

## INTEGRATED SCIENCE 2

### **1. GENERAL COMMENTS**

The standard of this year's paper compared favourably with that of previous years. The performance of the candidates in this year's examination was just above average, never the less, there were some few outstanding performances.

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

- (1) Candidates were able to identify the different types of soil
- (2) They were able to define mixed farming
- (3) Definition for pollination was well done
- (4) Calculation questions were well answered
- (5) Most candidates were able to identify some laboratory apparatus
- (6) Questions were answered with limited ambiguities

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

- (1) Some candidates could not state the correct scientific units
- (2) Could not use the appropriate scientific formulae and expressions
- (3) Most candidates could not distinguish between experimental observation and conclusion
- (4) Most candidates did not understand the formation of eclipse as they were unable to explain the concept
- (5) Inadequate knowledge of agricultural concepts
- (6) Most candidates were unable to interpret practical questions especially observations and conclusion
- (7) Most candidates could not distinguish between the terms, explain, what is, state Etc. This resulted in mis-interpretation of questions

### **4. SUGGESTED REMEDIES**

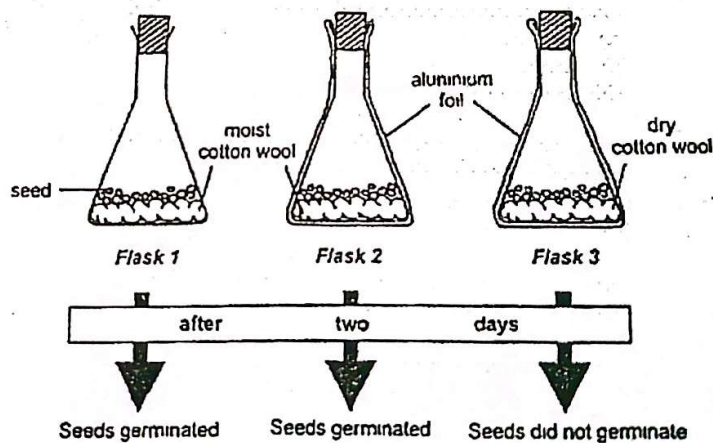
- (1) Teachers must take time to teach candidates the difference between the terms, explain, what is, state etc. and their demand when used to construct a question

- (2) Teachers should take students through practical questions involving basic scientific terms and conventions
- (3) Teachers should be encouraged to give students practical exercises and guide students to interpret, observe and draw correct conclusions
- (4) Students should be given assignments involving appropriate formulae, calculations, scientific expressions and basic standard units
- (5) Teachers should try to cover greater part of the syllabus with their students
- (6) Students should be encouraged to read more story books to improve their expressions and also help them use words appropriately
- (7) Candidates are advised to read through examination questions carefully and understand them before attempting to answer

## 5. DETAILED COMMENTS

### Question 1

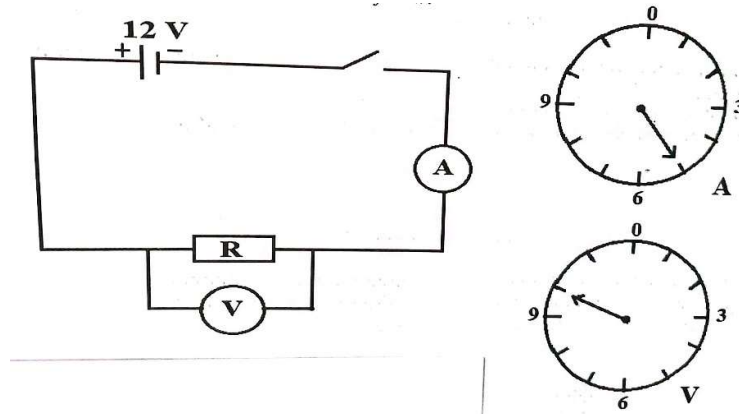
- (a) The diagrams below are illustrations of a set-up used to study the conditions for seed germination. The flasks were kept at 25°C during the experiment. *Study the diagrams carefully and answer the questions that follow.*



- (i) What conclusion can be drawn from the results of flask 1 and flask 2?
- (ii) What conclusion can be drawn from the results of flask 2 and flask 3?
- (iii) The seedlings in flask 2 died after two weeks. What can be the reasons for this occurrence?

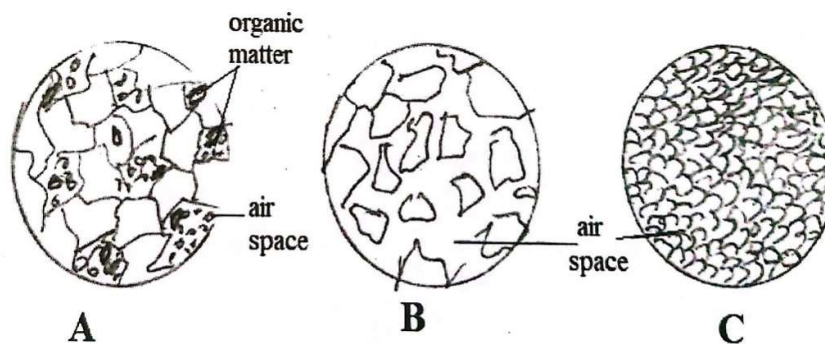
- (iv) A candidate concluded that light was an important factor for the germination.  
Did the candidate make a correct conclusion?
- (v) Give a reason for the answer stated in (iv) and state which of the flasks in the experiment could be used to support your answer.

- (b) The diagrams below are illustrations of an experimental set-up. *Study the diagrams carefully and answer the questions that follow.*

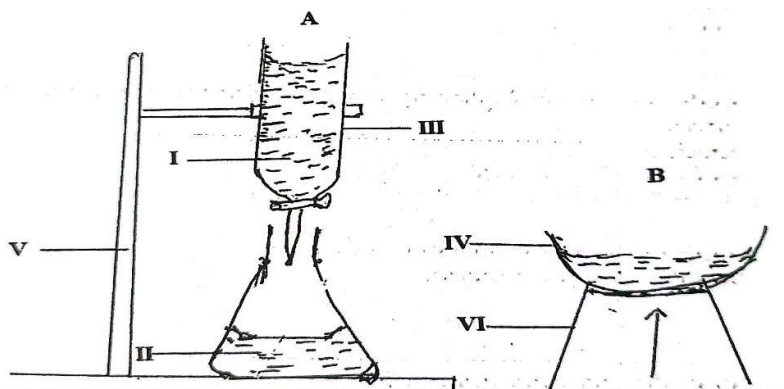


- (i) Name the measuring instrument that is in:  
 (a) parallel;  
 (b) series;  
 With the resistor R.
- (ii) What quantity does each of the named instruments in (i) measure?
- (iii) Read and record the values as indicated on:  
 (a) A in amperes;  
 (b) V in volts.
- (iv) Use the values read in (iii) to calculate the value of R.
- (v) State one precaution to be taken in performing this experiment.

- (c) The diagrams below are illustrations of different types of soil. Study the illustrations carefully and answer the questions that follow.



- (i) Identify each of the soil types labelled A, B and C.
  - (ii) Describe each of the soils under the following properties:
    - (α) particle size;
    - (β) air space.
  - (iii) Suggest two ways of improving soil type B for vegetable cultivation.
- (d) The diagrams below is a set-up for preparation of common salt in the laboratory. Study the diagrams carefully and answer the questions that follow.



- (i) Name each of the parts labelled IV, V and VI.
  - (ii) Name two possible solutions that can react to produce salt.
  - (iii) Name the process that takes place when the two solutions named in (ii) react.
  - (iv) Name the process that takes place in the set-up B.
  - (v) Write a balanced chemical equation for the reaction between the two solutions named in (ii).
- (a) Majority of the candidates could not draw reasonable conclusions from the results and observations of the experimental set-up. They could not state that light is not necessary for seed germination. They could not also infer from their observation that water is necessary for seed germination.

Candidates were to state reasons why seedlings in flask 2 died after two weeks; answers provided by majority of the candidates were variant from what was demanded. Candidates could not give the correct reasons for the death of the seedlings in flask 2 after two weeks. Candidates were required to indicate whether a conclusion drawn by a candidate that “light was an important factor for seed germination” was correct. Majority of the candidates were unable to state that the candidate made a wrong conclusion. They could not infer from the experimental set-up that light was not a necessary factor for seed germination.

This required candidates to give a reason for the answer and indicate the flask that could be used to support their reason. Even though majority of the candidates were unable to state that the candidate made a wrong conclusion, most of them, however, were able to state the correct flask (flask 2) that supports the expected answer.

The expected response were:

- (i) Conclusion drawn from results of flask 1 and flask 2  
Light is not necessary for germination
  - (ii) Conclusion drawn from results of flask 2 and flask 3  
Water is necessary for germination
  - (iii) Reasons for dead seedlings
    - the food stored in the seed is used up / the seedlings cannot carry out photosynthesis / no sunlight
    - lack of water / moisture
  - (iv) No / the candidate made a wrong conclusion
  - (v) because light is not necessary for the germination of seed, the seed in flask 2 germinated even though the flask was lined with the aluminium foil.
- (b) Most candidates were able to name the measuring instruments but few were unable to spell the names correctly. For example, **Ammeter** was spelt as Ameter or Ametor and **voltmeter** was spelt as voltmeter.
- (c) In part (b)(i), candidates were required to name the instrument that is connected in parallel and the one connected in series with the resistor in the experimental set-up. Most candidates were able to name the voltmeter as the instrument connected in “parallel” and the ammeter as the instrument connected in “series” with the resistor. Some candidates, however, interchanged the names of the instruments.

In part (b)(ii), candidates were required to indicate the quantity measured by each instrument in (b)(i). Majority of the candidates were able to read the value of the ammeter and voltmeter correctly. Few candidates, however, could not indicate the correct unit for the values they read.

In part (b)(iii), candidates were required to read and record the values as indicated on instruments A and instrument V. Answers provided by candidates were satisfactory and the performance here was good.

In part (b)(iv), candidates were required to use the values obtained to calculate the value of R. Most of the candidates were able to use the values read on the ammeter and the voltmeter to calculate the value of R. Nevertheless, some candidates could not indicate the correct unit for the R calculated.

In part (b)(v), candidates were required to state one precaution to be taken in performing the experiment described. Most candidates could not state any correct precautions that must be taken in performing the experiment.

- (c) Most candidates identified the different soil types correctly that is A – Loamy, B – Sandy and C – Clayey with the correct particle size and air space. Particle size A – medium or moderate, B – Large, C – Small. Most candidates were able to state how soil B could be improved by the use of organic matter, humus, cover cropping and mulching.

Candidates, however, were only familiar with application of fertilizer, leaving other possible ways such as planting cover crops, mulching etc which increase the water holding capacity of the sandy soil.

- (d) Part (d)(i) required candidates to name parts of an experimental set-up on preparation of common salt in laboratory. Most candidates answered this part satisfactorily. The only challenge few candidates faced here was wrong spelling of the labelled parts of the experimental set-up.

For example:

**Evaporating dish** was wrongly spelt as evaporation dish/disc/disk

**Retort** stand was wrongly spelt as retord stand

**Tripod** stand was wrongly spelt as treepod stand

Part (ii) required candidates to name two possible solutions that can react to produce salt. The answers candidates provided for this part of the question were mixed. Some candidates were able to give the correct examples of the two possible solutions required (hydrochloric acid and sodium hydroxide).

Some candidates, however, gave solutions that had nothing to do with the requirement of the question. For example, some of the answers candidates gave included potassium and oxygen; iron and lithium; sodium chloride and salt solution; sea water; water and sand; water and hydrogen; acid and hydrogen gas; sodium and chloride etc.

## Question 2

- (a) (i) State what happens when photosynthesis occurs in a leaf.  
(ii) What is pollination?
- (b) Explain briefly why the mass of lumpy charcoal remains unchanged when ground into powder but the mass of the same lump changes when heated to burn.
- (c) (i) What is a physical quantity?  
(ii) State two physical quantities?
- (d) State two importance each of:  
(i) light;  
(ii) temperature;  
(iii) in crop production.

- (a) Part (a)(i) demanded candidates to state what happens when photosynthesis occurs in a leaf.

Answers majority of the candidates gave were satisfactory. Most candidates were able to state that when photosynthesis occurs in a leaf the process leads to the production of plant food. Candidates, however, were unable to name the specific food produced in the leaf during photosynthesis.

Part (a)(ii) of this question demanded candidates to explain what pollination is. Majority of the candidates were able to explain what pollination is. Nonetheless, some candidates had problem with the spelling of anther, pollen grains and stigma.

For example, **anther** was wrongly spelt as anter/enter  
**Stigma** was wrongly spelt as stigimer

- (b) Part (b) of question 2 demanded candidates to explain why lumpy charcoal remains unchanged when grinded into powder but changed in mass when heated.

The concept of physical and chemical change were not understood by most candidates. Candidates could not indicate that “grinded lumpy charcoal into powder” is a physical change and “heating lumpy charcoal” is a chemical change. Also, most candidates could not state that in physical change, no change occurred in the mass of the substance whilst in chemical change some of the components of the substance are lost resulting in change of mass of the substance. Only few candidates were able to answer this question satisfactorily.

- (c) (i) This question was not well answered.  
Part (c)(ii) required candidates to explain what physical quantity is. Most of the candidates were unable to state what physical quantity is. They, however, cited correct examples of physical quantity required in the (c)(ii).

Some candidates mentioned the two types of quantity (fundamental and derived quantity) as the examples of physical quantities.

- (d) Part (d)(i)&(ii) required candidates to state the importance of light and temperature in crop production respectively.

Most candidates stated the importance of light to humans instead of to crops. Some of the answers candidates gave were; light helped humans to see during the night; light is a major factor in seed germination. These responses largely suggested that candidates either did not understand the demand of the question.

Many candidates also wrote wrong answers such as temperature helps to dry cocoa beans and other crop products. Very few candidates gave the correct answer as temperature helps in seed germination.

### **Question 3**

- (a) (i) **What is hardness of water?**  
(ii) **Give one example each of a natural source of water that is:**  
(a) **hard water;**  
(b) **soft water.**
- (b) **What is the end-product of each of the following food substances?**  
(i) **Meat;**  
(ii) **Cassava;**  
(iii) **Palm-oil.**
- (c) **Give one effect of each of the following factors considered in vegetable crop production:**  
(i) **soil type;**  
(ii) **nearness to market;**  
(iii) **nearness to source of water.**
- (d) (i) **Explain briefly why an eclipse occurs.**  
(ii) **Name the two types of eclipse.**

- (a) Part (a)(i) of this question required candidates to state what hardness of water is. Most candidates were unable to explain what hardness of water is. They rather explained what hard water is. Candidates could not also indicate the hardness of water is due to dissolved ions of calcium, magnesium and iron (II).



Part (a)(ii) required candidates to give one example of natural sources of hard water and soft water. Majority of the candidates gave the correct examples of natural sources of hard water and soft water. Few candidates, however, provided wrong answers such as lakes, rivers, ponds as natural sources of hard water. The commonest natural source of hard water cited by majority of the candidates was rain/rainfall. This suggested that candidates are not familiar with dew, snow etc as natural sources of soft water.

(b) The part (b) of this question required candidates to state the end-products of digestion of meat, cassava and palm oil as they could not identify the nutrients in each of the food substance. Majority of the candidates mentioned the nutrients in each food as the end product of digestion of each food. These include protein, carbohydrate and fats/oil.

Candidates who provided the correct answers such as glucose for cassava; amino acids for protein; and fatty acids / glycerol for fats and oils, had few challenges with correct spelling of these terms.

For example:

- glucose was wrongly spelt as grucose / glowcose
- fatty acid was wrongly spelt as fatti / fatty acid
- glycerol was wrongly spelt as gladserol

(c) Few candidates answered this question well by stating that (i) soil type enables farmer to know the type of crop to grow. (ii) nearness to market – to prevent rotting of crops and also for easy sale of farm produce (iii) nearness to source of water – for easy irrigation of crops. Most candidates gave wrong answers as for the crops to grow well for all the questions.

(d) The (d)(i) part of the question three required candidates to explain briefly why an eclipse occurs, and name the two types of eclipse.

Invariably majority of the candidates' explanations did not meet the requirement of the questions. For example, a candidate defined eclipse as the formation of umbra or shadows.

The part (d)(ii) required candidates to name the two types of eclipse. Answers given by majority of the candidates were those demanded by the question.

#### **Question 4**

- (a) (i) Explain the term convection as applied to heat transfer.  
(ii) Give two reasons why convection does not occur in solids.
- (b) Give two effects of each of the following soil physical properties on maize cultivation:  
(i) texture;  
(ii) water holding capacity.
- (c) Use any three of the following organisms to construct a food chain:  
Hawk, grasshopper, man, grass, toad, grasscutter.
- (d) (i) Consider the following elements and state which element(s) is/are metals:  
 $_{11}\text{Na}$ ,  $_{7}\text{N}$ ,  $_{6}\text{C}$ ,  $_{3}\text{Li}$ .  
(ii) Explain briefly what is observed when pieces of each of the following metals are dropped into two separate test tubes each containing dilute hydrochloric acid:  
( $\alpha$ ) magnesium;  
( $\beta$ ) silver.

- (a) Part (a)(i) of this question required candidates to explain the term “convection” as applied to heat transfer.

This question was very unpopular among greater number of candidates. Few candidates attempted this question and ended up in explaining “convection” poorly. Candidates mentioned transfer of molecules in fluid instead of movement of particles in solids.

Part (a)(ii) of this question required candidates to give reasons why convection does not occur in solids. Even though candidates were unable to explain the term convection in (i) majority of them were able to state correctly the reasons why convection does not occur in solids.

- (b) Part (b) of this question required candidates to give one effect of soil texture and soil water holding capacity on maize cultivation. This question was poorly answered by almost all candidates who attempted the question.

Most candidates could not state the effect of soil texture and water holding capacity on maize cultivation. Few candidates, however, were able to state that soil texture determines variety of maize to grow. They gave wrong answers like soil can hold the maize firmly instead of determines the variety of maize to grow or supply mineral nutrients to crops.

Majority of the candidates could not give the effects of water holding capacity of soil on maize cultivation.

- (c) Part (c) of this question required candidates to construct food chains selecting three organisms from a set of organisms provided by the examiner.

Although most candidates were able to sequence the three selected organisms correctly to form the correct food chain, they were unable to show the arrows linking one organism to the other (i.e. from producer to the various consumers).

- (d) Part (d)(i) of this question required candidates to state which element(s) is/are metals from set of metals. Answers most candidates gave for this question were good. They were unable to select the elements that are metals.

Part (d)(ii) of this question required candidates to explain briefly what is observed when pieces of metal (magnesium and silver) are dropped into two separate test tubes each containing dilute hydrochloric acid.

This part was surprisingly poorly answered by most of the candidates.

The expected response is:

- (i) Elements that are metal(s)  
-  $_{11}\text{Na}$   
-  $_{3}\text{Li}$
- (ii) Observation when metals are dropped into the solutions  
( $\alpha$ ) colourless gas evolves/ effervescence occurs  
( $\beta$ ) no (observable) reaction occurs

### **Question 5**

- (a) **State two important components each of the soil that helps:**  
(i) **crops to grow well;**  
(ii) **to maintain good soil structure.**
- (b) (i) **Explain how energy in a windmill is obtained.**  
(ii) **State one source of renewable energy.**
- (c) (i) **Explain why steel is preferred to iron in building construction.**  
(ii) **State two ways of preventing rusting.**
- (d) **State three ways of preventing indigestion.**

- (a) Part (a)(i) of this question required candidates to state two important components each of the soil that help crops to grow well and to maintain good soil structure.

Most candidates could state correctly the two important components each of the soil that helps crops to grow well and to maintain good soil structure. Candidates provided very good answers by stating (i) humus and water (ii) living organism and organic matter.

- (b) Part (b)(i) of this question required candidates to explain how energy in a windmill is obtained.

Majority of the candidates could not explain clearly how energy in a windmill is obtained. The answers candidates provided were variant to those required by the question.

Some of the wrong answers candidates gave included:

- when wind blows the windmill harness the wind energy
- energy is obtained in a windmill by the ability and capacity of it
- the windmill obtains energy because it has gears which control it to change the direction of the wind
- the wind hits the windmill it produces elastic energy

The expected response is:

- (i) How energy in a windmill is obtained

When the wind blows, a windmill turn the windmill which is connected to a turns turbine and this produces the energy

- (ii) Source of renewable energy

- sun
- wind
- water / hydropower
- geothermal source / heat from the ground
- biomass
- tidal wave

Part (b)(ii) of this question required candidates to state one source of renewable energy.

Majority of the candidates provided the correct answers to this question.

- (c) Part (c)(i) of this question required candidates to explain why steel is preferred to iron in building construction. Most candidates' responses provided to this sub-question were satisfactory. Part (c)(ii) of this question required candidates to state two ways of preventing rusting. Answers most candidates gave to this sub-question were good.

The commonest answers provided by candidates were greasing, oiling, painting and alloying.

- (d) Part (d) of this question did not pose much challenge to candidates. Answers most candidates gave were within those demanded by the question.

Some candidates however, provided answers that had to do with constipation rather than indigestion. This suggested that those candidates could not distinguish between indigestion and constipation.

Common wrong answers given by candidates included (i) drinking a lot of water eating food with lots of fibre.

### **Question 6**

(a) **State three ways by which the atmosphere in an industrial area is polluted.**

(b) (i) **Write word equation for each of the following reactions between:**

( $\alpha$ ) **calcium and oxygen;**

( $\beta$ ) **nitrogen and hydrogen.**

(ii) **State the hazard that could be prevented when each of the following protective materials are used in the laboratory:**

( $\alpha$ ) **gas mask;**

( $\beta$ ) **goggles.**

(c) **If a cuboid of weight 100 N, has sides 5 cm by 10 cm, calculate the:**

(i) **area of the cuboid;**

(ii) **pressure exerted by the cuboid when it lies on its side.**

(d) (i) **Explain the term *mixed farming*.**

(ii) **State two advantages of mixed farming.**

- (a) Part (a) of this question required candidates to state three ways by which the atmosphere in an industrial area is polluted.

This was simple straight forward question demanding candidates to state three ways by which the atmosphere in an industrial area is polluted. Candidates had a wide range of answers to write. Many candidates provided answers which were correct. Few candidates failed to limit their answers to industrial areas as required by the question.

- (b) (i)&(ii) Some candidates provided very good answers.

Part (b)(i) of this question required candidates to write a word equation for each of the following reactions between: calcium and oxygen; and nitrogen and hydrogen.

Majority of the candidates could not write the word equation correctly. Some candidates provided only the product of the reaction without indicating the reactants. A few of them rather wrote the chemical equation instead of the word equation demanded by the question. Most candidates also failed to follow the conventional way of writing equations.

Some examples of candidates' wrong answers provided included the following:

- Calcium and oxygen = CaO
- Nitrogen and hydrogen = NH
- $\text{Ca} + \text{O}_2 \rightarrow \text{CaO}_2$
- Nitrogen + hydrogen  $\rightarrow$  Nitrogen (IV) oxide
- Calcium + oxygen  $\rightarrow$  calcium oxide + Hydrogen
- Nitrogen + Hydrogen  $\rightarrow$  Nitrogen hydride

The expected responses are:

- (b) (i) Word equation
- ( $\alpha$ ) Calcium and oxygen  
- Calcium + oxygen  $\rightarrow$  calcium oxide
- ( $\beta$ ) Nitrogen and hydrogen  
- Nitrogen + hydrogen  $\rightarrow$  Ammonia

Part (b)(ii) of this question required candidates to state the hazard that could be prevented when each of the following protective materials are used in the laboratory: gas mask and goggles.

This part was well answered by majority of the candidates. A few candidates could not provide the correct answers required by the question. They wrote answers like; "when you cannot breathe well, you wear gas mask" "goggles is worn to protect the hand when holding corrosive, toxic, explosive substances" etc.

The expected answer is:

- (ii) Hazard that is prevented in wearing the following protective materials
- ( $\alpha$ ) gas mask:- Inhaling toxic / poisonous gases
- ( $\beta$ ) goggles:- injury to the eye

- (c) Candidates were able to calculate the area and the pressure correctly but few had challenges with the units for pressure. They tried to convert the centimeter to meters

(ii)  $2 \text{ M/m}^2$  and  $2 \text{ Pa}$  which were wrong.

Part (c)(i) of this question required candidates to calculate the area of a cuboid and the pressure exerted by the cuboid when it lies on its side, if the weight of the cuboid is  $100 \text{ N}$ , with sides  $5 \text{ cm}$  by  $10 \text{ cm}$ .

(i) was correctly answered by most of the candidates. Most candidates, however had problem with (c)(ii). They could not calculate the pressure exerted by the cuboid when it lies on its side.

- (d) Part (d)(i) of this question required candidates to explain the term “mixed farming”.

This part was answered correctly by most candidates. Many of the candidates were able to explain correctly what a mixed farming is. A few of them, however explained mixed cropping instead. They did not include raising of animals as part of the mixed farming.

Part (d)(ii) of this question required candidates to state two advantages of mixed farming.

Most of the candidates were able to state the two advantages of mixed farming. Candidates gave very good answers such as land is effectively used, crops residue can be used as feed for animals and animal droppings can be used as manure.