most of the candidates who answered it could mention at least three advantages each for staking and pruning.

(i) Advantages of Staking

**Expected Responses**

- saves space
- exposes leaves to sunlight
- provides clean fruits
- prevents soil-borne diseases of fruits
- makes harvesting easier
- easy to work on farm / accessible
- produces relatively larger fruits
- increases yield
- reduces attack by pest

(ii) Advantages of Pruning

**Expected Responses**

- controls / redirects growth
- removal of diseased /older branches
- increases yield
- removal of excess branches
- promotes fruiting
- prevents lodging
- ensures good farm sanitation
- easy identification of ripe fruits
- produces relatively larger fruits

(c) Reasons for carrying activities:

(i) Reasons for carrying out fermentation of cocoa beans

Candidates from cocoa growing regions were able to give a reason or two why cocoa is fermented but majority had no idea about it.

### **Expected Responses**

- to remove the mucilage or pulp for easy and fast drying
- to develop the special chocolate flavour
- to kill the seed embryo to prevent germination during drying
- to make the beans more brittle and easy to separate from the seed coat
- to develop the chocolate colour

(ii) Reasons for carrying out parboiling of rice

Most of the candidates had little or no idea as to why rice is parboiled.

### **Expected Responses**

- to retain vitamins in the grain during milling
- to transfer nutrients from the aleurone layer into the grain
- to soften the husk to make milling easier
- to reduce breakage of grains during milling / ensure high milling to percentage

## **Question 7**

(a) **Explain each of the following terms as used in animal nutrition:**

(i) **Maintenance ration;**

(ii) **Balance ration.**

(b) **Give two functions of each of the following hormones:**

(i) **Oxytocin;**

(ii) **Oestrogen.**

(c) **Mention the causal agents of the following livestock diseases:**

(i) **Anthrax;**

(ii) **Coccidiosis;**

(iii) **Fowl pox;**

(iv) **Newcastle;**

(v) **Rinderpest;**

(vi) **Foot and mouth.**

(d) **Explain the term *quarantine* as used in animal husbandry.**

(a) Explanation of terms

Candidates were able to explain the term 'maintenance ration' and 'balance ration' correctly.

### **Expected Responses**

(i) Maintenance Ration

It is the amount of balanced feed given to a farm animal in a day to enable it carry out its physiological functions only.

(ii) Balance Ration

It is the amount of feed that contains all the required nutrients in the correct proportion given to an animal in a day.

(b) Functions of hormones

Candidates were not able to give the function of oxytocin and oestrogen correctly.

### Expected Responses

(i) Function of Oxytocin

- stimulates the contraction of the uterine wall / muscle during parturition
- promotes the transport of serotonin/sperm in the genital tract
- brings about the release of milk after parturition

(ii) Functions of Oestrogen

- stimulates the growth of the duct system in the udder
- induces the rapid multiplication of the epithelium in the vagina
- stimulates the development of secondary sex characteristics e.g. heat behaviour
- increases ciliary activities and mucus secretion in the oviduct
- promotes the production of eggs through oogenesis

(c) Diseases and their causal agents

Candidates were to state the causal agents of the listed diseases. They were to state whether it is caused by a virus protozoa or bacteria. Only a few of the candidates had them right.

### Expected Responses

	Diseases	Causal Agent
(i)	Anthrax	Bacteria / <i>Bacillus anthracis</i>
(ii)	Coccidiosis	Protozoa / <i>Eimeria</i> spp. / coccidia
(iii)	Fowl pox	Virus / fowl pox virus
(iv)	Newcastle disease	Virus / newcastle virus
(v)	Rinderpest	Virus / morbill virus
(vi)	Foot and mouth disease	Virus / FMD virus

(d) Explanation of the term Quarantine

The candidates had it wrong. They understood it as curling which is different.

### Expected Responses

This is the situation where an animal that is being introduced into an existing flock is first kept in an isolation pen/unit for a period of time and observed for signs of disease, illness before they are mixed with the rest of the flock if found free from diseases.

### Question 8

(a) **State four effects of ectoparasites on farm animals.**

(b) **Give two reasons for undertaking each of the following livestock husbandry practices:**

- (i) **Flushing;**
- (ii) **Creep feeding;**
- (iii) **Castration;**
- (iv) **Dehorning.**

(c) **Mention four causes of decline in egg production in layer birds.**

(a) Effects of ectoparasites on farm animals

Most candidates were able to mention the effect of ectoparasites on farm animals. The common effects mentioned are 'animal become anaemic' and 'damage to skin'

**Expected Responses**

- animal becomes anaemic
- some ectoparasites transmit diseases
- causes body irritation/restlessness
- skin damage
- reduction in production/ reproduction
- reduction in growth
- weakness/emaciation
- may cause death of animals

(b) Reasons for undertaking husbandry practices

Candidates showed knowledge in husbandry practice such as flushing, creep feeding castration and dehorning.

(i) Reasons for Flushing

**Expected Responses**

- increases rate of ovulation resulting in release of eggs
- leads to increase rate of conception
- enhances multiple birth resulting in triplets and quadruplets
- helps to synchronize oestrus and parturition of animals

(ii) Reasons for Creep feeding

**Expected Responses**

- leaves the dam less suckled hence in a better condition for early mating
- helps to promote rapid rate of weaning
- minimizes risk of hypocalcaemia or milk fever
- makes young animals grow faster
- provides a sure way of nourishing young animals in case dam's milk is insufficient

(iii) Reasons for Castration

**Expected Responses**

- prevents the possible spread of sexually transmitted diseases
- eliminates indiscriminate and uncontrolled mating
- castrates produce tender meat
- makes animals docile / less aggressive and easy to handle
- eliminates smell / odour associated with some male animals e.g. goat / boar
- minimizes the spread of undesirable qualities
- makes animal fat/put on weight

(iv) Reasons for Dehorning

**Expected Responses**

- makes animals less risky to handle
- minimizes injury to other animals/fighting

- increases feeding space
- increases stocking rate
- easy to be transported
- prevents damage to farm structures
- prevents animals from being entangled during grazing

(c) Causes of decline in egg production in layers

Candidates had little or no challenge in answering this sub question. Each candidate was able to mention at least three causes of decline in egg production.

**Expected Responses**

- poor nutrition / low quality feed
- over and under feeding / untimely feeding
- inadequate water
- poor quality water
- overcrowding
- poor ventilation
- incidence of pest e.g. lice, fowl termite, worms etc
- extreme environmental conditions e.g. temperature
- incidence of disease
- poor lighting system
- stress
- ageing

**Question 9**

- (a) **Give two benefits of an agribusiness plan.**  
 (b) **Mention four agencies in the cocoa value chain.**  
 (c) **Discuss four ways in which extension services is of importance in the production of maize.**

(a) Benefits of agribusiness plan

It was obvious from the responses of the candidates that they had little or no knowledge of what agribusiness plan is hence their inability to answer the question correctly.

**Expected Responses**

- it provides a benchmark for comparing forecast with actuals
- it enables the entrepreneur to monitor and evaluate the business
- it makes the entrepreneur focus to analyze all aspects of the enterprise
- it provide an effective strategy to deal with uncertainties that may arise
- it enhances production efficiency

(b) Agencies in the cocoa value chain

Candidates were to note that the agencies are organization , institutions and group of players in the cocoa industry. Candidates could only mention COCOBOD and cocoa processing companies.

**Expected Responses**

- MOFA (Ministry of Food and Agriculture)
- Cocoa processing companies / Associations

- NGOs
- Extension Services of COCOBOD
- Cocoa licensed buying companies
- Transportation / haulers
- Formal and informal financial institutions / services
- Quality Control division of COCOBOD
- cocoa farmers
- Cocoa research institutions

(c) Importance of extension services in maize production

This sub question was not well answered by candidates. Candidates rather focused on the individual farm practices instead of the major roles extension agents provide in production.

**Expected Responses**

- teach maize farmers new and better skills in production
- provide technical and material services to farmers e.g. improved seeds, fertilizer subsidies etc
- help change outmoded beliefs and attitudes of the farmers e.g. wrong attitudes towards the use of fertilizers
- provide technical data and information to government /authority or policy makers
- provide effective linkage between farmers and researchers
- introduce farmers to modern tools, equipment and machinery

**Question 10**

(a) **Explain the following terms as used in agricultural economics:**

- (i) **Finance;**
- (ii) **Credit;**
- (iii) **Subsidy;**
- (iii) **Collateral.**

(b) **Differentiate between *quantity of produce supplied* and *change in supply*.**

(c) **Mention four benefits derived from the keeping of farm accounts.**

(a) Explanation of terms

Question 10 (a) was answered well by the candidates who attempted it but a few of them were confused with the term credit and subsidy. The confused candidates wrongly stated that 'credit is the ability to borrow money or access goods to be paid later'. Others also wrongly stated that 'credit is the money placed on a mobile phone'.

**Expected Responses**

- (i) Finance  
It is the acquisition and use of capital for agricultural purposes.
- (ii) Credit  
It is the repayable loan given in cash or kind with or without interest for agricultural purposes.



- (iii) Subsidy  
When government sells inputs such as fertilizers, agrochemicals tractors to farmers at a price less than the market price. The reduction in price is borne and paid by the government, NGOs, etc.

That reduction in price is called subsidy.

- (iv) Collateral  
It is anything that is offered as surety for loan repayment.

- (b) Differentiation between quantity of produce supplied and change in supply  
Almost all the candidates who attempted this sub question had it wrong.

**Expected Responses**

A change in quantity supplied refers to a movement along the supply curve which is caused only by the price of the commodity. It does not establish a new equilibrium price and equilibrium quantity while a change in supply refers to a shift of the supply curve either to the right showing increase or to the left showing decrease. It is caused by other factors affecting supply but not the price of the commodity.

- (c) Benefits of keeping farm accounts  
This was fairly answered by the candidates who attempted it.

**Expected Responses**

- allows for comparison;
- to obtain loans from the bank;
- helps in assessment of tax;
- for budgeting and planning;
- to know how each enterprise in the farm is performing/financial position of the farm;
- helps in auditing to detect fraud.

### **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 most of the candidates was encouraging, as quite a large number of them scored higher marks as compared to the previous year.

#### **2. SUMMARY OF CANDIDATES' STRENGTHS**

1. 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.
2. Candidates were quite impressive, as majority of them wrote the question numbers in the order in which they answered them, behind the answer booklets.
3. Every candidate attempted to answer all the questions, though some of them had no idea about the requirements of some of the questions.

Candidates had very little difficulties answering the following questions:

- Parts of cassava and groundnut that is propagated.
- Products obtained from groundnuts and cashew.
- Uses of mattock and ways of prolonging its lifespan.
- Management practice for which burdizzo is used.
- Steps involved in the use of burdizzo.
- Reasons for castration of a he-goat.
- Equipment that could be used in place of burdizzo.
- Crops that cotton stainers feed on.
- Classification based on the mode of feeding of cotton stainer and grasshopper.
- Life cycle of a grasshopper.
- Cultural methods of controlling cotton stainers.
- Management practice to obtain a horn.
- Reasons for carrying out dehorning.
- Methods of applying urea fertilizer.

### 3. SUMMARY OF CANDIDATES' WEAKNESSES

- (1) Some of the candidates had difficulties in understanding some of the questions, thus providing answers which were wrong.
- (2) It appeared some candidates did not devote enough time to read over their answers to questions, to enable them 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.
- (3) Few candidates provided more answers to some questions, than were required of them. This behavior 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.
- (4) Some of the candidates spent so much time to answer questions, and later cancel them out, probably because they later realized their friends had provided different answers to those questions. These could have been avoided if they spent about minutes to read all the questions at the start of the exams.
- (5) Errors associated with spellings of technical words were very common, and this caused candidates to lose precious points.

Areas that posed much problems to the candidates include:

- \* Varieties of Manihot esculenta (Cassava) and Arachis hypogea (groundnut).
- \* Viral and fungal diseases of cassava and groundnuts
- \* Economic uses of cashew.
- \* Equipment used in place of burdizzo.
- \* Classification based on mode of feeding of cotton stainer and grasshopper.
- \* Life cycle of grasshopper.
- \* Other fertilizers that can serve the same purpose of urea fertilizer.
- \* Methods of applying urea fertilizer.
- \* Problems associated with the use of urea fertilizer.
- \* Advantages of applying poultry manure.
- \* Reasons why the use of poultry manure is not popular in Africa.

#### 4. **SUGGESTED REMEDIES**

- (1) There should be effective teaching on agricultural terminologies and scientific names.
- (2) Teachers should organize regular practical lessons to enable students develop skills in description and explanations of agricultural terminologies.
- (3) Teachers should educate candidates on how to answer questions in examination; reading of instructions, selection of questions and organization of ideas.

#### 5. **DETAILED COMMENTS**

##### **Question 1**

- (a) Give two varieties each of specimens A and B.
- (b) Mention the parts of specimens A and B that are used for their propagation.
- (c)
  - (i) Name one viral and one fungal disease of the plant from which specimen A was obtained.
  - (ii) Name one viral and one fungal disease of the plant from which specimen B was obtained.
- (d) Name three products obtained from processing specimen B.
- (e) Give two economic uses of specimen C.

##### **Question 1**

- (a) Varieties of specimen  
Quite a number of the candidates got this wrong due to wrong spelling. However, a handful of them were able to provide the names correctly.

##### **Varieties of Specimen A (Manihot esculenta/ cassava)**

##### **Expected Responses**

- |                 |              |                  |
|-----------------|--------------|------------------|
| - Aukra / Ankra | - IFAD       | - Nkabom         |
| - Abosome Nsia  | - Otuhia     | - Eskamaye       |
| - Afisiafi      | - Sikabankye | - Agbelifia      |
| - Biafra        | - Abasafitaa | - Essambankye    |
| - Ampong        | - Tekbankye  | - Bankyehemaa    |
| - Buronibankye  | - Dokuduade  | - Capevarsbankye |
| - Bankyebotan   |              |                  |

Varieties of Specimen B (Arachis hypogea - groundnut)

**Expected Responses**

- Nketia
- Yewawoso
- Sum nut
- Adepa
- Jenkaah
- Nkosour/Nkoso
- Azivivi

(b) Parts used for propagation

Almost all the candidates were able to state the parts correctly. Only a small number spelt the word **stem** wrongly. Some wrote **stern** and others wrote **steam**.

**Expected Responses**

Specimen A- (Cassava)	Specimen B- (Groundnut)
Stem	Seeds

(c) (i) Diseases of specimen A (Cassava)

Majority of the candidates had problem with this question. They had problems with spelling the names of the diseases. Some also misplaced the viral diseases with the fungal diseases.

**Expected Responses**

Viral Diseases	Fungal Diseases
Leaf mosaic	Brown leaf spot
Green mottle	White leaf spot
Brown streak	Anthraxnose
African cassava mosaic	Root rot
Cassava frog skin	Bud necrosis
India cassava mosaic	Leaf blight/Leaf spot
Cassavas vein mosaic	White thread of roots

(iv) Diseases of specimen B (Groundnut)

**Expected Responses**

Viral Diseases	Fungal Diseases
Rosette	leaf spot
Streak virus	Groundnut rust
Groundnut mottle	Tikka
Indian clump	Mouldy seed
	Anthraxnose
	Wilt
	Root rot

(d) Products obtained from producing specimen B (groundnut).

Majority of the candidates were able to state the products. However it was observed that some of the candidates indicated only its uses as food in different ways.

**Expected Responses**

- Groundnut paste
- Oil/groundnut oil
- Groundnut cake
- Confectionery
- Roasted snack

(e) Economic uses of C (cashew)

Candidates could not state the economic uses of cashew. The indication is that, they might not have been taught and may also not have taken the trouble to read wide but kept depending on their teachers' notes.

**Expected Responses**

- |                 |                       |
|-----------------|-----------------------|
| - Pulp for jam  | - For medicine        |
| - Ice cream     | - Cashew milk         |
| - Confectionery | - Cashew yoghurt      |
| - Oil           | - Cashew butter/paste |
| - Drinks        | - Roasted snacks      |

**Question 2**

- (a) (i) **State three uses of specimen D on a farm.**  
(ii) **State three ways by which the lifespan of specimen D could be prolonged.**
- (b) (i) **Mention the management practice for which the equipment labelled E is used for on the farm.**  
(ii) **Outline the steps involved when performing the operations for which specimen E is used on the farm.**
- (c) (i) **Give two reasons for performing the operation for which specimen E is used on the farm.**  
(ii) **Name one other equipment that could be used in place of specimen E on the farm.**

- (a) (i) Most of the candidates were able to mention the correct used of the tool in the farm. Few however just wrote any farm practice they know which were wrong. E.g tilling of the land.

Uses of specimen D (mattock) on a farm

**Expected Responses**

- For felling of trees
- Chopping logs
- Uprooting stumps
- Digging hole
- Removal of stones

- (ii) Majority of the candidates were able to state the correct ways of prolonging the lifespan of the tool. Few however could not write the appropriate ways.

Ways of prolonging the lifespan of specimen D (mattock)

**Expected Responses**

- Keep clean after use/ wash and dry
- Use for its purpose
- Keep in a cool dry place
- Oil metal parts before storage
- Repair damaged parts
- Keep in termite free environment
- Sharpen cutting edge

- (b) (i) Majority of the candidates were able to name the right management. Few however spelt the word wrongly.

Management practice for which specimen E (Burdizzo) is used

**Expected Response**

To perform close castration /for castration

- (ii) Almost all the candidates got the steps correctly. Only few mixed the steps up hence losing marks for sequence.

Steps involved in the use of specimen E (Burdizzo)

**Expected Responses**

- Restrain the animal
- Locate the spermatic cord
- Open the Burdizzo and close it on the spermatic cord
- Crush the cord
- Repeat on other spermatic cord
- Release animal after the operation

- (c) (i) Almost all the candidates gave the right response to the question like making the animal docile, avoid indiscriminate breeding, etc.

Reasons for operation (castration)

**Expected Responses**

- Remove taint /odour
- Fatten animals
- Make animal more docile
- Prevent animal from mating
- Prevent sexually transmitted diseases
- Prevent transfer of undesirable traits

- (ii) A lot of the candidates could not state the alternative equipment. Some wrote sharp blade or knife. Few however got it right.

Equipment in place of burdizzo

**Expected Responses**

Elastrator/Henderson pliers/Emasculator

**Question 3**

- (a) (i) **Name two crops that specimen F could feed on.**  
(ii) **Classify specimens F and G based on their mode of feeding.**
- (b) **Draw the life cycle of specimen G.**
- (c) **Give three cultural methods of controlling specimen F.**
- (d) (i) **Mention one management practice that could be carried out on an animal to obtain specimen H.**  
(ii) **State three reasons for carrying out the management practice mentioned in (d)(i).**
- (a) (i) Majority of the candidates were able to indicate the correct crops. Few however wrote crops which are not fed on by cotton stainers.

Crops that specimen F (cotton stainer) could feed on

**Expected Responses**

- |             |            |
|-------------|------------|
| - Cotton    | - Hibiscus |
| - Orange    | - Millet   |
| - Mango     | - Sorghum  |
| - Pawpaw    | - Eggplant |
| - Okra/okro |            |

- (ii) Here, candidates did well by identifying their mode of feeding. However, some got it wrong due to spelling mistakes and writing them in the wrong order. E.g. instead of **biting** and **chewing**, they wrote **chewing** and **biting**. Also **sucking** and **piercing** instead of **piecing** and **sucking**.

Classification of specimen F and G based on mode of feeding

Specimen F (Cotton stainer)

**Expected Response**

Piercing and sucking

Specimen G (Grasshopper)

**Expected Response**

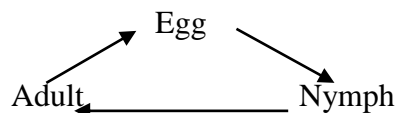
Biting and chewing



- (b) This question was well answered by majority of the candidates. However, few of them drew a complete metamorphosis which is not the case for grasshopper. Some also failed to bring the arrow that shows the metamorphosis from one stage to the other. Again, some drew the arrows anti-clockwise. This caused them to loose a lot of marks.

Life cycle of specimen G (Grass hopper)

**Expected Response**



- (c) This question seemed to pose a lot of problem to the candidates. There is every indication that candidates did not read and understand the question well. They gave answers like the use of **recommended chemicals** when the question clearly stated **cultural methods**.

Cultural methods of controlling Specimen F (cotton stainer)

**Expected Responses**

- Hand picking in small farms
- Crop rotation
- Early planting/late planting
- Early harvesting/late harvesting
- Weed control

- (d) (i) Apart from spelling mistakes from few students, almost all the candidates provided the right response.

Management practices to obtain specimen H (horn)

**Expected Response**

- Dehorning

- (ii) Majority of the candidates were able to provide the right responses. However, few of them provided answers like '**to make the animal docile**'. Some also wrote the same answer in different ways. This made them lose precious marks.

Reasons for carrying out practice (dehorning)

**Expected Responses**

- Easy handling of animals
- Prevent injury to other animals
- Prevent damage to hide
- Increase feeding space
- Prevent damage to farmer
- Increase stocking rate
- Prevent damage to farm structures
- Prevent animal from being entangled during feeding

#### Question 4

- (a) (i) Name three other fertilizers that could serve the same purpose as specimen J.  
(ii) Mention two methods of applying specimen J.  
(iii) Mention two problems associated with the use of specimen J on the farm.
- (b) (i) Give five advantages in the use of specimen K.  
(ii) Give three reasons why the use of specimen K is not popular in West Africa.

- (a) (i) This question was problematic to the candidates. Some gave wrong answers by just writing any kind of fertilizers they know. Some also got it wrong due to spelling mistakes.

#### Other fertilizers that can serve the purpose of specimen J (urea)

##### **Expected Responses**

- NPK
- Sulphate of Ammonia
- Potassium Nitrate
- Ammonium Nitrate
- Cow dung
- Poultry manure
- Compost

- (ii) This question was also not well answered. Most of them wrote answers like **drilling, fertigation** which are not methods of applying urea fertilizers. Teachers should try and help students know the methods of application of the various kinds of fertilizers.

#### Methods of applying specimen J (urea)

##### **Expected Responses**

- Broadcasting e.g. in rice
- Ring method
- Side/ row/ band placement
- Fertigation

- (iii) Candidates understood the question and actually knew some of the answers to this question. The problem was with the inability of some of them to state the correct answers. Some mentioned the effect on the farmer rather than the soil.

#### Problems associated with the use of specimen J (urea)

##### **Expected Responses**

- Causes acidity
- Volatilization
- Has to be buried/difficulty in application
- Easily leached

- (b) (i) This question was straight forward but quiet problematic to the candidates. Most of them could not provide all the five advantages as required. Some provided the same answers in different ways. E.g. Improves soil structure, binds loose soils, and drainage all which have to do with soil structure.

Advantages of using specimen K (poultry manure)

**Expected Responses**

- Releases nutrients slowly over a longer period
- Does not leach easily/low leaching ability
- May act as energy source for microorganisms in the soil
- Improves soil structure/aeration/drainage
- improves nutrients holding capacity of the soil
- Acts as buffer
- Regulates soil temperature when it breaks down
- Improves water holding capacity of the soil

- (ii) This question appeared to be simple and straight forward but majority of the candidates did not do well in answering it. Most of them could provide only one or two correct responses. Some did not even receive a single mark for this sub question.

A greater majority could not state the possible causes of the problem. It is possible the teachers ignored such topics. Teachers and students should read wide.

Reasons why the use of specimen K (poultry manure) is not popular

**Expected Responses**

- It is bulky
- Causes pollution to underground water
- Difficult to transport
- Could be injurious to plant when applied fresh/undecomposed
- Laborious to apply
- Difficult to obtain for a large farm

## INTEGRATED SCIENCE 2

### (1) GENERAL COMMENTS

The standard of the paper is the same as that of the previous year. The performance of candidates was better than last year.

### (2) SUMMARY OF CANDIDATES' STRENGTHS

- (1) Majority of the candidates exhibited good knowledge of scientific principles and their applications.
- (2) Classification and contributions of three scientists (Mendeleev, Linnaeus and Aristotle) to science were well answered by most of the candidates.
- (3) Candidates were familiar with reasons for weaning piglets, bisexual and unisexual flowers and alloys.

### 3. SUMMARY OF CANDIDATES' WEAKNESSES

- (1) Failure to number answers in some cases.
- (2) One word answers were spelt wrongly e.g. ultraviolet, inductor, capacitor, ossicles, etc.
- (3) Time wasted by candidates who copied the questions, before answering them.
- (4) SI units were wrongly written in some cases e.g. 'Joules' instead of joules.
- (5) Some candidates wasted time answering more than the four (4) questions required.
- (6) In a few cases, the handwriting was not legible.
- (7) Some candidates gambled by providing more answers than required when they were not sure what answer was required of them – compelling the examiner to select the correct answer among the lot provided.

### 4. SUGGESTED REMEDIES

- (1) Need to have vocabulary drills on key words/spelling at the start of lessons.
- (2) Specific lessons should be taught on SI units of fundamental/derived quantities, and how they should be written.
- (3) Candidates must be reminded that extra questions answered do not fetch more marks.
- (4) There's the need for candidates to improve on their English vocabulary as well.

### 5. DETAILED COMMENTS

#### Question 1

- (a) (i) Define *classification* as used in science.
- (ii) State one contribution to science by the following scientists:
  - ( $\alpha$ ) Mendeleev;
  - ( $\beta$ ) Linnaeus;
  - ( $\gamma$ ) Aristotle.

- (b) (i) Define *mechanical energy*.  
 (ii) A body of mass 10 kg is placed at a height 200 cm above the ground. Calculate the potential energy possessed by the body [ $g = 10 \text{ m s}^{-2}$ ]
- (c) (i) Distinguish between a base and an alkali.  
 (ii) Name one natural source of each of the following bases:  
 (α) ammonia;  
 (β) potassium hydroxide;  
 (γ) carbon oxide.
- (d) (i) Explain the term *mulching*.  
 (ii) List three materials used for mulching.

This question was very popular among candidates.

- (a) (i) Classification was well explained by candidates.  
 (ii) Most candidates were able to give the contributions of the three scientists – Mendeleev, Linnaeus and Aristotle to science. Except a few who wrote ‘Period table’ instead of Periodic table as contribution of Mendeleev.
- (b) (i) Some Candidates misread Mechanical Energy for Mechanical advantage and provided answers for the latter leading to loss of marks.  
 (ii) Some candidates failed to convert 200 cm to metres before substituting into the equation  $PE = mgh$  and wrote the unit for P.E as Joules instead of joules/J. Candidates also failed to define the ‘g’ as acceleration due to gravity, but rather wrongly put it as ‘gravity’ and consequently lost the mark for stating the wrong formula.
- (c) (i) Some candidates rather chose to differentiate between bases and acids and not a base and alkali as demanded by the question. Many candidates were able to differentiate between a base and an alkali.
- (d) Almost all candidate defined ‘mulch’ instead of mulching which is the act of depositing organic materials/compost around crops/plants. They were however able to give examples of materials used for mulching.

## Question 2

- (a) (i) Differentiate between a pest and a parasite.  
 (ii) Name the states in the life-cycle of a weevil.
- (b) A solution was prepared by dissolving 25 g of KOH in  $250 \text{ cm}^3$  of distilled water.  
 (i) Calculate the concentration of the solution in  $\text{mol dm}^{-3}$ .  
 [K = 39, O = 16, H = 1]  
 (ii) If  $125 \text{ cm}^3$  of the solution is diluted to  $1000 \text{ cm}^3$ , calculate the concentration of the diluted solution in  $\text{mol dm}^{-3}$ .
- (c) Name the discrete electronic component describe by each of the following statements:  
 (i) it stores electric charge;  
 (ii) it stores magnetic field when electric current flows through it;  
 (iii) it opposes the flow of electric charge;  
 (iv) it is made of two parallel plates separated by an insulator;  
 (v) it allows electric current to flow in one direction only.

(d) Copy and complete the table below.

<i>Blood group</i>	<b>Antigen on surface of red blood cell</b>	<b>Antibody in the serum of the same individual</b>
<b>A</b>		
<b>B</b>		
<b>AB</b>		
<b>O</b>		

- (a) (i) Candidates stated correctly that pest cause damage to crops but failed to add that they do not directly cause diseases as demanded by the scheme – parasites were however defined correctly.
- (b) The Mole calculation was attempted by most of the candidates who answered this question; a few however failed to write correctly the unit for the conc. as mol/dm<sup>3</sup>; some wrote it wrongly as mol/dm<sup>-3</sup>.
- (c) The Discrete electronic components were given but some candidates had challenges with the spelling of resistor, capacitor, and inductor.
- (d) This question was well answered by almost all candidates who attempted it.

### Question 3

- (a) (i) **Explain the statement, pure water is neutral.**  
(ii) **State two causes of hardness of water.**
- (b) (i) **What is a**  
(α) **bisexual flower?**  
(β) **unisexual flower?**  
(ii) **Give an example of a**  
(α) **bisexual flower;**  
(β) **unisexual flower.**
- (c) (i) **Define the term weaning.**  
(ii) **Give three reasons for weaning piglets.**
- (d) (i) **What are organic compounds?**  
(ii) **State the function of two of the components named in (i).**
- (a) (i) Very popular question with most candidates stating that pure water has a pH of 7.  
(ii) Some candidates who chose to write specific compounds of magnesium and calcium as causes of hardness of water, wrote the compounds wrongly when they should have just indicated that hardness of water was caused by Mg<sup>2+</sup>/Ca<sup>2+</sup>/Fe<sup>2+</sup>.
- (b) (i)/(ii) Most candidates were very comfortable with this question and were able to define Bisexual/Unisexual flowers correctly - a few however had wrong spelling for some examples like pride of Barbados.
- (c) (i) Candidates demonstrated knowledge of the concept of weaning to involve separating young animals from their breast-feeding mother, but failed to indicate also that it involves introducing them (young animals) to other diet.  
(ii) Candidates were familiar with the reasons for weaning which include preparing the mother for early servicing, providing for faster growth of the young ones to reduce pressure on mother when it is sick etc.

- (d) The challenge candidates had in this section was with spellings of Malleus, Stirrup, and Eustachian tubes and the function of Malleus which they stated wrongly as transmitting sound waves to the incus' instead of transferring VIBRATIONS.

#### **Question 4**

- (a) (i) What are *organic compounds*?  
(ii) Name the three main sources of organic compounds.
- (b) (i) What is *litter* as used in poultry?  
(ii) Name the term brooding as used in animal production.
- (c) (i) What is meant by *non-heritable characteristic*?  
(ii) Give three examples of non-heritable characteristic.
- (d) (i) Differentiate between speed and velocity.  
(ii) A body of mass 10 kg in motion, changes its speed from  $50 \text{ m s}^{-1}$  to  $100 \text{ m s}^{-1}$  in 10 s. calculate the:  
(a) acceleration of the body;  
(b) force that caused the acceleration.
- (a) (i) Even though candidates know that organic compounds always contain carbon, they failed to add that the carbon atoms are covalently linked to other elements such as hydrogen.
- (b) (i) Candidates stated correctly that litter is used as bedding for poultry on the floor of the poultry house, but were not able to name wood shavings/cut straws/spilled feed as materials that could be used as bedding.  
(ii) Brooding was very well answered.
- (c) (i) Candidates stated correctly that non-heritable characteristics are traits that cannot be passed from a parent to a child but failed to add 'through the genes' as the second half of the answer required.  
(ii) The open ended nature of this question gave candidates room to give weird examples of non-heritable characteristics – some visible (physical) characteristics would have been preferred.
- (d) (i) To differentiate two terms/concept required explaining each separately and not to tabulate differences – in this case only explanations of speed and velocity were required separately.  
(ii) The calculations of the acceleration 'a' from  $\frac{v-u}{t}$  and  $F=ma$  posed no challenge to candidates.

#### **Question 5**

- (a) Explain why the:  
(i) tip of needles are made pointed;  
(ii) wheels of earth moving machines are broad.
- (b) Explain each of the following terms:  
(i) Balanced ration;  
(ii) Maintenance ration.
- (c) (i) What are *metalloids*?  
(ii) Give two examples of metalloids.  
(iii) Name two alloys and state the constituents of each of them.
- (d) (i) Describe the process of fat digestion in humans.  
(ii) Name two disorders that affect the liver.

- (e) (i) **This sub-question was well answered as most of the candidates were able to explain metalloids correctly.**  
(ii) **Correct examples of metalloids such as Silicon, Boron and Arsenic were given. However, some candidates lost marks due to wrong spellings of names.**
- (f) **Most of the candidates correctly described the process of digestion in humans. However, quite a few candidates could not name disorders that affect the liver.**
- (a) (i) This was a question to test candidates' application of the concept of pressure from the formula  $P = F/A$ . Regrettably, some candidates failed to state that the pointed end of the needle provides a small surface area, creating a large pressure which makes piercing the material easier.  
(ii) On the other hand the broad wheels of the machine presents a small pressure exerted on the soil, making it not to sink. – it has nothing to do with friction.
- (b) (ii) Candidates were familiar with the terms Balanced ration and Maintenance ration. Their correct explanation include: Balance ration is the feed that contain all nutrients in their correct proportions. And maintenance ration is a feed mixture which is just sufficient to meet the requirements of a specific animal in 24-hour period.

### **Question 6**

- (a) (i) **What is meant by the term *decomposers*?**  
(ii) **State two ways in which decomposers are important in an ecosystem.**
- (b) (i) **What are *secondary colours* of light?**  
(ii) **Name two secondary colours of light.**  
(iii) **Name two electromagnetic radiations that have frequencies higher than violet light.**
- (c) (i) **List three scientific principles involved in the production of palm oil.**  
(ii) **State two hazards in the school laboratory.**
- (d) (i) **Differentiate between *sedimentary rock* and *metamorphic rocks*.**  
(ii) **List three characteristics of igneous rocks.**
- (a) (i) Well answered as most of the candidate correctly state that decomposers are orgqanisms which breakdown organic materials.  
(ii) Candidates mentioned that decomposers return nutrients back into the soil, but failed to add that they help to maintain ecological balance in the environment, they ensure that dead matter/waste do not accumulate in the ecosystem or may serve as food for other organisms.
- (b) (i) Mixing of two primary colours to give a secondary colour is accepted; not 'combining', which quite a number of candidates stated.  
(ii) Green is not accepted as a secondary colour of light; blue-green however is in addition to Cyan/Purple/Yellow and Magenta.  
(iii) Quite a few got the spelling of ultraviolet rays wrong as an example of y electromagnetic radiations with higher frequency than violet light. – other radiations stated correctly were Gamma rays and X-rays sometimes with the spelling of the former becoming a challenge.
- (c) (i) The most poorly answered question of this paper – Candidates were rather outlining the process of preparing palm oil instead of stating boiling, mixing, skimming, evaporation, and sterilization as scientific principles involved in the process.



- (ii) This question was misunderstood by candidates who states what one does not have to do in the laboratory. Candidates were expected to state choking from fumes from chemical burns from acids//bases, toxic gases, corrosive substance, fire, food contamination, poisonous chemicals, etc.
- (d) (i) In providing an explanation for metamorphic rocks, some candidates failed to indicate they change their original shape and form due to intense heat and pressure.
- (ii) Well answered sub-question as most of the candidates listed the correct characteristics of igneous rocks. Their correct answers include:
- generally crystalline;
  - very hard;
  - glassy;
  - angular.



### **INTEGRATED SCIENCE 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:

- (1) Scientific principle involved in preparation of soap from cocoa pod i.e. saponification;
- (2) Correct identification of organisms illustrated i.e. caterpillar / A, Bird / B, Roundworm / C and Tick /D;
- (3) Correct conversion of distance (d) into volume using the scale provided

#### **3. SUMMARY OF CANDIDATES' WEAKNESSES**

The following weaknesses were noticed in the scripts of candidates:

- (1) Inability to rearrange steps in soap making in correct sequence;
- (2) Wrong spellings of technical terms and scientific words;
- (3) Inability to identify correctly the adaptive features of the bird which enable it to destroy crops;
- (4) Failure of candidates to draw and label the triangle on the line of best fit for the determination of the slope.

#### **4. SUGGESTED REMEDIES**

The Chief Examiner made the following suggestions meant to remedy the weaknesses of candidates:

- (1) Teachers should periodically use question and answer to drill students on scientific words and technical terms;
- (2) Teachers should give more exercises involving plotting of graphs and determination of slope on the graph;
- (3) Teachers should organise more practical lessons involving identification of organisms and their adaptive features.

#### **5. DETAILED COMMENTS**

##### **Question 1**

The steps involved in the preparation of soap from palm oil are outlined below as I, II, III, IV, V and VI but not in any order.

Study the steps carefully and answer the questions that follow.

- I. Water is added to the cocoa pod ash, stirred and filtered.
- II. The mixture is boiled and stirred for sometime and then allowed to cool;
- III. Palm oil is poured into a can and heated;
- IV. Dry cocoa pods are burnt into ash;
- V. The solution is poured into hot oil;
- VI. The crust that forms on top of the liquid is removed.

- (a) Arrange the steps in the correct sequence.
- (b) Name the scientific principle underlying the preparation of soap.
- (c) Name the substance that could be used to speed up the precipitation of the soap.
- (d) State the step in which it is most appropriate to introduce the catalyst.
- (e) Name the chemical substance present in the solution of the cocoa pod ash.
- (f) State two effects of impurities in the soap produced.
- (g) Describe the test to confirm that the product is soap.

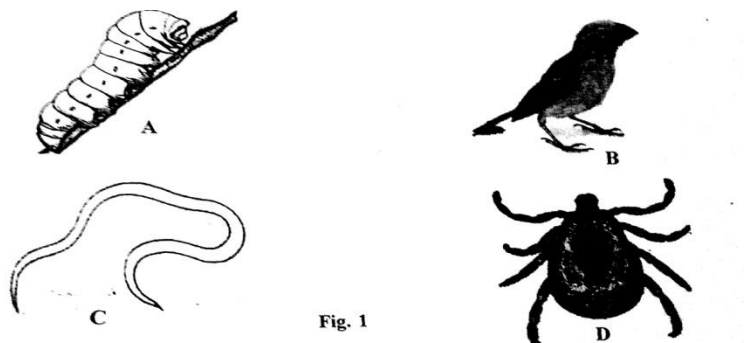
### Question 1

A great majority of the candidates who attempted this question exhibited a fairly good familiarity and ideas about the preparation of local soap.

- (a) Candidates were required to arrange the steps in preparation of soap from cocoa pod and palm oil in correct sequence.  
Most candidates did not re-arrange the steps in correct order. The expected correct order is indicated below:  
IV → I → III → IV → II → VI
- (b) Candidates were to name the scientific principle underlying the preparation of soap. Most of the candidates mentioned saponification. However, some candidates lost marks due to the wrong spelling of saponification.
- (c) Most of the candidates wrongly mentioned Conc. H<sub>2</sub>SO<sub>4</sub> instead of Brine / Conc. NaCl solution as the catalyst to speed up the precipitation of the soap.
- (d) Many candidates correctly mentioned appropriate step to introduce the catalyst.
- (e) Potassium hydroxide / potash was correctly named as the chemical substance present in the solution of the cocoa pod ash.
- (f) Most of the candidates were able to state correctly the effects of impurities in soap produced. Their correct answers include:
  - undesirable colour;
  - undesirable odour;
  - itching of the skin / skin irritation.

### Question 2

**Fig. 1** is an illustration of organisms labelled A, B, C and D that attack crops and farm animals. Study the illustration carefully and answer the questions that follow.



- (a) Identify each of the organisms labelled A, B, C and D.
- (b) List the organism(s) that can be classified as:
  - (i) pests;
  - (ii) parasite.
- (c) Name one crop or animal that is attacked by each of the organisms labelled B and D.
- (d) State the kind of damage that each of the organisms labelled A, B and C causes to its hosts.
- (e) State one adaptive feature of the organism labelled B which enables it to cause the damage stated in (d).
- (f) State two methods of controlling the organism labelled D.

### Question 2

This question was well answered by most of the candidates.

- (a) Candidates were required to identify the illustrated organisms labelled A, B, C and D. Most of the candidates identified the organisms as:  
A as a caterpillar, B as a bird / weaver bird, C as a Roundworm / Ascaris and D as a Tick.  
Some candidates lost valuable marks due to wrong spellings of names of organisms.
- (b) Most of the candidates correctly classified the organisms into pests and parasites. The correct groupings are indicated below:  
Pests → Bird / B and Caterpillar / A  
Parasite → Roundworm / C and Tick / D
- (c) Majority of the candidates correctly mentioned cereals such as corn, millet, rice, sorghum as crops attacked by Birds / B and cattle, goat, sheep as animals attacked by Tick / D.
- (d) Candidates were required to state the kind of damage caused by each of the organisms to its host. Candidates were generally familiar with this sub-question as most of them correctly outlined the damages caused to its host as indicated below:  
Caterpillar / A feeds on leaves of crops;  
Birds / weaver bird / B feeds on grains, leaves, fruits  
Roundworm / C feeds on digested food of its host.
- (e) This sub-question was poorly answered by most of the candidates. Candidates could not identify and state the adaptive features that Bird / B possessed to enable it cause damage to crops;  
The expected correct answer is indicated below: Bird / B has a short / stout / pointed beak; digits end with claws for scratching.
- (f) Methods of controlling organisms D / Tick was well answered by most of the candidates. Their correct responses include:
  - regular disinfection of animal house;
  - regular dipping;
  - dusting with commended chemicals;
  - using recommended insecticide.

### Question 3

The table below shows the height distribution of a number of students in a Senior High School in Ghana.

*Study the table carefully and answer the questions that follow.*

<i>Height/cm</i>	<i>Number of students</i>
139.5 – 149.5	6
149.5 – 159.5	9
159.5 - 169.5	7
169.5 - 176.5	5
179.5 - 189.5	2
189.5 - 199.5	1

- (a) Draw a histogram with *height* on the horizontal axis and the *number of students* on the vertical axis.
- (b) Calculate the total number of students in the class.
- (c) (i) From the histogram, determine the number of students with heights:  
 (α) less than 159.5 cm;  
 (β) more than 169.5 cm;  
 (ii) Calculate the percentage of students with heights between 149.5 cm – 179.5 cm.
- (d) Stat the concept in Genetics that the data illustrates.
- (e) Give two other examples of physical traits in humans that could illustrate the concept stated in (d).

### Question 3

Candidates' performance on this question was only fair as most of them could answer it well.

- (a) Candidates were able to draw a histogram with height on horizontal axis and number of students on vertical axis. However, some of the candidates could not label the axes with units, others chose wrong scales on both axes, hence discontinuous rectangle were provided. A few candidates drew a Bar charts which are different from histograms.
- (b) Candidates were required to determine the total number of students. Most of the candidates correctly provided 30 students as the answer.
- (c) This sub-questions requested candidates to use the histogram to determine the heights less than 159.5 cm and more than 169.5 cm. so calculate the percentage of students with heights between 149.5 cm and 179.5 cm.

Many candidates could not determine the number of students with the stated heights.

The correct determinations were outlined below:

Less than 159.5 cm = 9 + 6 = 15 students

More than 169.5 cm = 5 + 2 + 1 = 8 students

The percentage of students with heights between 149.5 cm and 179.5 cm

$$\begin{aligned}
 &= \frac{9 + 7 + 5}{30} \times 100 \% \\
 &= \frac{21}{30} \times 100 \% \\
 &= 70 \%
 \end{aligned}$$

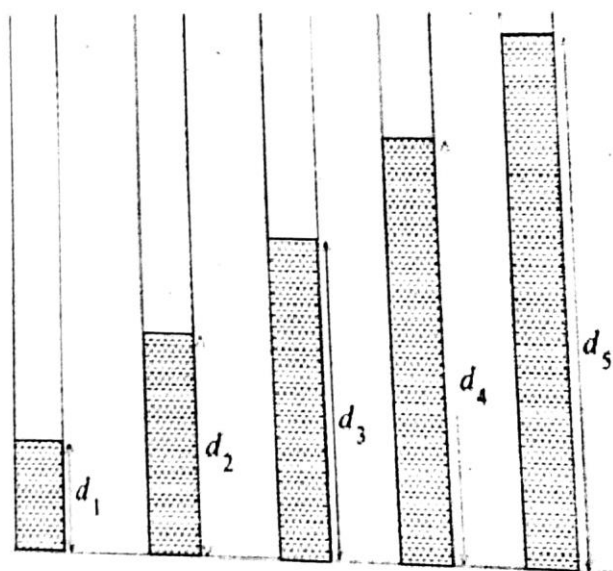
Some candidates could not obtain the correct values because their histograms were not drawn properly.

- (d) As regards the concept of Genetics illustrated by the data, many candidates correctly identified it as continuous variation or variation.
- (e) Most of the candidates correctly mentioned examples of physical traits in humans as height, weight, skin colour, finger length, foot length, age and scored full marks for the sub-question.

#### Question 4

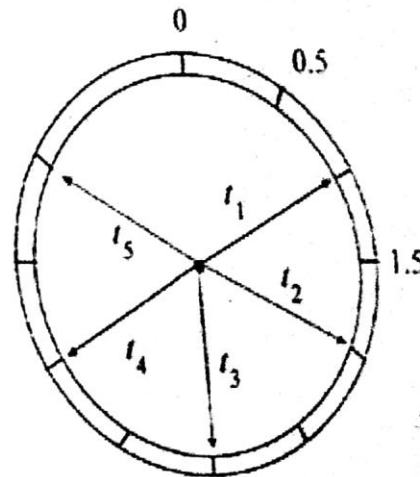
The rate of flow of water from a pipe in the laboratory was determined. The tap was opened to deliver water into a container. The volume  $V$ , of water discharged into the container in a time interval,  $t$  was measured. The procedure was repeated for four different volumes of water discharged and in each case, the time interval was recorded.

Fig. 2(a) illustrates the raw volumes  $d = d_1, d_2, d_3, d_4$  and  $d_5$  of water discharged while Fig. 2(b) illustrates the corresponding time interval  $t = t_1, t_2, t_3, t_4$  and  $t_5$  of discharge.



Scale: 1 cm represent  $500 \text{ cm}^3$

Fig. 2(a)



Time in Seconds

Fig. 2(b)

- (a) Measure and record the raw volumes  $d = d_1, d_2, d_3, d_4$  and  $d_5$
- (b) Convert  $d$  to real volumes  $V = V_1, V_2, V_3, V_4$  and  $V_5$ , using the scale provided.
- (c) Read and record  $t = t_1, t_2, t_3, t_4$  and  $t_5$ .
- (d) Tabulate the results in table 1.
- (e) Plot a graph with  $V$  on the vertical axis and  $t$  on the horizontal axis.
- (f) Determine the slope of the graph.
- (g) Explain the value of the slope.

#### **Question 4**

This question tasked candidates to study illustrations and record the distance, convert distance to volume (using a scale provided) and time.

Most of the candidates could not correctly convert raw volume to real volume values using the scale provided. As a result the graph of real volume,  $V/\text{cm}^3$  vrs time in seconds were poorly drawn.

In the determination of slope, some candidates failed to draw and label the triangle on the line of best fit hence performed poorly.

However, some candidates calculated the slope correctly and explained the value of the slope by stating correctly that “water will fill the container to a depth of  $700 \text{ cm}^3$  in a second.



## PHYSICS 2

### **1. GENERAL COMMENTS**

The questions set were within the scope of the syllabus. The standard of the questions did not vary from those of previous years.

The performance of candidates declined slightly from that of last year.

### **2. A SUMMARY OF CANDIDATES' STRENGTHS**

The candidates exhibited commendable skills in the following areas:

- (a) Question numbers were written on top of each page;
- (b) Sub-questions were clearly identified;
- (c) Regarding knowledge of the subject matter, candidates demonstrated tremendous skills in the following areas:
  - they stated the quantities that can be deduced from a graph of  $F$  against  $e$  within the elastic limit;
  - candidates stated correctly the characteristics of laser lights.
  - many of the candidates were able to use the band theory to explain the reduction of electrical resistance of a semiconductor with increase in temperature;
  - the candidates defined correctly Electric field and Electric field potential.

### **3. SUMMARY OF CANDIDATES' WEAKNESSES**

- (a) A Summary of Candidates' Weaknesses:
  - (i) Some candidates did not comprehend some of the theories in Physics.
  - (ii) Units were mixed up and some calculations were not carried out in SI unit by some candidates.
  - (iii) Most candidates had difficulty in solving problems set on mechanics, sound, heat and electricity.
  - (iv) Many candidates were not able to differentiate between inertia of motion and inertia of rest.
  - (v) Candidates could not differentiate between potential difference and electromotive force.
  - (vi) Many candidates failed to satisfactorily define the principal focus of a concave lens.

### **4. SUGGESTED REMEDIES**

- (1) Teachers should explain Physics theories and principles well for students to understand; and also apply them.
- (2) Students should prepare adequately before attempting the Physics examination.
- (3) Candidates should solve past Physics examination questions.
- (4) Chief examiner's report on Physics should be read by candidates.



- (5) Candidates should improve on their standard in English language to enable them understand the questions adequately.
- (6) Candidates should give concise answers to questions.

## 5. DETAILED COMMENTS

### Question 1

**A car travels a distance,  $y$  in time,  $t$ . if the car starts from rest and moves with a constant acceleration,  $a$ , show that the expression  $y = \frac{at^2}{2}$  is dimensionally correct.**

*Candidates were to show that the expression  $y = \frac{at^2}{2}$  is dimensionally correct.*

This question was attempted by many and most of them showed the equation was dimensionally correct as shown below:

### Question 2

**State three examples of donor impurities.**

*This question requested them to state examples of donor impurities.*

Most candidates gave correct responses and stated: - Arsenic, Phosphorus, Bismuth and Antimony.

### Question 3

**Two balls X and Y are projected from the same point at an angle  $\theta$  to the horizontal. If X is projected with an initial velocity twice that of Y, calculate the ratio of the time of flight of X to Y.**

*Candidates were to calculate the ratio of the time of flight of two balls X to Y, when both are projected from the same point but the velocity of X is twice that of Y.*

Most candidates gave incorrect calculations.

The expected solution:

$$t_y = \frac{2Uy \sin \theta}{g} \text{ and } t_x = \frac{4Uy \sin \theta}{g}$$

$$t_x : t_y = \frac{4Uy \sin \theta}{g} / \frac{2Uy \sin \theta}{g}$$

$$= 2:1$$

### Question 4

**A satellite orbits the earth at a speed of  $8.0 \times 10^3 \text{ m s}^{-1}$ . Calculate the period of orbit of the satellite if the distance between the centre of the earth and the satellite is 6,400 km?**

*Candidates were to calculate the period of orbit of a satellite which orbit the earth at a speed of  $8.0 \times 10^3 \text{ m s}^{-1}$  if the distance between the centre of the earth and the satellite is*

*6400 km  $[\pi = 3.14]$*

Many candidates solved the problem correctly.

$$V = \frac{2\pi r}{T}$$

$$T = \frac{2 \times 3.14 \times 6400 \times 10^3}{8 \times 10^3}$$

$$T = 5024 \text{ s}$$

### **Question 5**

*Candidates were requested to use the labelled stress-strain graph of an elastic material to identify a) the region Hooke's law holds, b) Yield point and c) elastic region.*

Most candidates could not identify the regions. Graph interpretations:

- (a) OX
- (b) Y
- (c) OQ

### **Question 6**

**State three characteristics of laser lights.**

*Candidates were requested to state the characteristic of laser light.*

*Most candidates stated the correct answers as*

- monochromatic
- coherent
- directional
- bright, etc.

### **Question 7**

**(a) State two reasons why the wave effect of massive particles are less noticeable.**

**(b) Write the de-Broglie equation relating the wave and particle nature of matter.**

*They were asked to state two reasons why the wave effect of massive particles are less noticeable and (b) write the de-Broglie equation.*

The wave effect of massive particles due to their

(i) Large momentum and (ii) short wavelength.

(a)  $\lambda = \frac{h}{mv}$

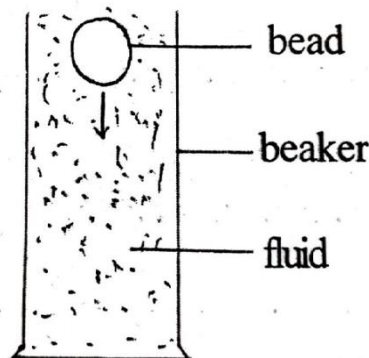
## Question 8

(a) **Explain inertia of motion.**

Many candidates could not differentiate inertia of motion from inertia of rest, and most of them therefore gave wrong explanations.

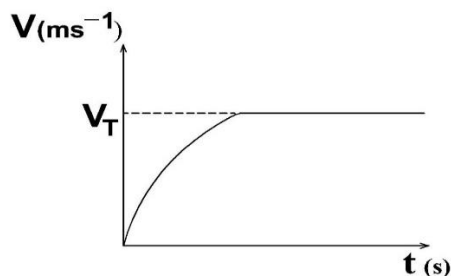
The expected response is Inertia of motion is the tendency of a body to continue in its uniform motion in a straight line unless an external force compels it to act otherwise.

(b) **The diagram below is an illustration a spherical bead in motion down in a tall beaker containing a fluid.**

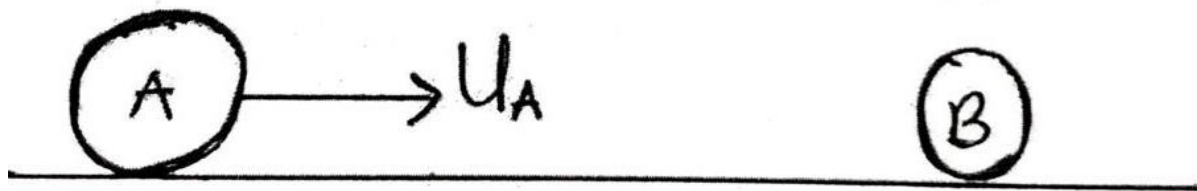


- (i) **Name two of the forces acting on the bead;**
- (ii) **Sketch a velocity-time graph to depict the motion of the bead;**
- (iii) **Explain any special feature of the graph sketched in (ii).**

Most candidates named the forces acting on the bead in the fluid. But candidates could not sketch correctly the velocity-time graph to depict the motion of the bead. Many of the candidates' graphs were poorly drawn and labelled. The expected graph is as shown below



- (b) In a diagram below, a body A, travelling with velocity  $U_A$  collides perfectly elastically with another body B, initially at rest.



- (i) If the mass of A is twice that of B, show that, after impact, the velocity  $V_A$  of A is given as  $V_A = \frac{1}{3}U_A$ .
- (ii) Calculate the initial velocity of A if it moved at  $15 \text{ m s}^{-1}$  after the impact.

The proof of  $V_A = \frac{1}{3}U_A$  was a huge challenge for many candidates because they could not carefully identify that;

- Body B was at rest initially,  $U_B = 0$ .
- Mass of A is twice that of B.

Most could however calculate the velocity of A if it moved at  $15 \text{ m s}^{-1}$  after the impact. That is:  $U_A = 3V_A = 3 \times 15 = 45 \text{ m s}^{-1}$ .

### Question 9

- (a) Define each of the following terms:
- (i) Work;
  - (ii) Potential energy.
- (b) A body of mass  $m$  is held at a height  $h$  above the horizontal ground. Show that its energy at that height is the same as the workdone in falling through  $h$ .
- (c) (i) What is a calorimeter?  
(ii) Name two experiments that require the use of a calorimeter in Physics.
- (d) A calorimeter weighing  $100.0 \text{ g}$  contains  $60.0 \text{ g}$  of water initially at  $15^\circ\text{C}$ . An immersion heater operating at  $6.0 \text{ V}$  heats the water steadily for 10 minutes by the passage of a current of  $1.0 \text{ A}$ . calculate the final temperature of the water in the calorimeter.  
[Specific heat capacity of calorimeter =  $420 \text{ J kg}^{-1} \text{ K}^{-1}$ ,  
Specific heat capacity of water =  $4200 \text{ J kg}^{-1} \text{ K}^{-1}$ ]

- (a) Most candidates were able to define (i) Work and (ii) Potential energy. However, a few candidates confused 'position' with 'rest'.
- (b) Few candidates could show that the body of mass  $m$ , held at a height  $h$  above the horizontal ground has the same energy as the work done in falling through the height  $h$ .
- (c) (i) Most candidates stated incorrectly what a calorimeter is.  
A calorimeter is a thermal device/ container used in holding liquid / substances during heat experiment.
- (ii) Experiments that require the use of calorimeter: Determination of:

- Specific heat capacity;
  - Specific latent heat of fusion/vapourisation;
  - Melting point;
  - Equilibrium temperature;
  - Rate of cooling.
- (d) Only few candidates could solve the heat problem.

The final temperature  $\theta$ , is obtained from

$$Ivt = (m_c c_c + m_w c_w) \Delta \theta$$

$$1 \times 6 \times 600 = (0.1 \times 420 + 0.06 \times 4200)(\theta - 15)$$

$$\theta - 15 = \frac{3600}{294}$$

$$\theta = 27.2 \text{ } ^\circ\text{C}$$

### **Question 10**

- (a) **Define the principal focus of a convex mirror.**
- (b) **An object is placed 5 cm from the principal focus of a converging lens. If a real image is formed 10.0 cm from the lens, calculate the:**
- (i) focal length of the lens;**
  - (ii) power of the lens.**
- (c) **(i) State three differences between mechanical waves and electromagnetic waves.**
- (d) **State how each of the following properties of sound waves vary as the waves travel from air to water:**
- (i) velocity;**
  - (ii) frequency;**
  - (iii) wavelength.**

(a) Few candidates were able to define the principal focus of a concave lens. This is the point of the principal axis from which rays travelling parallel and close to the principal appear to diverge after reflection.

(b) Candidates did not realize that the object was placed 5 cm from the focus of the converging lens. As such they solved the problem incorrectly.

The expected solution:

$$\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$$

$$\frac{1}{5+f} + \frac{1}{10} = \frac{1}{f}$$

$$f^2 + 5f - 50 = 0$$

$$(f - 5)(f + 10)$$

$$F = 5 \text{ cm}$$

- (ii) Power of lens =  $\frac{1}{f}$   
 $= \frac{1}{f}$   
 $= +20 \text{ D}$

- (c) Most candidates stated the differences between mechanical waves and electromagnetic waves correctly and they also gave satisfactory examples of the two types of waves.
- (d) The variation of velocity, frequency and wavelength as sound waves travel from air to water was not given correctly by most candidates.
- The expected answers are:
- (i) Velocity: increases
  - (ii) Frequency: does not change
  - (iii) Wavelength: increases

### **Question 11**

- (a) **Distinguish between *electromotive force* and *potential difference* in terms of energy transformation.**
- (b) **Define each of the following terms:**
- (i) **Electric field;**
  - (ii) **Electric potential.**
- (c) (i) **Explain the term full scale deflection of a measuring instrument.**
- (ii) **A pointer instrument with a full scale deflection of 5 mA and a resistance of  $2\ \Omega$  is to be recalibrated to function as a (0 – 10 V) instrument.**
- (a) **With the help of a suitable diagram, determine the value of the resistance required.**
- (b) **Copy and complete the table below for the equivalent readings on the instrument.**

<b>I / mA</b>	<b>0</b>	<b>1.0</b>		<b>3.5</b>	
<b>v/V</b>	<b>0</b>		<b>4</b>		<b>10</b>

- (d) **State the function of the proof plane in connection with the Gold leaf electroscope.**

This question was not very popular and only few candidates attempted it. Most of the few candidates gave wrong answers.

- (a) Candidates could not distinguish between electromotive force and potential difference in terms of energy transformation.

Expected answer:

Electromotive force is the energy per unit charge transformed in the cell/ source while potential difference is the energy per unit charge transformed in the load.

- (b) Candidates were not able to define (i) electric field and (ii) electric potential.

Expected definition:

- (i) Electric field: the region around a charged body where an electric force is experienced/ felt by a body.
- (ii) Electric potential: the work done in bringing a unit positive charge from infinity to a point in an electric field.

- (c) Candidates could not explain full scale deflection of a measuring instrument.
- (i) Full scale deflection is the maximum possible reading that can be read on a measuring instrument.
  - (ii) Solution to the multiplier problem:  

$$V = V_A + V_R$$

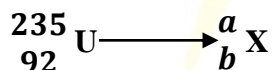
$$= I(r + R_m)$$

$$10 = 0.005(2 + R_m)$$

$$R_m = 1998 \Omega$$
- (d) Few candidates could state the function of the proof plane in connection of the GLE. The proof plane is used to transfer small sample of charge to the gold leaf electroscope.

### Question 12

- (a) State the function of each of the following components of the X-ray tube in operation:
- (i) low voltage battery;
  - (ii) high tension source.
- (b) Give a reason for each of the following design features of the X-ray tube:
- (i) glass envelope is highly evacuated;
  - (ii) cooling fins located outside the glass tube.
- (c) The energy of the hydrogen atom in a stationary state is given by
- $$E_n = \left( \frac{-13.6}{n^2} \right) \text{ eV}$$
- (i) Explain what happens to the hydrogen atom when  $n = 1$  in the given equation.
  - (ii) If the atom de-excites from the second excited state, calculate the wavelength of the energy radiated.  
 $[\hbar = 6.6 \times 10^{-34} \text{ J s}; e = 1.6 \times 10^{-19} \text{ C}; c = 3.0 \times 10^8 \text{ m s}^{-1}]$
- (d)
  - (i) State the radioactive decay law.
  - (ii) Given that, the nuclear reaction below had occurred, determine the values of  $a$  and  $b$ .



- (a) Candidates could not state the function of (i) low voltage battery and (ii) high tension source as component of X-ray tube.

Expected answers:

- (i) Low voltage battery: heats up the filament to release electrons by thermionic emission.
  - (ii) High tension source: Accelerate the liberate electrons to high speed (to collide with the target)
- (b) Candidates were not able to state the reason for design features of the X-ray tube.
- (i) The glass envelope is highly evacuated to prevent gaseous ionization (of air) in the tube (which will interfere with motion of the thermo electrons towards the target.)
  - (ii) Cooling fins located outside the glass tube to prevent breakage of the envelope (as a result of the intense heat produced by the colliding thermos electrons).

- (c) Significance of  $n = 1$ : the atom is in a ground state when  $n = 1$ , or has the least energy.
- (d) (i) The radioactive decay law: The time rate of disintegration/ decay is a radioactive nucleus is directly proportional to the amount of the active nuclei present.
- (iii) Most candidates were able to determine the values of 'a' and 'b';  
 $a = 227$  and  $b = 88$





## **PHYSICS 3**

### **1. GENERAL COMMENTS**

The standard of the paper has not varied from that of the previous years. The performance of candidates saw a dip as compared to that of last year.

### **2. A SUMMARY OF CANDIDATES' STRENGTHS**

Some commendable features noted in candidates' answers were:

- (1) presentation of data in a composite table;
- (2) use of correct units for both measurable and deduced quantities;
- (3) correct distinction of axes;
- (4) computation of slope of graphs using large right angled triangle;
- (5) evaluation of given expressions using correct substitutions.

### **3. A SUMMARY OF CANDIDATES' WEAKNESSES**

Below are some weaknesses noted in candidates' answers:

- (1) failure to record length measured with the metre rule to 1 decimal place in centimeters;
- (2) inability to make simple deductions from graphs;
- (3) inability to plot points correctly to the accuracy of chosen scales;
- (4) failure to record  $T^2$  to at least 3 significant figures.

### **4. SUGGESTED REMEDIES**

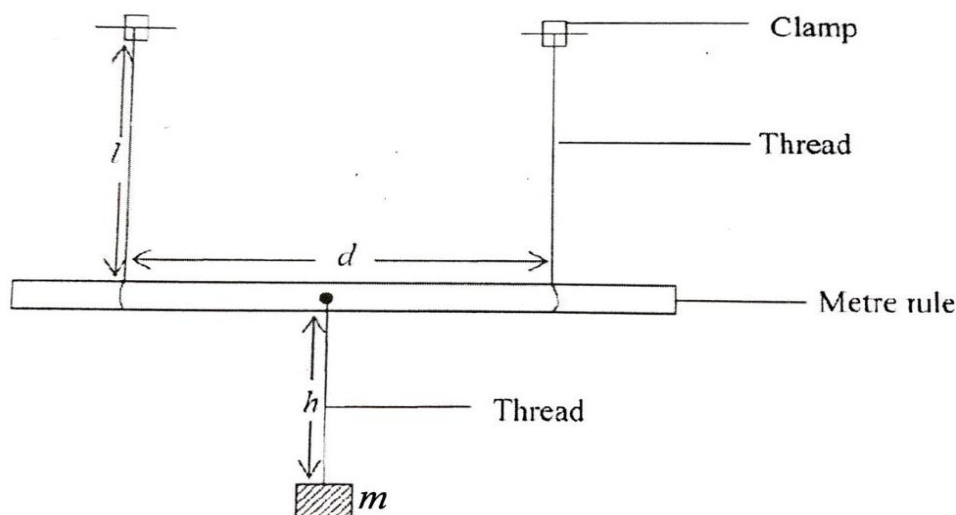
- (1) Students should be exposed to and made to use laboratory equipment early enough.
- (2) Students should be taught the acceptable number of decimal places for the instruments in the laboratory.
- (3) The theory underlying the practical questions should be explained to candidates.

## 5. DETAILED COMMENTS

### ALTERNATIVE A

#### Question 1

(a)



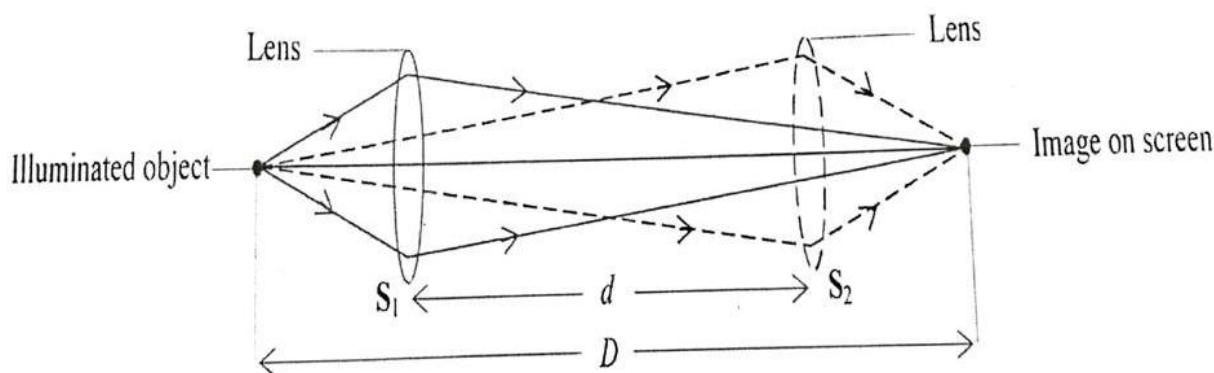
You are provided with a set of masses, two metre rules, a piece of thread, two retort stands and clamps, a stop watch, split corks and a weighing balance.

Use the diagram above as a guide to perform the experiment

- (i) Measure and record the mass,  $M$ , of the metre rule.
  - (ii) Suspend the metre rule, whose mass has been measured, by means of two vertical strings of equal lengths,  $l = 70$  cm.
  - (iii) Make the separation between the threads,  $d = 80$  cm
  - (iv) Suspend a mass  $m = 20$  g from the mid = point of the metre rule by means of a thread such that the distance between the mass and the rule,  $h = 15$  cm.
  - (v) Displace the ends of the metre rule in a horizontal plane in opposite directions. Release the rule to perform horizontal oscillations.
  - (vi) Determine the time,  $t$  for 20 oscillations.
  - (vii) Evaluate the period  $T$ ,  $T^2$  and  $T^{-2}$ .
  - (viii) Repeat the procedure for four other values of  $m = 30$  g, 50 g, 70 g and 100 g keeping the values of  $h$ ,  $d$  and  $l$  constant. In each case, determine  $t$  and evaluate  $T$ ,  $T^2$  and  $T^{-2}$ .
  - (ix) Tabulate the results.
  - (x) Plot a graph with  $T^{-2}$  on the vertical axis and  $m$  on the horizontal axis.
  - (xi) Determine the slope,  $s$ , of the graph.
  - (xii) State two precautions taken to ensure accurate results.
- (b)
- (i) Define *the period* of an oscillatory motion.
  - (ii) State two differences between *mass* and *weight*.

- (a) The mass,  $M$  of the suspended metre rule was not recorded by most candidates. The varying masses,  $m$ , were correctly recorded but the corresponding times,  $t$ , recorded by the candidates were completely out of trend with  $m$ . The correct trend is as  $m$  increases,  $t$  decreases. Most candidates did not record  $T^2$  and  $T^{-2}$  to the required number of decimal places.  
Candidates' graph was quite satisfactory. A lot of candidates lost marks for precautions because they were poorly stated. For school candidates, precautions stated in command tenses are not acceptable.
- (b) (i) A good number of candidates could not define the period of oscillatory motion. The expected answer is:  
***It is the time taken by a body to make one complete oscillation.***
- (ii) The distinction between mass and weight was well answered by candidates.

## Question 2

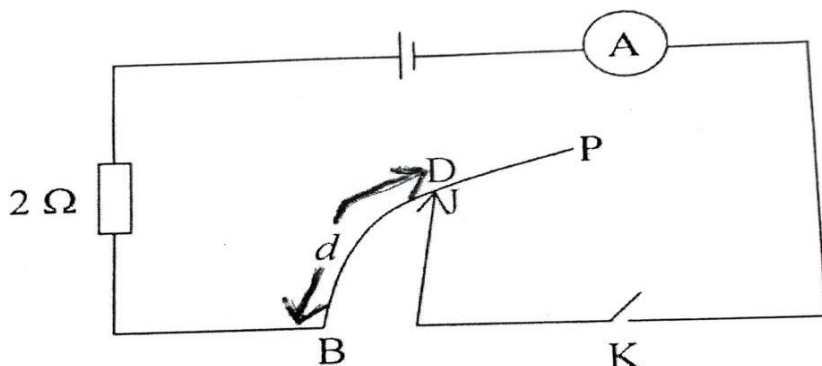


- (a)
- You are provided with an illuminated object, a lens, a screen, a lens holder and a metre rule.  
Use the diagram above as a guide to perform the experiment.
- Determine the approximate focal length,  $f$ , of the lens by focusing a distant object on the screen.
  - Place the illuminated object and the screen a distance  $D = 100$  cm apart.
  - Place the lens at a position  $S_1$  to obtain a sharp image of the object on the screen. Note  $S_1$ .
  - Move the lens to a position  $S_2$  to obtain another sharp image of the object on the screen. Note  $S_2$ .
  - Measure the distance,  $d$ , between  $S_1$  and  $S_2$ .
  - Evaluate  $D^{-1}$ ,  $D^2$ ,  $d^2$  and  $\frac{d^2}{D^2}$ .
  - Repeat the procedure for four other values of  $D = 90$  cm,  $85$  cm,  $80$  cm and  $70$  cm.  
In each case, evaluate  $D^{-1}$ ,  $D^2$ ,  $d^2$  and  $\frac{d^2}{D^2}$ .
  - Tabulate the results.
  - Plot a graph with  $\frac{d^2}{D^2}$  on the vertical axis and  $D^{-1}$  on the horizontal axis.
  - Determine the slope,  $s$ , of the graph.
  - Given that  $s = 4k$ , determine  $k$ .
  - State two precautions taken to ensure accurate results.
- (b) (i) Draw and label the ray diagram of a simple microscope.  
(ii) State two differences between a *real image* and a *virtual image*.

- (a) The approximate focal length,  $f$  of the lens used in the experiment was not recorded by a lot of candidates. For the few candidates that stated the focal length, quite a good number did so without any decimal point or appropriate unit. Candidates lost marks for recording  $D$  to no decimal place. Performance in the graph work was quite satisfactory.
- (b) (i) The candidates were exposed in drawing of ray diagrams and earned very poor scores in the ray diagram for a simple microscope.
- (ii) Candidates' performance in the distinction between real and virtual images was very commendable.

### Question 3

(a)

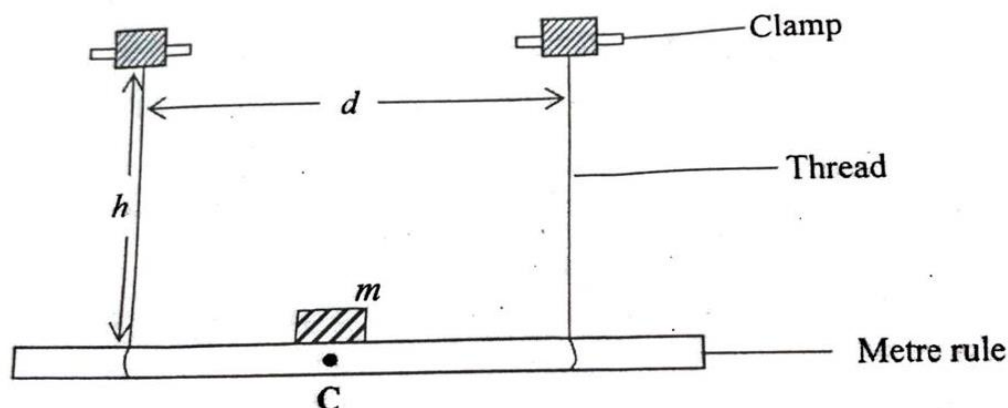


You are provided with an accumulator, an ammeter, a  $2\ \Omega$  resistor, a key, K, a resistance wire BP, a crocodile clip, J and other necessary materials.

- (i) Connect the circuit as shown in the diagram above.
- (ii) Use the crocodile clip to hold the resistance wire at D such that  $BD = d = 80\text{ cm}$ .
- (iii) Close the key, read and record the ammeter reading,  $I$ . evaluate  $I^{-1}$ .
- (iv) Repeat the procedure for four other values of  $d = 70\text{ cm}$ ,  $50\text{ cm}$ ,  $40\text{ cm}$  and  $30\text{ cm}$ , in each case, record  $I$  and evaluate  $I^{-1}$ .
- (v) Tabulate the results.
- (vi) Plot a graph with  $d$  on the vertical axis and  $I^{-1}$  on the horizontal axis.
- (vii) Determine the slope,  $s$ , of the graph.
- (viii) State two precautions taken to ensure accurate results.
- (b) (i) State two factors on which the sensitivity of a moving coil galvanometer depends.
- (ii) A resistance wire of diameter  $0.6\text{ cm}$  has a resistivity of  $1.0 \times 10^{-6}\ \Omega\text{ m}$ . what length of the wire would be needed to make a  $4\ \Omega$  resistor?
- (a) The lengths,  $d$ , of the resistance wire was expected to be recorded by the candidates. One very common error was the recording of  $d$ , to no decimal place which resulted in loss of marks. Just as was expected, the current values,  $I$ , recorded by the candidates decreased as  $d$  increased. The values of  $I^{-1}$  was unfortunately not recorded to the required number of decimal places.
- (b) (i) Candidates were able to state the factors on which the sensitivity of a moving coil galvanometer depends.
- (iii) The length of wire needed to make a  $4\ \Omega$  resistor was accurately calculated by many candidates.

## ALTERNATIVE B

### Question 1



You are provided with a set of masses, a metre rule, a thread, two retort stands and clamps, a stop watch, a knife edge and split corks.

Carry out the following instructions using the diagram above as a guide.

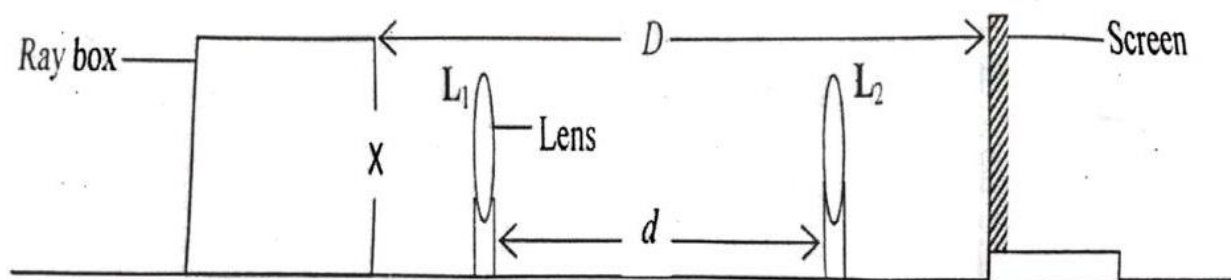
- (i) Determine the centre of gravity, C, of the metre rule using the knife edge
  - (ii) Read and record the mass, M, of the metre rule written on the reverse side of it
  - (iii) Suspend the metre rule by means of two parallel threads of equal length,  $h = 70$  cm with one at the 10 cm mark and the other at the 90 cm mark of the metre rule.
  - (iv) Attach a mass  $m = 30$  g firmly to the metre rule at C. ensure that the graduated face of the metre rule is facing upwards and that  $d = 80$  cm throughout the experiment.
  - (v) Set the metre rule into smaller angular oscillations about the vertical axis through its centre of gravity by displacing its ends in opposite directions.
  - (vi) Determine the time,  $t$ , for 20 oscillations and evaluate the period  $T$ ,  $T^2$  and  $T^{-2}$ .
  - (vii) Repeat the procedure for four other values of  $m = 40$  g, 50 g, 60 g and 70 g. In each case, determine  $t$  and evaluate  $T$ ,  $T^2$  and  $T^{-2}$ .
  - (viii) Plot a graph of  $T^{-2}$  on the vertical axis and  $m$  on the horizontal axis.
  - (ix) Determine the slope,  $s$ , of the graph.
  - (x) Evaluate  $Q = \frac{0.68}{s}$ .
  - (xi) State two precautions taken to ensure accurate results
- (b)
- (i) Give two example of simple harmonic motion other than the motion of a simple pendulum.
  - (ii) Explain the term *centre of gravity of a body*.
- (a) Many candidates had no values for the centre of gravity, C, and the mass, M of the metre rule recorded. Few of the candidates who recorded C did so without any decimal point or unit which resulted in the loss of marks.

The recorded values of the mass,  $m$  and time,  $t$ , were not in correct trend. The correct trend is as  $m$  increases,  $t$  decreases.

Many candidates did not record  $T^2$  and  $T^{-2}$  to at least three decimal places. Candidates' performance in the graph work was satisfactory.

- (b) (i) The candidates were able to give examples of systems/bodies executing simple harmonic motion.
- (ii) Candidates should note that centre of gravity is the point through which the force of gravity of a body acts.

## Question 2



(a)

You have been provided with a ray box, a converging lens, a lens holder, a screen, a metre rule and a half-metre rule.

Use the diagram above as a guide to perform the experiment.

- (i) Determine the approximate focal length,  $f$ , of the lens by focusing a distant object on the screen.
  - (ii) Place the ray box and the screen such that the distance between the illuminated cross-wire and the screen,  $D = 150$  cm.
  - (iii) Place the lens at a position  $L_1$  where a sharp image of the cross-wire is obtained on the screen. Note  $L_1$ .
  - (iv) Move the lens to a position  $L_2$  to obtain another sharp image of the cross-wire on the screen. Note  $L_2$ .
  - (v) Measure the distance,  $d$ , between  $L_1$  and  $L_2$ .
  - (vi) Evaluate  $D^2$ ,  $d^2$  and  $D^2 - d^2$ .
  - (vii) Repeat the procedure for four other values of  $D = 130$  cm,  $100$  cm,  $90$  cm and  $80$  cm. In each case evaluate  $D^2$ ,  $d^2$  and  $D^2 - d^2$ .
  - (viii) Tabulate the results.
  - (ix) Plot a graph with  $D^2 - d^2$  on the vertical axis and  $D$  on the horizontal axis.
  - (x) Determine the slope,  $s$ , of the graph.
  - (xi) Evaluate  $k = \frac{s}{4}$ .
  - (xii) State two precautions taken to ensure accurate results.
- (b) (i) Distinguish between a virtual image and a real image?
- (ii) With the aid of ray diagram, explain how a converging lens produces a virtual image.
- (a) The approximate focal length,  $f$ , was not recorded by a lot of candidates. The few who complied to the directive recorded  $f$  to no decimal point and in some cases the unit was missing.

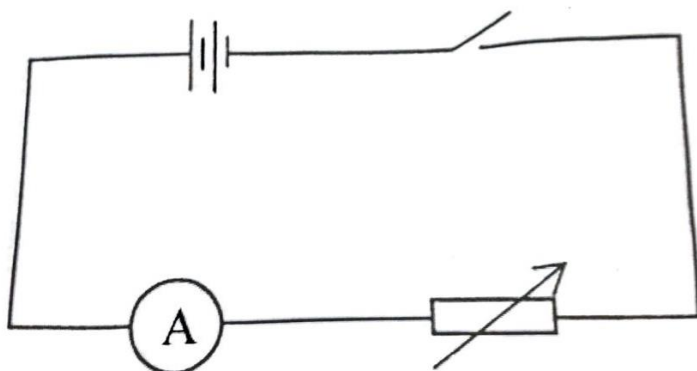
Many candidates recorded the value of  $D$  to no decimal point resulting in loss of marks. Values of  $d$  recorded by candidates were in correct trend with the values of  $D$ .

$D^2$ ,  $d^2$  and  $(D^2-d^2)$  were correctly evaluated.

Candidates who expressed  $(D^2-d^2)$  in the form  $b \times 10^n$  had troubles plotting the graph and calculating the slope. The multiplying factor was also missing in the computation of the slope.

- (b) (i) Candidates correctly distinguished between real and virtual images.  
(ii) The ray diagram was not different from that of the simple microscope. Most of the candidates who attempted this question could not draw an acceptable ray diagram.

### Question 3



(a)

You are provided with a battery, an ammeter, a voltmeter, a resistance box, a key and connecting wires.

- (i) Set up the circuit as shown in the diagram above.
  - (ii) With the key opened, measure and record the e.m.f,  $E_0$  of the battery
  - (iii) With the key closed, select the resistance  $R = 1 \Omega$  on the resistance box. Read and record the current,  $I$ .
  - (iv) Evaluate  $I^{-1}$ .
  - (v) Repeat the procedure for five other values of  $R = 2 \Omega, 3 \Omega, 4 \Omega, 5 \Omega$  and  $6 \Omega$ . In each case, record  $I$  and evaluate  $I^{-1}$ .
  - (vi) Tabulate the results.
  - (vii) Plot a graph with  $R$  on the vertical axis and  $I^{-1}$  on the horizontal axis.
  - (viii) Determine the slope,  $s$ , of the graph.
  - (ix) Determine the intercept,  $c$ , on the vertical axis.
  - (x) State two precautions taken to ensure accurate results.
- (b) (i) Define potential difference in an electric field.  
(ii) A piece of resistance wire of diameter  $0.2 \text{ mm}$  and length  $25 \text{ cm}$  has a resistance of  $7 \Omega$ . Calculate the resistivity of the wire.

$$[\pi = \frac{22}{7}]$$

- (a) Most candidates as always did not record the emf,  $E_0$  of the battery. Few of the candidates who recorded  $E_0$  did so without a unit or decimal point.  
The values of  $R$  and  $I$  were in trend. The values of  $I$  decreased with increasing values of  $R$ . Values of  $I^{-1}$  was recorded without the expected minimum of three decimal places.  
A good number of candidates managed to produce good graph and slope.  
The precautions stated by the candidates were generally acceptable.

- (b) (i) Potential difference in an electric field was not correctly defined by most candidates. The expected response is:  
It is the work done per coulomb in moving a charge between two points.

**OR**

It is the energy per coulomb released when electricity moves from one point to the other.

- (ii) The resistivity,  $\rho$  of the wire was expertly calculated by the candidates as shown below.

$$\rho = \frac{R.A}{L}$$
$$= \frac{7 \times 22 \times (0.2 \times 10^{-1})^2}{25 \times 7 \times 4} \quad [1/2]$$

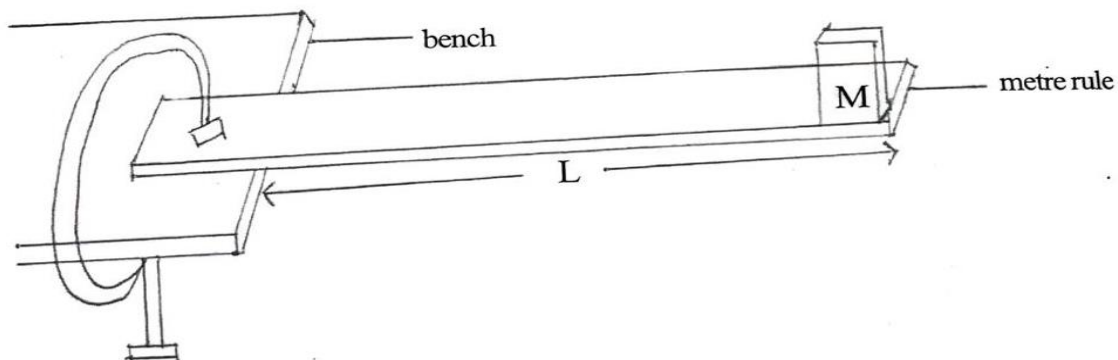
$$= 8.8 \times 10^{-5} \Omega cm$$

$$= 8.8 \times 10^{-7} \Omega m$$

### ALTERNATIVE C

#### Question 1

(a)



You are provided with a G-clamp, a meter rule, mass M, stop watch, sellotape, micrometer screw gauge and other necessary materials.

Use the diagram above as a guide to carry out the experiment.

- (i) Measure the thickness of the metre rule with the micrometer screw gauge at three different points along the metre rule and record the average thickness,  $b$ .
- (ii) Measure the width of the metre rule at three different points along the metre rule and record the average width,  $w$ .



- (iii) Fix the mass  $M$  with value  $M = 100 \text{ g}$  to one end of the metre rule and clamp the other end securely with a G-clamp at the edge of the bench with the length  $L = 95 \text{ cm}$  projecting from the edge of the bench with the graduated face of the metre rule facing upward.
- (iv) Evaluate  $L^3$ .
- (v) Depress slightly the loaded end of the metre rule and release to oscillate.
- (vi) Record the time,  $t$  for 20 oscillations.
- (vii) Determine the period  $T$  and evaluate  $T^2$ .
- (viii) Repeat the procedure for four other values of  $L = 90 \text{ cm}$ ,  $85 \text{ cm}$ ,  $80 \text{ cm}$  and  $75 \text{ cm}$ . In each case, measure  $t$  and determine  $L^3$ ,  $T$  and  $T^2$ .
- (ix) Tabulate the results
- (x) Plot a graph with  $T^2$  on the vertical axis and  $L^3$  on the horizontal axis.
- (xi) Determine the slope,  $s$ , of the graph.
- (xii) Evaluate  $k = \frac{6\pi^2 M}{wb^2 s}$ .
- (xiii) State two precautions taken to ensure accurate results.
- (b) (i) Define a *couple*.
- (ii) State two effects of a force.
- (a) A lot of candidates did not carry out the initial task of measuring the width,  $w$ , and thickness,  $b$ , of the metre rule used. This omission cost candidates 3 marks.
- The values of time,  $t$ , for twenty oscillations were in trend with the projecting length,  $L$ , of the clamped metre rule. The values of  $T$  were correctly evaluated but  $T^2$  were not recorded to at least three decimal places. The values of  $L^3$  were correctly computed. The graph work for many students was good.
- The evaluation of  $k = \frac{6 M \pi^2}{wb^2 s}$  was conspicuously missing from many candidates' responses.
- (b) The definition of Couple and the effects of forces were correctly answered by many candidates as expected and shown below.

### **DEFINITION OF A COUPLE**

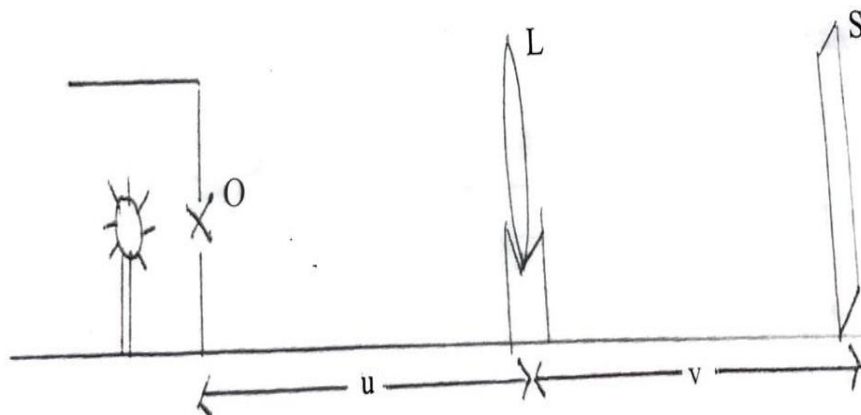
It is a pair of equal and opposite forces acting on a body and separated by a distance.

### **EFFECTS OF FORCES**

- Can move a stationary body.
- Can stop a body from moving.
- Can change the shape of a body/ deform a body.
- Can change the direction of a moving body.
- Can increase the speed of a moving body.

## Question 2

(a)



You are provided with a lens, a ray box, a screen, a lens holder, a metre rule and other necessary materials.

Use the diagram above as a guide to perform the experiment.

- (i) Hold the lens in front of a distant object.
  - (ii) Place the screen behind the lens and move the lens towards or away from the screen until a sharp inverted image of the object is seen on the screen.
  - (iii) Measure and record the distance,  $d$ , between the lens and the screen
  - (iv) Set up the illuminate object O, the lens L and the screen S as shown in the diagram above
  - (v) Place the lens at a distance  $u = 25$  cm from O. Move S towards or away from L until a sharp image of O is seen on the screen.
  - (vi) Measure and record the distance,  $v$ , between L and S.
  - (vii) Repeat the procedure for four other values of  $u = 30$  cm, 35 cm, 40 cm and 45 cm. in each case, measure and record  $v$ .
  - (viii) Evaluate  $(u + v)$  and  $uv$  in each case.
  - (ix) Tabulate the results.
  - (x) Plot a graph with  $(u + v)$  on the vertical axis and  $uv$  on the horizontal axis.
  - (xi) Determine the slope,  $s$ , of the graph.
  - (xii) Evaluate  $k = \frac{1}{s}$ .
  - (xiii) State two precautions taken to ensure accurate results.
- (b)
- (i) Define *principal focus of a converging lens*.
  - (ii) Using a ray diagram, illustrate how a real image of the same size as the object could be formed by a converging lens.

(a) An unpardonable oversight kept recurring in all the experiments as stated earlier. The preliminary task in all the experiments were constantly overlooked by most candidates. It was therefore not a surprise that the value of  $d$  was not recorded by a lot of candidates.

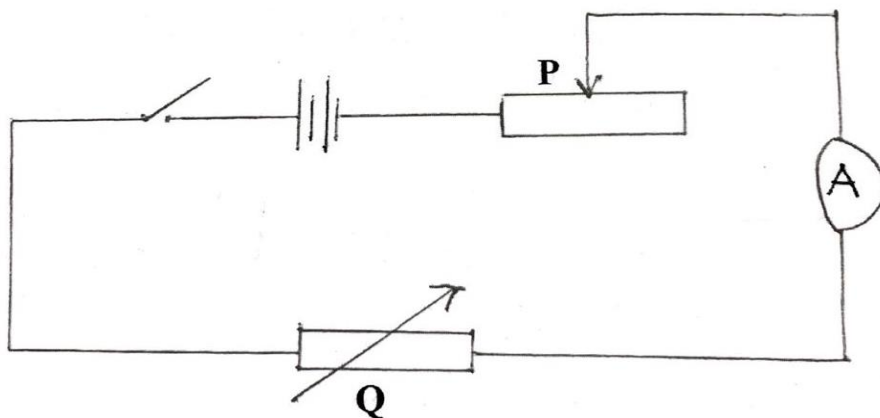
The trend between the values of U and V was perfect. The derived quantities were correctly evaluated by the candidates.

The graph work was well handled by a good number of candidates. Acceptable precautions were stated by the candidates.

- (b) (i) A lot of candidates could not define the principal focus of a converging lens, a correct definition is as follows:  
It is a point on the principal axis of the lens where all light rays close and parallel to it meet/converge after refracting through the lens.
- (iv) The ray diagram as has been a regular fixture of this report was poorly drawn by most candidates. Candidates should take note of the following:
- The principal focus, F should be clearly marked on the principal axis and on both sides of the lens.
  - The object should be placed at  $2F$ .
  - A ray from the head of the object parallel to the principal axis which passes through F after refraction.
  - Another ray from the head of the object that passes through the optical centre undeviated.
  - The refracted rays converge to form real images.

### Question 3

(a)



You are provided with a battery, a key, a rheostat, P, resistance box Q, an ammeter and connecting wires.

Set up the circuit as shown in the diagram above.

- (i) With the resistance, R on the resistance box set at  $0 \Omega$ , close the key and adjust the rheostat until the current in the ammeter is maximum.  
Read and record the current  $I_0$  on the ammeter. Open the key.
- (ii) Keeping the rheostat fixed at this position, select a resistance  $R = 1 \Omega$  on the resistance box. Close the key. Read and record the current,  $I$ , on the ammeter
- (iii) Evaluate  $I^{-1}$ .

- (iv) Repeat the procedure for five other values of  $R = 2 \Omega, 3 \Omega, 4 \Omega, 5 \Omega$  and  $6 \Omega$ .
- (v) Repeat and record  $I$  and evaluate  $I^{-1}$  in each case.
- (vi) Tabulate the results.
- (vii) Plot a graph with  $R$  on the vertical axis and  $I^{-1}$  on the horizontal axis.
- (viii) Determine the slope,  $s$ , of the graph.
- (ix) State two precautions taken to ensure accurate results.

- (b) (i) The potential difference across a load in a circuit is always less than the e.m.f. of the supply battery. Explain this observation.
- (ii) A cell of e.m.f.  $3 \text{ V}$  and internal resistance  $0.5 \Omega$  is connected to a  $2 \Omega$  resistor.  
Calculate the terminal p.d.

(a) The preliminary tasks in all the previous experiments were again ignored by the candidates. It is therefore not surprising that  $I_0$  was not recorded by many candidates. The values of  $R$  and  $I$  recorded by the candidates were in correct trend.  $I^{-1}$  was not recorded to at least 3 dp. The candidates were able to produce good graph. Acceptable precautions were stated by the candidates.

- (b) (i) “The observation is due to loss of volts across the internal resistance of the battery”. Many candidates were not able to explain this point well.
- (ii) Many candidates were able to calculate the terminal voltage as shown below:

$$\begin{aligned}
 E &= Ir + IR \\
 3 &= 0.5 I + 2I \\
 I &= \frac{3}{2.5} = 1.2 \text{ A} \\
 \text{Terminal p.d} &= IR \\
 &= 1.2 \times 2 \\
 &= 2.4 \text{ V}
 \end{aligned}$$

**OR**

$$\begin{aligned}
 \text{Terminal p.d} &= E - Ir \\
 &= 3 - 1.2 (0.5) \\
 &= 2.4 \text{ V}
 \end{aligned}$$