Examination Report

Science

414

JC

2025

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Paper 414/02

General comments

This paper aims at assessing the ability of candidates to confidently apply knowledge of scientific concepts with understanding, handling given information and show skills in problem solving. Candidates are also expected to be able to display science process skills such as carrying out investigations correctly, interpret and evaluate experimental observations and data. The paper seemed well balanced, having both lower order (simple recall), and higher order (application) questions which were assessing all three themes of the syllabus (Physical properties of matter, Chemical behaviour of substances and Maintenance and continuity of life.

About 17000 candidates sat for this examination which shows a slight increase when compared to 2024. This group performed poorly compared to 2024 and 2023 i.e. more single digit scores were recorded as compared to the previous two years. Some common mistakes noted which might have affected the performance include, failure to adhere to command words e.g. describe, leaving some questions unanswered, failing to give correct units in calculations.

Questions that seemed particularly easy include Question **3(b)(i)**, Question **5(a)**, Question **7(a)**, Question **9(b)**, Question **12(a)(iii)**, Question **13(c)**. Questions that seemed most challenging to candidates include Question **2(b)**, Question **4(b)**, **(c)** & (d), Question **7(b)(i)**, Question **7(c)**, Question **8(c)**, Question **10**, Question **12(a)(ii)** & **(b)**.

Comments on specific Questions

Section A

Question 1

This question was fairly done, with a majority of candidates scoring at least half of the marks on offer.

(a) Candidates were required to define the term *drug.* A common mistake candidate was making was defining using common facts about drugs which were not giving the required understanding given by the definition e.g. illegal substance which makes one feel dizzy after taking it, a substance that increases reaction time.

Expected response: any externally administered substance which modifies or affects chemical reactions in the body;

(b) Candidates were required to describe the term *alcoholism.* Most candidates described alcoholism as a person who is addicted to alcohol / drugs which was considered incorrect.

Expected response: addiction to alcohol / alcohol dependence / inability to stop drinking alcohol;

(c) This part of the question required candidates to describe how heroin leads to the spread of HIV. A majority of candidates were able to recall the way of administering heroin but could not explain how that can promote HIV transmission. Another commonly noted misconception was the sharing of injection instead of needles. Candidates who were able to recall that blood to blood contact is required failed to mention that one person should be infected.

Expected response: heroin is injected into the body;
users share the needle;
blood of user infected with HIV remains on the needle get into blood of the other users/ blood of infected person transferred into blood of the other user;

(d) Candidates were asked to explain how HIV leads to the development of acquired immunodeficiency syndrome, AIDS. Some candidates described mode of transmission e.g. having unprotected sexual intercourse as well as not taking medication.

Expected response: destroys/kills white blood cells;
no protection from other viruses of bacteria / weakens the immune system;
opportunistic infections affect the body;

Question 2

The question was fairly done. Most candidates did well in part **(a)** as well as part **(c)**.

(a) Candidates were asked to state the use of electricity in an electric iron. Even though some candidates were giving the use of the appliance e.g. ironing clothes to remove creases, removing wrinkles, to steam clothes. Such responses could not be awarded the mark as these given examples are not the actual uses of electricity.

Expected response: for heating;

(b) This part of the question required candidates to describe the term *power* of an appliance. A common mistake noted was the use of the formula for calculating power being used as a description e.g. voltage of an appliance multiplied by current flowing in the appliance.

Expected response: rate at which energy is transferred/ converted;
or
rate at which work is done;

(c) Candidates were expected to calculate the power of the appliance shown in Fig. 2.1 showing working and stating the correct unit. Some candidates could not recall the correct formula while others were using units in the formula. These could not be awarded the first mark. Some of those that were able to write the correct formula had incorrect substitution which made them forfeit the first mark as well. Another

challenge candidates had was writing the units correctly. Some wrote “w” instead of “W”. Others wrote the full name “watts” which was acceptable.

Expected response: P = IV / 20 × 230;
4600;
W;

Question 3

This question was one of the most well-done questions. A majority of candidates scored more than half of the marks allocated.

(a) Candidates were given Fig. 3.1 showing the arrangement of particles in a solid moth ball and asked to describe the arrangement. A common mistake was describing the arrangement in terms of spaces between particles e.g. close together. This wasn’t awarded a mark because this also applies to liquids, difference being that those in a liquid are not arranged in the form of layers giving a pattern.

Expected response: regular / form a lattice;

(b) **(i)** Candidates were required to name the process by which the solid moth ball changes to a gas when heated.

Expected response: sublimation;

(ii) This part required candidates to draw the arrangement of the moth ball particles after heating. Mistakes that resulted in the loss of marks include, drawing of particles of a different size from the given implying contraction or expansion of the particles during heating, drawing more particles than given in the solid state which implied that particles split forming new ones during ones during heating, drawing particles showing an orderly pattern yet in a gas particles are randomly arranged.

Expected response: particles far away filling the whole space + random;
particles of same size and shape;

(c) This question required candidates to describe, using the kinetic particle theory, how kinetic energy and intermolecular forces change when the moth ball is heated.

Expected response: kinetic energy increases;
intermolecular forces are weakened;

Question 4

This question was the most challenging questions, and this resulted in poor performance. Only a few candidates were able to obtain half the marks allocated.

(a) Candidates were asked to give the name of the blood vessel labelled A in Fig 4.1(transporting blood from body tissues back to the heart).

Expected response: vena cava;

(b) Candidates were required to describe the function of the part labelled B (tricuspid valve) in Fig. 4.1. a majority of candidates describe the general function of valves in the circulatory system instead of being specific.

Expected response: prevents the backflow of blood from the left ventricle to the left atrium / ensures one way flow of blood from the left atrium to the left ventricle;

(c) Candidates were asked to describe differences in the composition of blood in the pulmonary artery and the pulmonary vein. Some candidates could not understand well what the question required, as a result they described functions of these two blood vessels.

Expected response:

	Pulmonary artery	**Pulmonary vein**
difference 1	less oxygen / low concentration of oxygen	more oxygen / high concentration of oxygen;
difference 2	more carbon dioxide / high concentration of carbon dioxide	less carbon dioxide / low concentration of carbon dioxide;

(d) Candidates were asked to describe the role of lungs. A few candidates got this one correct.

Expected response: for gaseous exchange;
allows carbon dioxide to diffuse from blood to the lungs and oxygen to diffuse from lungs to blood;

Question 5

This question was fairly done.

(a) Candidates were asked to state the energy conversions that occur as the girl in Fig. 5.1 swings from position **C** to position **D**. Even though candidates were able to deduce the form of energy possessed by the girl at each position, some failed to write the conversion in the correct order. Some referred to gravitational potential energy as "gravitational" only which confused it with gravitational force.

Expected response: gravitational potential energy to;
kinetic energy;

(b) **(i)** This was well answered by a majority. Candidates were required to name the force that enables the girl in Fig. 5.1 to climb up the trunk of the tree where the

swing is hung.

Expected response: frictional force;

(ii) This question required candidates to suggest how the girl can reduce the size of the force named in **(i)**. Instead of suggesting ways of reducing frictional force, candidates confused this by suggesting ways on how to make climbing easy. Such responses could not address what the question required and as a result the mark was missed by a majority. These responses include using a ladder, wearing hand gloves, powdering hands, and cutting the tree to make it shorter.

Expected response: greasing / oiling / making the tree trunk smooth;

(iii) Candidates were expected to state one disadvantage of the force named in **(i)** above.

Expected response: produces unnecessary heat or sound / wears off materials or surfaces;

Question 6

This question was fairly done. Quite a large number of candidates scored at least half of the marks allocated. Missed marks were due to failure to make reference to given example in part **(a)** as well as writing symbols of elements in sodium chloride using lowercase in part **(c)**.

(a) Candidates were asked to define the term *compound* with reference to sodium chloride or potassium chloride. Most candidates gave the general definition failing to make refence to the given examples.

Expected response: substance made of two elements, sodium and chlorine / potassium and chlorine;
chemically combined;

(b) This question required a description on how large crystals of potassium chloride can be obtained from its solution**.** Candidates were able to describe well how crystals

could be prepared missing the part of making them “large” which requires that the solution should be saturated first instead of completely evaporating the water. The most common description was evaporation method rather than crystallization and as result some marking points were missed.

Expected response: gently heat the solution;
to evaporate some of the water / until solution is saturated or concentrated;
remove solution from heat and allow to cool / water to evaporate slowly forming crystals;

(c) Candidates were asked to state the chemical formula of sodium chloride.

Expected response: NaCl;

Question 7

This question was fairly done as well with candidates scoring at least half of the marks allocated.

(a) Candidates were asked to name the tissue that transports water up the stem in a plant. A majority responded well to this question, a few had a challenge in writing the correct spelling.

Expected response: xylem;

(b) **(i)** This part required candidates to name the transparent tissue on the leaves that allows light to pass through to palisade cells. A common incorrect response was ‘cuticle” which is a layer that is transparent but does not fit in the description of a tissue. Such a response was not able to earn a mark.

Expected response: epidermis;

(ii) Candidates were required to write the word equation for photosynthesis. Some could not write the equation in the correct format even though reactants and products were known e.g. using =, and, writing the essential conditions

(chlorophyll, light) as either reactants or products. This resulted in a loss of marks.

Expected response: carbon dioxide + water; ⟶ glucose + oxygen;

(c) This part required a description on how other parts of the plant obtain the products of photosynthesis. Quite a large number of candidates were able to name the tissue response even though spelling was a challenge. Only a few were able to name the process by which the products are moved.

Expected response: translocation; by the phloem;

Question 8

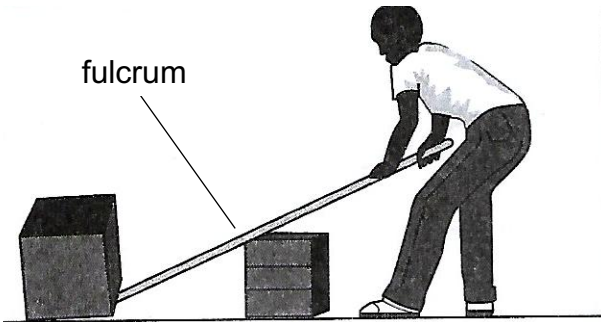
Performance in this question was very poor mainly due to failure to give the full definition of lever in part **(a)** as well as the calculation in part **(c)**.

(a) Candidates were asked to define the term *lever*. The mark was lost here due to giving half of the definition which was very common.

Expected response: a type of a simple machine consisting of a rigid rod pivoted at the fulcrum;

(b) This part required candidates to mark and label the fulcrum in Fig. 8.1. this mark was missed by a majority due to, failure to label appropriately e.g. instead of using a label line but they were simply writing ‘fulcrum’ on the point causing it to spill beyond the pivot, using letter ‘F’ which brought ambiguity with force, some labelled on the box where the bar is resting instead of the point on the bar where it swings on that box.

Expected response:



(c) Candidates were asked to calculate the moment produced by the load when placed 80cm away from the fulcrum. Most candidates missed the first make by failing to convert the distance from cm to m. others were writing the formula as an expression with no subject, while d was also given in uppercase D. a majority could not write the units correctly e.g. N/m instead of Nm.

Expected response: 0.8m;
M = F × d / 100 × 0.8;
= 80 Nm;

Question 9

This question was generally well answered by a large number of candidates making it one of the most accessible questions.

(a) Candidates were supposed to state the name given to the rows of elements of the Periodic Table.

Expected response: periods;

(b) This question asked candidates to state one physical property of Group 1 metals shown in Fig. 9.1.

Expected response: soft;

(c) Candidates were supposed to describe one observation made when sodium metal is dropped into water.

Expected response: sodium floats;
moves fast / rapidly on the water surface;

bubbles formed;
fizzy sound;
effervescence;
sodium disappears / melts fast;

(d) Candidates were required to describe, using the reaction of sodium with water, why it is a chemical change. Most candidates were giving general properties of chemical changes instead of making reference to the given e.g. a new substance is formed instead of sodium hydroxide is formed.

Expected response: sodium hydroxide is formed;
the product is generally irreversible / heat energy is released;

(e) **(i)** This required a description for a positive test for hydrogen gas.

Expected response: *test* – insert a lighted splint into the test tube containing the gas;
result – burns with a pop sound;

(ii) Candidates had to state **one** use of hydrogen gas.

Expected response: as a fuel in space rockets / manufacture of margarine / manufacture of ammonia;

Question 10

This question was poorly done. Most candidates could not deduce and apply the concept of static electricity that was being tested.

(a) Candidates were asked to describe how the roll and the end of the tape in Fig. 10.1 become electrically charged by friction when the end is pulled down.

Expected response: roll and the end of tape rub against each other as they are pulled apart;

electrons move from the tape to the roll / from the roll to the tape;
the tape and the roll gain opposite electrical charges, negative and positive;

(b) Candidates were expected to explain why the end of the tape moves back towards the roll. Candidates could not explain in terms of attraction between oppositely charged materials but were relating that to the end being sticky.

Expected response: unlike charges in roll and end of tape;
causes attraction between them;

Section B

Question 11

This question was fairly done. A majority of candidates manged to score at least 4 of the 7 marks allocated.

(a) Candidates were asked to describe how a student can use a litmus paper to identify solution **A** as an acid. Even though a majority of candidates were able to state the colour change observed when litmus paper is put into an acid, some failed to state the colour of the litmus that gives the red colour change, yet this was necessary in the description. Some candidates missed a mark due to failure to describe how the litmus paper is used e.g. put / insert litmus paper into the acid.

Expected response: dip / put /insert a blue litmus paper into the solution;
litmus paper changes to red;

(b) **(i)** This part of the question was challenging to a majority of candidates. Instead of describing an observation made during the reaction, the applied their understanding of reactions of acids with bases such as decrease in pH base or increase in pH of the acid reaching pH 7.

Expected response: effervescence observed / bubbles formed / fizzy sound produced;

(ii) Candidates were required to state the name of the reaction that occurs between solution **A** and solution **B**.

Expected response: neutralisation;

(c) Candidates were asked to suggest one change that the student can make on the experiment to increase the speed of the reaction. Some candidates missed the mark due to suggesting factors that do affect the speed of a reaction but were not applicable in this experiment e.g. reducing particle size of reactants (note reactants were given in solution form).

Expected response: heat / increase the temperature of solution **A** or **B /** increase the concentration of solution **A** or **B**;

(d) This part of the question was generally well answered. It required candidates to describe how the student can determine the pH of the soluble base.

Expected response: dip universal indicator paper / add drops of universal indicator solution into the base;
then match colour formed with colours of the pH chart / observe colour change and match with the pH chart;

Question 12

This question seemed challenging to a majority of candidates. They failed to apply the concept of osmosis hence making it difficult to deduce why the size of the raisin changed and why at a particular concentration, no change was observed.

(a) **(i)** Candidates were asked to describe and explain the appearance of the raisin after being left for an hour in distilled water.

Expected response: larger / swollen;
water moves into the raisin / water enters the raisin by the process of osmosis;

(ii) A few candidates got this question correct. Candidates were asked to describe one precaution the student takes with the raisin before measuring its mass.

Most were describing precautions to take with the instrument used for measuring the mass of the raisin e.g. remove any dust particles on the instrument / make sure the instrument reading is at zero.

Expected response: dry the raisin between filter papers / paper towel / cloth;
or
wipe off any water from the surface of the raisin using a paper towel / cloth;

(iii) This was generally well answered. Candidates were required to name the instrument the student uses to measure the mass of the raisin.

Expected response: balance / any named balance i.e. beam / lever arm /electronic;

(b) Candidates were required to state and explain why there was no change in mass when the raisin was left for another hour in a sugar solution. Candidates could not apply their understanding of osmosis but assumed that the raisin is now full, therefore cannot take in any more water.

Expected response: concentration of the sugar solution and that of the raisin is equal;
no net / overall movement of water molecules into or out of the raisin / no osmosis;

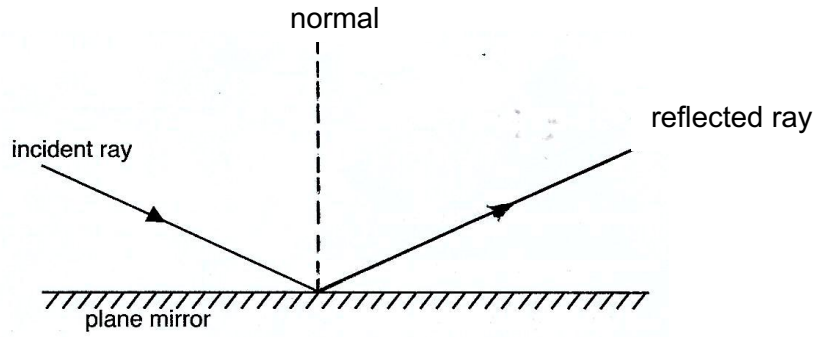
Question 13

This question was generally well done. Even so, it was noted with concern that quite a large number of candidates did not have the required material to do well especially in part **(a)** and **(b)** i.e. protractor and ruler. Most seemed to be simply guessing the angles. This affected the overall performance in the question.

(a) Candidates were required to complete Fig. 13.1 to show the reflected ray after striking the plane mirror.

Expected response: correctly drawn normal line (broken line, 90˚ to the point of contact of the incident with the mirror);

correctly drawn reflected ray (solid straight line with an arrow, lying on the same plane as the incident ray, staring where the incident ray strikes on the mirror);



(b) Candidates were asked to measure and record the angle of incidence and the angle of reflection. Even though some candidates were giving incorrect measurement due to having no protractors, understanding of the law of reflection, i = r, was evident in their responses. This enabled candidates to score at least 1 of the 2 marks on offer.

Expected response: $i = 65^0$;

$i = r$;

(c) Candidates were required to state one characteristic of the image formed by the plane mirror.

Expected response: virtual;

upright;

same size as the object;

laterally inverted;

at the same distance from the mirror as the object from the mirror;

(d) Candidates were required to complete Fig. 13.2 to show the direction of a parallel beam of light after passing through a concave lens. Most common mistakes candidates were making in this question include failure to show the ray inside the lens (leaving gaps), leaving arrows on the rays shown after passing the lens.





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