

INTEGRATED SCIENCE

1. GENERAL COMMENTS

The standard of the paper has been maintained and questions covered a wide range of topics in the syllabus. Some environmental issues were also given some attention.

There is not much change in the performance of students in this year's examination. Majority of candidates scored just above average with few being outstanding.

2. SUMMARY OF CANDIDATES' STRENGTHS

The following are a summary of the strengths of the candidates:

- (1) The questions on biology appeared to be most favourable to the candidates and hence scored good marks in that area.
- (2) Most candidates followed the rubrics of the questions and arranged their questions well
- (3) Most candidates were able to complete their work within the given time.
- (4) Many candidates exhibited legible and good handwriting

3. SUMMARY OF WEAKNESSES

- (1) Spellings of some simple words continue to be a problem for most candidates. For example "skin" is wrongly spelt as "skain", "solid" is wrongly spelt as "soild" "virtual" is wrongly spelt as visual, and "space" is wrongly spelt as "speac" and a host of other words.
- (2) Wrong units. The correct units of some physical quantities continue to pose problems for most of the candidates. Candidates must appreciate simple units like "joules", ("J") as unit for energy or work, Kilogram (kg) for mass and °C for temperature.
- (3) Candidates should also take note of differences between "a thermometer and temperature as the former is an instrument to measure the latter.

Most of the candidates have problems with English Language. Even though it seemed they had the idea, expressing it was their handicap. There is basically a problem with the communication skills of the candidates.

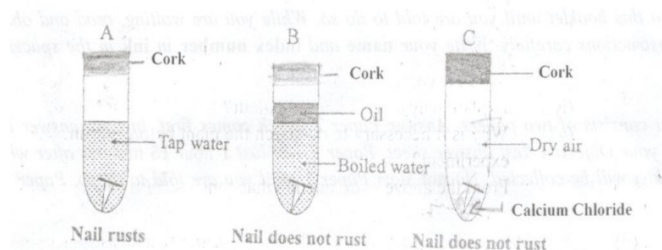
4. SUGGESTED REMEDIES

- (1) The students should be subjected to special drills after each topic taught. Students should be made to relate whatever is taught in class to the questions set in examinations.
- (2) Diagrams connected with every topic should be drawn well on the blackboard and labelled correctly according to scientific method of labeling.
- (3) Students should be taught international way of naming organisms and chemicals. E.g. Vibrio cholerae, Tubercle Bacillus bacteria, Iron (II) Chloride, concentrated tetraoxosulphate (VI) acid.
- (4) Candidates should be exposed to more calculation problems involving formulae.

5. DETAILED COMMENTS

Question 1

- (a) In an experiment, the surfaces of three iron nails were cleaned dry and placed in three separate test tubes. A, B and C as shown in the diagram. *Study the diagram carefully and answer the questions that follow.*



After three days the nail in test tube A was found to have rusted while the nail in test tubes B and C did not rust.

- (i) Suggest an aim for the experiment
- (ii) Why was the water in test tube B boiled?
- (iii) State the function of the oil on top of the water in test tube B.
- (iv) What is the purpose of the calcium chloride in test tube C?
- (v) Why did the nail in test tube A rust?
- (vi) Why did the nail in test tube
 - (α) B not rust?
 - (β) C not rust?
- (viii) From the experiment, explain why oil is applied on the surface of a metal to prevent rusting.

- (b) In an experiment, the following activities were carried out on two green leaves A and B. leaf A was taken from a plant placed in the sunlight for sometime while leaf B was taken from a plant placed in a dark cupboard for 24 hours.

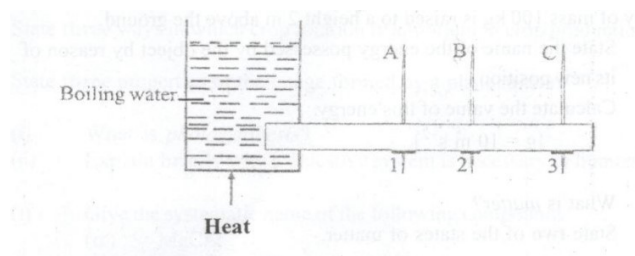
Activity

- I. Leaves dipped in boiling water for 1 minute;
- II. Leaves dipped in warm alcohol;
- III. Leaves washed in cold water;
- IV. Leaves dipped in iodine solution.

After dipping in the iodine solution, it was observed that leaf A changed colour.
Study the activities carefully and answer the questions that follow.

- (i) Suggest an aim for the experiment
 - (ii) Explain briefly why each of the following activities were carried out:
 - (α) I;
 - (β) II;
 - (γ) III.
 - (iii) State the colour change of leaf A.
 - (iv) Explain why leaf A changed colour?
 - (v) Why is it necessary to de-starch the plant before starting the experiment?
 - (vi) From the above experiment, what conclusion(s) can be drawn.
- (c) You are provided with two dry soil samples A and B, a measuring cylinder, beakers, funnels, filter paper, beam balance, stop watch and water.
With the aid of a labelled diagram, describe an experiment to find out which of the two soil samples can hold more water.
- (d) The diagram below is an illustration of an experiment that was carried out. In the experiment three pins 1, 2 and 3 were fixed with candle wax onto a metal bar and one end of the bar was heated by means of boiling water. A, B and C are thermometers inserted in holes along the bar to measure the temperatures at the various points.

Study the diagram carefully and answer the questions that follow.



- (i) Suggest an aim for the experiment.
 - (ii) What is the temperature of the boiling water?
 - (iii) State the observation that would be made about the pins 1, 2 and 3.
 - (iv) State the observations that would be made about the temperatures recorded by the thermometers A, B and C.
 - (v) State how heat from the sun is transmitted to the earth.
- (a) Most candidates did not understand the concept of rusting. They failed to state that water and air or moist air was required for rusting instead of just air or water. They did not know the purpose of the calcium chloride in the experiment. They gave a general everyday explanations instead of the science behind the experiment.

The expected responses are:

- (i) Aim of experiment
 - Experiment to prove that both air and water are necessary for rusting of iron

OR

 - investigating the conditions necessary for the rusting of iron
- (ii) Reason for boiling water in test tube B
 - It was boiled to remove (dissolve) air / oxygen.
- (iii) Function of oil on top of water in test tube B
 - to prevent the entry of air (into the water)
- (iv) Purpose of calcium chloride in test tube C
 - to remove / absorb all the moisture / water (vapour) present in the air in test tube C.

(v) Reason why nail in test tube A rusts

- it rusted because there was the presence of air and water

OR

- because it was exposed to both air and water / moist air

(vi) Reasons why nail in test tube

(α) B did not rust

- because the nail in test tube B was exposed only to water / moisture / no air was present

(β) C not rust

- because the air in the test tube is dry / does not contain water / moisture

(vii) Reasons why oil is applied on the surface of a metal to prevent rusting

- It forms a protective coating for the metal (and hence prevent it from rusting) / to prevent air / moisture from coming into contact with the metal.

OR

- it prevents air / moisture from coming into contact with the metal

(b) Reasons for carrying out activities I, II, III instead of boiling of leaves to stop photosynthesis or make the cells ready to be decolourised they were writing about killing of 'germs'.

The expected responses are:

(i) Aim of the experiment

To show that sunlight is important for photosynthesis

(ii) Reason for Activity I, II & III

(α) I - to kill cells / stop photosynthesis process

(β) II - to remove green pigment / chlorophyll

(γ) III - to wash off the alcohol / soften the leaf

(iii) Colour change of leaf A

- turned blue-black

(iv) Reason for colour change

- starch produced / present

(v) Reason for de-starching plant

- to remove the existing starch from the leaves / because the experiment cannot be done with starch in the leaf.

OR

- (if it is not de-starched), both leaves would show the presence of starch and the experiment would not be successful / no valid conclusion can be drawn / to serve as a control experiment.

(vi) Conclusion from the experiment

- Sunlight is necessary for the process of photosynthesis

(c) This question was poorly answered. Those who answered it faltered in the drawing of the diagram. Most of the candidates did not state the amount of each soil to be measured to be of the same quantity and same volume of water needed to be poured on each soil. Some of the candidates also did not indicate the presence of filter paper in the funnel thereby making their diagrams not workable. Labelling of the setup was poorly done.

The expected responses are:

Experiment to find out which soil sample holds more water

The same weight / mass of samples of soil **A** and **B** are taken using the beam balance and each sample poured into a separate funnel fitted with a filter paper placed over a beaker. The same volume of water is measured and poured on each of the soil samples.

- the water is allowed to drain out completely from each set up
- the soil sample in the set-up with the least drained-out water is the one that can hold more water
- the soil sample in the set-up with the most drained-out water is the one that can not hold more water / that can hold least water

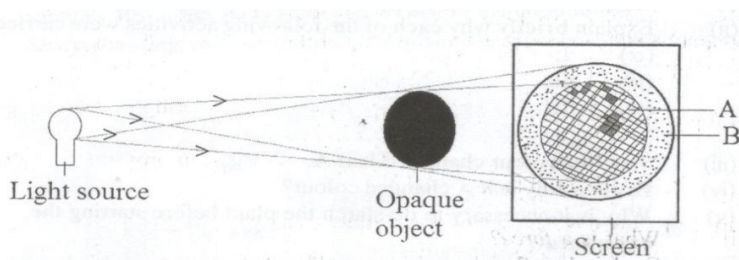
- (d) This is where there was the greatest challenge. Most candidates answered that the nails would be hot instead of falling off as the wax melted.

The expected responses are:

- (i) Aim of experiment
- to show that heat (energy) is transferred through metals / solids (by conduction)
- (ii) $100^{\circ}\text{C} + 2^{\circ}\text{C}$
- (iii) Observation
- the pins fall off the rods as the wax melts
- (iv) The temperature of thermometer A would be higher than that of B and C / temperature of $A > B > C$ / $C < B < A$
- (v) through radiation

Question 2

- (a) (i) What is a *food chain*?
- (ii) Why is the plant in any food chain referred to as a producer?
- (iii) What is the term given to the other organisms that depend directly or indirectly on the producer for food.
- (b) The diagram below is an illustration of the picture obtained on a screen when an opaque object is placed in the path of a light source.
Study the diagram and answer the questions that follow.



- (i) Name each of the shadows that is cast on the screen:
- (α) A;
- (β) B.
- (ii) What does the shadow of the object cast on the screen illustrate?

- (c) Describe briefly how a sample of pure sugar could be obtained from a mixture of sugar and sand.
- (d) State three ways by which soil can be conserved.

(a) **Definition of food chain**

The first part of the answer was stated correctly by most candidates, however the second part was missed. This part involved the transfer of energy from one organism to the other, through eating and being eaten.

The expected responses are:

(a) (i) Food chain

It is the (linear) feeding relationship between organisms (in a particular habitat) which involves eating and being eaten/transfer of energy from one organism to another.

(ii) Reason for naming plants as producer

Because it makes its own food

(iii) Term for other organisms in the food chain

Consumer(s)

- (b) Spellings of Umbra and Penumbra were wrongly spelt. Unbra instead of Umbra and Perrumbra instead of Penumbra.

The expected answers are:

(i) Name of shadow

- | | | | |
|--------------|---|---|---------------------------|
| (α) | A | - | umbra / total shadow |
| (β) | B | - | penumbra / partial shadow |

- (ii) It indicates / shows that light travels in straight lines / rectilinear propagation of light

(c) **The expected answers are:**

To obtain pure sugar from a mixture

- Water is added to the mixture and stirred/shaken
- the resulting mixture is filtered
- the filtrate/liquid is evaporated to dryness and then the pure sugar is obtained.

(d) **The expected responses are:**

Ways of conserving soil

- crop rotation
- addition of fertilizer/manure
- prevent erosion
- afforestation
- avoid overgrazing
- practice covercropping
- avoid bush burning, etc.

Question 3

- (a) **A body of mass 100 kg is raised to a height 2 m above the ground.**
- (i) **State the name of the energy possessed by the object by reason of its new position**
- (ii) **Calculate the value of this energy.**
[$g = 10 \text{ m s}^{-2}$]
- (b) (i) **What is *matter*?**
- (ii) **State two of the states of matter.**
- (c) (i) **Describe the nature of a loamy soil.**
- (ii) **Name any two plant nutrients.**
- (d) (i) **State the causative organism for each of the following diseases:**
- (α) **cholera;**
- (β) **tuberculosis.**
- (ii) **State one method of prevention of cholera.**

(a) **The expected responses are:**

(i) Name of energy possessed by the body

Potential energy

(ii) Calculation of the energy

$$\begin{aligned} \text{P.E} &= mgh \\ &= 100 \times 10 \times 2 \\ &= 2000 \text{ joules} \\ &\text{OR} \\ &2000 \text{ J} \end{aligned}$$

(b) The expected responses are:

(i) Explanation of matter

- It is anything that has weight / mass and occupies space

OR

- anything that occupies space and has weight / mass

(ii) States of matter

- Solid
- Liquid
- Gas
- Plasma

(c) Description of nature of loamy soil

Most candidates stated that loamy soils are good for the cultivation of crops instead of its composition

- quantities of sand, silt, clay and humus.

The expected responses are:

(i) Description of nature of loamy soil

- Soil containing (roughly equal quantities of) sand, silt and clay and (large amount of) humus / organic matter / nutrient

(ii) Plant nutrients

- | | |
|-------------|-------------|
| - nitrogen | - zinc |
| - sulphur | - iron |
| - potassium | - magnesium |
| - calcium | |

(d) (i) With the causative organisms the spelling for vibrio cholerae was a problem.

- (ii) The preventive measures for cholera was poorly answered
The first part of question 3 was well answered by most candidates

The expected responses are:

- (i) Causative organism for each of the following
- (α) Cholera - Bacteria / bacterium /
Vibrio cholera
- (β) Tuberculosis - T.B germ
- Tubercle Bacillus bacteria
- Bacterium / bacteria /
- Micobacterium
- (ii) Method of prevention of cholera
- proper disposal of faeces
 - washing hands with soap under running water before eating
 - immunization
 - wash hand with soap under running water after visiting toilet
 - drinking treated water
 - eating food hot
 - keeping environment clean
 - etc / any correct stated method

Question 4

- (a) **State briefly why a tomato plant is likely to wilt if too much fertilizer is applied.**
- (b) **State the dangers involved in each of the following activities in the laboratory.**
- (i) **eating or drinking water in the laboratory;**
- (ii) **walking barefooted;**
- (iii) **washing hands with unknown liquid in a beaker.**
- (c) **A child is found not to be able to see at night.**
- (i) **What deficiency disease may the child be suffering from?**
- (ii) **What food nutrient is the child lacking?**
- (iii) **State three sources of food substances that can provide the nutrient that the child lacks.**
- (d) (i) **What is a *force*?**
- (ii) **Explain briefly why a driver could not stop a car on a slippery section of a road when he applied the brake.**

- (a) The question on fertilizer application causing wilting was not well understood.

The expected responses are:

Explanation for tomato plant to wilt if too much fertilizer is applied

- (If the fertilizer is too much), the solution in the soil becomes more concentrated than that of the plant. Osmosis then occurs and the tomato plant loses water.
- (b) Question on laboratory safety was poorly done. Most candidates did not know why certain precautions should be taken in the laboratory. It may be that candidates do not even have laboratory exposure and may not have been taught theoretically.

The expected responses are:

Dangers involved in each of the following activities in the laboratory

- (i) Eating or drinking water

May drink poisonous substances / eat contaminated foods

- (ii) Walking barefooted

A person may be pricked with pieces of broken bottles/pins/get burnt/slip

- (iii) Washing hands with unknown liquid in a beaker

Causes burns/irritation/injury/harm

- (c) This part was well answered.

The expected responses are:

- (i) Deficiency disease

Night blindness

- (ii) Food nutrient the child is lacking

Vitamin A

(iii) Sources of food nutrients

- liver
- fish oil / cod liver oil
- milk
- egg
- orange / fruits
- (leafy green) vegetables / carrot / sweet potato etc
- tomato products
- cereals
- palm oil

- (d) (i) This part was well answered.
(ii) Candidates could not apply the concept of friction between the tyres and the road here.

The expected responses are:

(i) Force

- Is a pull or a push
- OR**
- is that which changes a body's state of rest / uniform motion in a straight line

(ii) Explanation why a driver could not stop on slippery section of road

Because there was no friction between the tyres and the road

Question 5

- (a) Describe briefly how the volume of an irregularly shaped lead ball could be measured.
(b) State three characteristics of living things.
(c) (i) What is pollution;
(ii) Name one air pollutant.
(d) State three factors which influence vegetable crop production.

- (a) Only few candidates were able to demonstrate how the volume of an irregularly shaped ball could be determined. Candidates did not understand the concept of displacement.

The expected responses are:

Determination of volume of an irregularly shaped ball

- water is poured into an overflow can until some of the water flows out of the spout
- when the water flow stops, a measuring cylinder is placed under the spout
- the ball is lowered gently into the can
- the ball displaces its volume of water which flows out of the can into the cylinder
- the volume of the water is read off from the cylinder
- record volume
- this is the volume of the irregularly shaped lead ball

- (b) Candidates should be taught general characteristics of living things. E.g. respiration or they respire instead of they breathe. Reproduction or they give birth to young ones etc.

Characteristics of living things

- movement
- reproduction
- feeding / nutrition
- growth
- respiration
- sensitivity / irritability
- excretion

- (c) Some candidates mistook pollution for pollination. Pollution was well defined but the names of pollutants were wrongly spelt especially when they are chemical compounds.

The expected responses are:

(i) What is pollution

Is the introduction of waste / toxic / unwanted / harmful / dangerous substances into the environment so that they cause harm to man and other living organisms

(ii) Name of air pollutant

- smoke
- dust
- (exhaust) fumes / lead
- sulphur dioxide / sulphur (IV) oxide
- sulphur trioxide / sulphur (VI) oxide
- carbon monoxide / carbon (II) oxide
- chlorofluorocarbon / CFC
- named oxide of nitrogen

(d) **The expected responses are:**

Factors which influence vegetable production

- rainfall
- temperature
- sunlight
- wind
- soil pH
- soil fertility
- soil structure / texture / porosity
- any named agricultural practices

Question 6

(a) **State three ways in which crop rotation is important in crop production.**

(b) **State three properties of the image formed by a plane mirror.**

(c) (i) **What is photosynthesis;**

(ii) **Explain briefly why a digestive system is necessary in humans.**

(d) (i) **Give the systematic name of the following compounds:**

(α) **MgCl₂;**

(β) **FeS.**

(ii) **What is an *element*?**

(iii) **What is the name given to a solid mixture?**

(a) This part was well answered

The expected responses are:

Ways in which crop rotation is important

- used to reduce diseases
- used to reduce pest
- to control weeds
- to improve soil quality / structure / texture
- decrease risk during bad season
- check erosion
- ensures economic use of land
- adds nitrogen to soil / improve soil fertility

(b) This part was well answered.

The expected responses are:

Properties of the image formed by a plane mirror

- virtual
- upright
- same size / shape as the object
- left-right reversed / lateral inversion
- same distance from the mirror as the objects distance

- (c) Candidates stated that green plants use sunlight to make their food instead of mentioning the main reactants water and carbon dioxide

The expected responses are:

- (i) Explanation of photosynthesis
Is the process by which (green) plants manufacture food / carbohydrate / glucose / starch using carbon dioxide and water in the presence of sunlight (and chlorophyll)
- (ii) Importance of digestive system in humans
To breakdown food so that it can be used by the body for energy / cell growth / repair.

OR

Breaking down food to give (named) end product of digestion

- (d) Most candidates failed to state that elements are made up of the same kind of atoms and cannot be broken down into simpler substances using chemical methods.

The expected responses are:

- (d) (i) Systematic name of the following compounds

(α)	MgCl ₂	-	Magnesium Chloride
(β)	FeS	-	Iron (II) Sulphide

- (ii) Explanation of an element

- Is a substance whose atoms are of the same kind

OR

- they are chemically the simplest substances and hence cannot be broken down / split using chemical methods into simpler substances.

- (iii) Name of solid mixture

- Alloy
- any named solid-solid mixture