EXAMINATIONS COUNCIL OF ESWATINI

EGCSE

EXAMINATION REPORT

FOR

PHYSICAL SCIENCE (6888)

YEAR

2020

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EGCSE PHYSICAL SCIENCE

Paper 6888/01

Short Answers

General Comments

The total number of candidates who sat for this paper was about 11500. This shows a slight decrease from the previous year exam. This year's performance was better compared to last year.

The marks ranged between zero and thirty- five. Most candidates scored in the range 20 - 30, very few got more than 30. There were few candidates who scored less than 10. Only four candidates scored zero even though they had attempted most of the questions.

Questions that were more challenging to most candidates were **Questions 3(b), 5(b), 12** and **15(b**). Question 12 proved to be most inaccessible question because only a few candidates got full marks. Questions that were more accessible to most candidates were **1, 2, 3(a), 5(a), 7(a), 9(a)** and **13(a)**.

Comments on Specific Questions

Question 1.

This question was generally accessible to most candidates. Candidates were given diagrams showing structures of four different molecules. They were required to identify the diagram that represents the structure of water molecules.

The correct answer was **D**.

Some common wrong responses were **A** and **B**.

Question 2

(a) This part was accessible to most candidates. Candidates were required to sketch a speed-time graph for the motion of a car driving up a hill on straight road with zero acceleration.

The expected correct response was a straight horizontal line (anywhere within the grid).

Some common wrong answers were; a vertical line, diagonal line, hand drawn line. Some candidates drew a horizontal line on the time axis at 0 m/s implying that the car was stationery yet the car was moving at a constant speed. This response earned a zero mark.

(b) This part was also accessible to most candidates. Candidates were required to state the value of the resultant force acting on the car.

The correct response was 0 N.

Some common wrong answers were zero with a wrong unit e.g 0m/s, 0J, 0 Nm. Other wrong answers were 10 N, 10 N/kg and terminal velocity.

Question 3

(a) This part was generally accessible to most candidates. Candidates were given a diagram showing some of the interconversions between the three states of matter. They were required to identify process **E** which represented a change of state from liquid to solid.

The expected correct response was freezing/solidification.

Common wrong responses were; condensation and evaporation. Some candidates were able to identify the process but were let down by wrong spelling such as frezzing, frizzing, freazing, freizing.

(b) This part of the question was inaccessible to most candidates. Candidates were required to explain why substances in the solid state have a definite shape.

The expected correct response was; particles in solid substances are held in fixed positions by strong forces of attraction.

Most candidates showed misconception on the kinetic particle theory. They referred to solids being held by strong forces at fixed positions. Other candidates stated that solid particles do not move but vibrate about fixed points. Other wrong responses were; solids have fixed shape/fixed volume/ particles vibrate when heated.

Question 4

This question was accessible to most candidates. Candidates were required to state two changes that can occur when a force is applied to a body.

The correct responses were; change in shape/ direction/ speed (acceleration)/ size/temperature.

Some candidates were giving equivalent points which earned a mark. e.g. change in speed and acceleration, change in motion and direction, body at rest moves and moving body stops, body moves and body changes position.

Wrong responses mentioned were: reference to human body e.g. body sweating, muscles contract, a person falls.

Other wrong responses were; when force is applied energy occurs, force of gravity, twisting, compression and squeezing.

Question 5

(a) Candidates were given a diagram showing apparatus used to separate liquids **J**, **K** and **L** from their mixture. They were given boiling points for **J** as 45^0C, **K** as 65^0C and **L** as 85^0C.

This part of the question was accessible to most candidates. Candidates were expected to name the method of separation shown in the diagram.

The expected correct response was fractional distillation.

Common wrong responses were: simple distillation, simple fractional distillation and fractionating column. Some candidates were able to identify the method but were let down by wrong spelling such as fractional destilation, frictional distillation.

(b) Candidates were expected to explain why the distillate collected at 45^0C was pure liquid **J**.

The correct response was: **J** is more volatile than **K** so liquid **J** vapour reaches the condenser while liquid **K** vapour condenses on glass beads.

Most responses lacked comparison of the boiling points between the different liquids instead candidates were reciting the given boiling points. They were also giving the function of the fractionating column instead of describing its application in the question. Some candidates linked the difference in boiling points to criteria for purity.

Question 6

This question was accessible to most candidates.

Candidates were given a diagram showing two types of shoes, shoe **1** and shoe **2** of the same height. Candidates were expected to explain why shoe **2** was more stable than shoe **1**.

The correct answer was: shoe **2** has a wider base area and lower centre of mass.

Most responses did not link stability to base area and position of centre of mass. Most candidates did not compare the base areas but referred to the surface area of the shoes and thickness of the sole.

Common wrong answers: bigger stiga, bigger solar, larger centre of mass, concentrated centre of mass, no centre of mass, broader base of the hill.

Question 7

(a) This part of the question was average.Candidates were required to complete a table by naming the type of bond present in methane, potassium bromide and carbon dioxide.

Correct responses were:

Covalent for methane

Ionic for potassium bromide

Covalent for carbon dioxide

Common wrong answers:

The most common wrong answer was metallic, single/double bond,

Common wrong spellings: convalent, covalet, covelent, covalant, ironic

(b) This part of the question was moderately done. Candidates were required to describe how bonding in graphene enables it to conduct electricity.

The correct answer was: graphene has free/delocalised electrons.

Most candidates did not understand that it is the carbon atoms that bond but instead referred to graphene bonding to three carbon atoms.

Some common wrong responses were: delocalised ions/atoms, presence of extra /spare electron/ unbonded carbon atom, free electrons due to metallic bonding/electrostatic forces.

Question 8

This question was moderately done as most candidates were able to score one mark.

Candidates were given a diagram showing a battery-powered torch in use. They were required to state the energy changes that occurred in the torch.

The correct answer was: chemical to electrical to light (and heat).

Some candidates gave vague responses such as potential instead of chemical, kinetic instead of light.

Common wrong responses were: chemical, electrical and light/; chemical to electrical to light to heat; light to heat

Question 9

Candidates were given two chemical changes, combustion of magnesium and respiration.

(a) This part of the question was accessible to most candidates. Candidates were required to state one similarity in terms of the input gases between combustion of magnesium and respiration.
The correct answer was: both changes require oxygen.
Some candidates thought oxygen reacts with combustion of magnesium/ respiration. Some thought the oxygen is a product of the two changes.

Common wrong answers: carbon dioxide produce, heat energy produced, both changes are combustion reactions.
(b) This part of the question was moderately done.
Candidates were required to describe a property of a chemical change using combustion of magnesium.
The correct response was: energy is released/ magnesium oxide is formed as a new product, the change is irreversible because magnesium cannot be obtained back from magnesium oxide.
Most candidates did not apply the properties of a chemical change to the given change but instead listed the general properties of a chemical change.
Some common wrong responses were: a new substance is formed and magnesium oxide cannot be reversed.

Question 10

Candidates were told that the human ear can detect sound across a wide range of frequencies.
(a) This part of the question was accessible to most candidates. Candidates were required to state the approximate values of audible frequencies.
The expected correct response was: [15 ─ 25 Hz] to [15 ─ 25 kHz]
Some common wrong responses were: 20 Hz, 20kHz, $3x10^8$ m/s, 330m/s, wrong units.

(b) This part was also accessible to most candidates. Candidates were required to state the term used to describe the property of sound related to frequency.

The expected correct response was: pitch

Some common wrong responses were: echo, wavelength, electromagnetic spectrum, loudness, amplitude, audible, pitchiness.

Question 11

This question was moderately done. Candidates were given a table showing some reactions of different types of oxides (amphoteric, basic and neutral oxides) with acids and base. They were required to complete the table by using a tick and/or a cross to indicate differences in reactivity of the oxides.

The correct responses were as follows:

type of oxide	reaction wit acid	reaction with a base
amphoteric oxide	√	√
basic oxide		x
neutral oxide	x	

Question 12

This question was the most challenging. Candidates were given a diagram showing a section of the heating curve of water. They were required to explain why the temperature remains constant between region **M** and **N**.

The correct response was: heat/energy (input) is used to cause a change of state/weaken forces of attraction between the molecules not to increase the kinetic energy of the particles.

Most candidates failed to link the question to arrangement of particles in solids and liquids when explaining the process of melting. They referred to breaking forces of attraction yet during melting particles become loosely packed, still held by weak forces of attraction. Some candidates confused the graph with a speed-time graph, hence describing the region as uniform speed and zero acceleration.

Most common wrong responses were: breaking bonds, boiling point, particles gain kinetic energy.

Question 13

Candidates were given a diagram showing a light bulb with labels for tungsten filament and gas **Q** in the bulb.

(a) This part of the question was accessible to most candidates.

Candidates were required to state the name of gas **Q**.

The correct answer was: argon.

The common wrong responses were: oxygen, helium and hydrogen.

(b) This part was also accessible to most candidates.

Candidates were asked to state one physical property of transition elements such as tungsten.

The correct answer was: forms coloured compounds/good conductors of heat and electricity/hard/ high densities/high melting points.

Common wrong answers were: strong/ ductile/malleable/low melting point/ used as catalyst/denser than air/ varying oxidation states.

Question 14

This question was generally inaccessible to most candidates. They were required to describe the image formed by a plane mirror.

The correct answer was o: laterally inverted; same size as object; same distance from mirror as object.

Most of the responses lacked comparison between image and object. Some candidates confused image with object.

Some common wrong answers were: same size, same shape, image same distance from mirror line, inverted, literally inverted, upside down, the same and same size as real image.

Question 15

(a) This part of the question was accessible to most candidates. Candidates were required to state what is observed at the magnesium rod. They were given a diagram showing two metal rods, magnesium and copper, inserted in dilute sulfuric acid to form a simple cell.

The correct response was**:** bubbles/ magnesium rod decreases in size.

Most candidates confused the simple cell with electrolysis apparatus.

The most common wrong answers were: gas produces, rod erodes/dissolves, brown colour formed on the rod.

(b) This part was inaccessible to most candidates. Very few candidates were able to score the two marks. Candidates were given a diagram showing a bulb connected to the simple cell. They were required to explain how the simple cell enables the bulb to light.

The expected correct response was: magnesium rod discharges electrons which move from magnesium to copper.

Most candidates failed to show understanding that the electrons move through the wire and bulb to the copper rod.

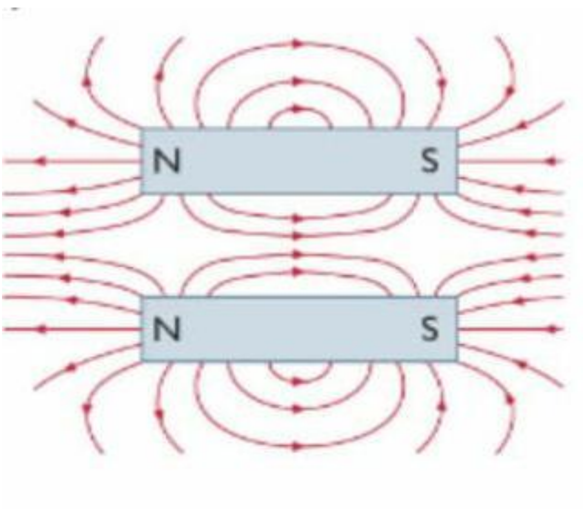
Most common wrong responses were: electrons move from magnesium through the electrolyte/acid to copper, movement of positive ions, copper loses electrons, magnesium and copper are good conductors of electricity, electrons move from anode to cathode.

Question 16

This question was moderately done. Candidates were given a diagram showing two permanent magnets with like poles placed side by side. They were required to draw the magnetic field lines around the magnets.

The correct response: at least two solid lines running from north to south on each magnet, not crossing, showing repulsion and correct direction.

The most accessible mark was for correct direction while repulsion was the most inaccessible.



Common wrong responses were: dotted lines, lines crossing/touching, lines drawn from N to N or S to S, converging filed lines at the end opposite direction on the same magnet.

Question 17

This question was accessible. Candidates were given an incomplete equation showing decay of polonium-218 by beta emission. They were required to complete the nuclear equation.

The correct response was: $^{218}_{84}Po \rightarrow ^{218}_{85}At + ^{0}_{-1}\beta$

Some common wrong responses were: Po/ Astatine/ X/Bi/Rn-222 for At, 210 for 218

EGCSE PHYSICAL SCIENCE

Paper 6888/02

Structured Questions

General Comments

Approximately 11535 candidates registered for this component. This was a decrease of about 400 candidates compared to the previous year. This may mean that more and more centres are making Physical Science an elective subject over Biology.

The paper was marked out of a total of 80 marks. Generally, the paper was of the same difficulty as the previous year's. The highest score was 1 mark more than the previous year's. The scores ranged from 0 to 70. The majority of the candidates scored between 15 and 25 marks but there was also a noticeable number of scores above 40.

Use of correct symbols in formulae and equations was still a challenge. Another outstanding challenge was the use of correct scientific terms, for example, "particles" instead of the correct scientific term "ions". Failures to round off calculations correctly also lead to loss of marks.

All questions were equally attempted. Most candidates attempted all the questions. However, there were some candidates who did not attempt some questions and part questions but it is not evident enough that it was because of lack of time.

Questions that proved to be easy for most candidates were: **1(a),(b), 4(d),(e), 7, 8(a),(c), 9(a), (c)(iii), 10(a) and 10(c)(i)** as most candidates were able to score full marks from them. Questions that proved to be difficult for most candidates were: **1(c), 2(b),(c)(i),(ii), 3(b),(c), 4(a), (b), (c), 5(a), 6(c), 8(e)(i)(ii) and 10(c)(iii)** as most candidates failed to obtain full marks from these questions.

Comments on Specific Questions

Question 1

(a) This question was well done.

Candidates were required to calculate the weight of a bag, given its mass. Most candidates were able to use the relation ***W = mg*** to get the expected value of ***1000 N***. Candidates lost a mark for omitting the unit or writing a wrong unit.

(b) This question was also well done.

Candidates were required to calculate the gravitational potential energy of a bag. The expected response of: *g.p.e. = mgh = 1 000 x 100 x 10 = 1 000 000 J* was common**.**

(c) This question was poorly done as most candidates failed to score both marks.

Candidates were required to explain why the potential energy at the top is not equal to the kinetic energy when the bag hits the ground. The most common wrong response was the reference to terminal velocity.

The expected response was: *not all the potential energy is converted into kinetic energy as the bag fall. Some of the energy is lost as heat through air resistance.*

Question 2

(a) This question was fairly well done but not as well as expected.

Candidates were required to define oxidation in terms of electron transfer. The expected response of "*the loss of electrons*" was averagely common. The common wrong responses were: - gain of electrons; copper loses electrons

(b) This question proved challenging to most candidates.

Candidates were required to state and explain which substance has been reduced in the equation: $Zn(s) + Cu^{2+}(aq) \rightarrow (aq) + Cu(s)$.

Common wrong responses included: copper loses electrons, copper is reduced to form solid copper, and zinc loses electrons to form Zn^{2+}.

The expected response was: copper ion is reduced. It gains two electrons to form copper atom.

(c) **(i)** This was a not well done question as most candidates failed to make comparison between the physical properties of brass and copper.

Candidates were required to state two reasons why brass is used in the manufacture of door handles while copper is not. The most common wrong response was listing physical properties of copper instead of comparing the two.

The expected responses were: *brass is harder than copper, brass is less reactive than copper, brass is more resistant to corrosion than copper.*

(ii) Another poorly done question as most candidates failed to score all the marks.

Candidates were required to explain, using metallic bonding, why copper is malleable. Use of inappropriate scientific terms such as atoms and particles instead of ions led to loss of marks.

The expected response was**:** *copper has layers of positive ions. The* *<u>layers</u>* *slide over each other without breaking the metallic bond when a force is applied.* This response was not common. Candidates lost the mark for not mentioning that it is the layers that slide over each other not ions or atoms or particles.

Question 3

This question was about thermal physics. The whole question was challenging for the majority of the candidates.

(a) This was a fairly done question as most candidates were able to score at least 1 mark out of the available 2.

Candidates were required to explain how a thermos flask reduces heat loss by conduction. Candidates were expected to identify a feature of the thermos flask that reduces conduction and then explain how it reduces the heat transfer by conduction. A common wrong response was that it has a vacuum which traps air.

The expected response of "*it has a vacuum between the glass walls which prevents heat loss by conduction because it has no particles*" was not very common. Another correct response was that "*it has a plastic stopper which is a poor conductor of heat.*"

(b) This question poorly done.

Most candidates were not able to describe how the hot tea eventually reaches the temperature of the environment when the flask is left open. This question was simply asking the candidates to describe how the hot tea loses heat. A common wrong response was that the heat diffuses out of the flask or the heat escapes through the opening. Candidates were expected to describe heat loss by convection of the air just above the tea surface.

The expected response was***:*** the hot, less dense air particles just above the tea surface rise up, taking heat energy with them and are replaced by cold denser air particles.

(c) This was a poorly done question as most candidates were not able to explain what would happen to the hot tea if the silver painted glass walls are replaced with black painted glass walls.

Most of the candidates' responses lacked comparison. A common wrong response was that the heat is conducted away by the black surface. Even some high scoring candidates failed to make reference to the tea cooling faster. It was also common to find "black surfaces are good conductors of heat" instead of good absorbers or emitters of heat.

The expected response was: heat loss will be faster because *black surfaces are better emitters of infra-red radiation than shiny surfaces and so the tea becomes cooler faster.*

Question 4

(a) This was a challenging question to most candidates. The second mark was not common.

The majority of the candidates failed to realise that the question was on diffusion not on the reactivity series. Most common wrong responses referred to volatility and reactivity.

The expected response was**:** *solution **A** particles are lighter than solution **B** particles, so solution **A** particles diffuse faster than solution **B** particles.*

(b) This question was poorly done. Most candidates failed to score both marks from this question.

Candidates were required to explain why ammonium nitrate is preferred as a fertilizer to ammonium chloride. Candidates ignored the comparison of the amount of nitrates in ammonium nitrate and in ammonium chloride. A common incorrect response was that ammonium nitrate has nitrates while ammonium chloride has no nitrates.

The expected response was: *ammonium nitrate has a higher percentage of nitrogen atoms than ammonium chloride. Nitrogen promotes plant growth.*

(c) This was another challenging question to most candidates.

Candidates were required to write a balanced chemical equation for the reaction of lime with ammonium nitrate. The majority of the candidates had a challenge with the formulae for the compounds. Some candidates who were able to write the correct formulae for the compounds failed to balance the chemical equation. There were no common wrong responses.

The correct response was: $CaO + 2NH_4NO_3 \rightarrow Ca(NO_3)_2 + 2NH_3 + H2O$

(d) This was a fairly well done question as the correct response of ***"****lime neutralises* *acidic soil"* was common among the candidates' responses.

Common unacceptable responses included: lime reacts with the soil, lime is neutral, lime reduces the pH of the soil and lime reacts with hydrogen ions.

(e) This question was well done. Most candidates were able to score both marks.

Candidates were required to calculate the percentage by mass of hydrogen in ammonia. Quite a number of candidates lost a mark for failing to round off correctly.

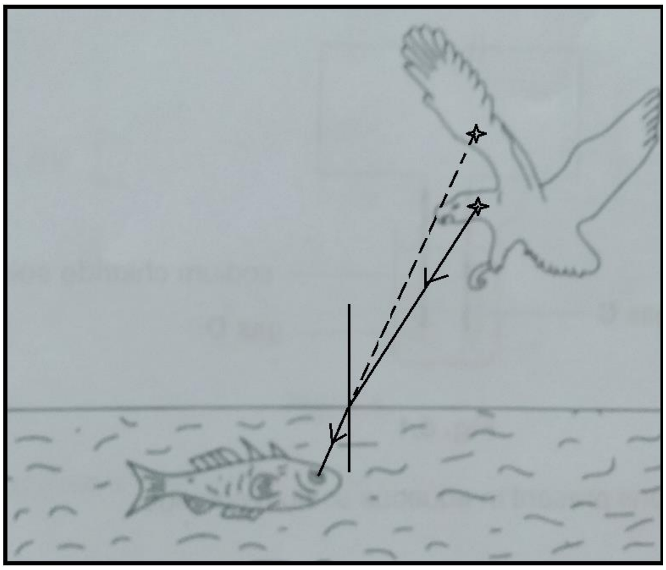
A common incorrect response was: $\frac{17}{100}$ x 100% = 17%

The correct response was: $\frac{3}{17}$ **x 100% = 17.6 %**

Question 5

(a) This was one of the most challenging questions in the paper as most candidates failed to score more than 1 mark out of the available 4 marks**.**

Candidates were required to show the position of the bird as seen by the fish**.** The concepts of refraction and apparent depth were lacking for most candidates.



The expected response was as shown in the figure above. A ray from any part of the bird to the water surface is then refracted towards the normal to the fish's eye. Then an apparent ray straight to vertically above the point where the first ray started to show the apparent height of the bird as seen by the fish.

(b) This was a well done question. Most candidates were able to score maximum marks from this question.

Candidates were given the angle of incidence and the refractive index of water and were required to calculate the angle of refraction. The correct formula $n = \frac{sin\ i}{sin\ r}$ was common. Candidates lost marks for writing wrong symbols like r or r.i. instead of *n* for refractive index.

The expected response was: $n = \frac{sin\ i}{sin\ r}$

$$1.3 = \frac{sin\ 60}{\sin r}$$

$$\sin r = \frac{sin\ 60}{1.3}$$

$$r = sin^{-1}(\sin 60/1.3)$$

$$r = 41.8°$$

A few candidates omitted the unit (°) and they lost a mark. Candidates also lost a mark for failure to round off correctly.

Question 6

(a) This question was fairly well done as most candidates were able to give the expected response of *hydrogen ions and sodium ions* as the positive ions in aqueous sodium chloride.

(b) This question was also fairly well done. The majority of the candidates were able to give the expected responses of ***C-*** *chlorine gas* and ***D-*** *hydrogen gas* as the gases give out in the electrolysis of concentrated sodium chloride solution using carbon electrodes.

(c) This question was poorly done as the majority of the candidates failed to explain why the solution formed in the electrolysis of concentrated sodium chloride solution is alkaline. The most common unacceptable response was that sodium when dissolved in water forms an alkaline solution. Another common wrong response was that it turns red litmus paper blue.

The expected response was: *sodium ions and hydroxide ions remain in the solution forming sodium hydroxide which is alkaline*.

Question 7

This question was on electricity. Candidates were given a circuit diagram consisting of 2 resistors in parallel, an ammeter measuring the main current and a 6 V power source. The whole question was well done.

(a) This part question was fairly well done as most candidates were able to calculate The combined resistance of the two resistors in parallel. A common wrong response was R_T = 8 Ω + 4 Ω = 12 Ω.

The correct expected response was: $R_T = (R_1 \times R_2)/(R_1 + R_2) = (8 \times 4)/(8 + 4)$ *= 2.67 Ω.*

Candidates lost marks for failing to round off correctly to 3 significant numbers.

(b) This question was fairly well done as most candidates were able to recall and use the formula I = V/R to get the correct response of 2.25 A.

(c) This question was also well done. The majority of the candidates were able to state the correct potential difference across the 4 Ω as *6 V*.

(d) This question was fairly done. Most candidates were able to recall and use the relation P = V I although some candidates had a challenge in calculating the current first. Some candidates used $P = V^2/R$ and scored all the marks.

The correct response was: *I = 6/8 = 0.75 A, P = VI = 6 x 0.75 = 4.5 W or*
$P = V^2/R = 6^2/8 = 4.5$ *W*

(e) This was generally a challenging question to most candidates. Most candidates who attempted it were only able to score 1 mark out of the available 2 marks. Candidates were required to explain why the 4 Ω resistor feels warmer than the 8 Ω resistor after several minutes. Lack of comparison of the current through the two resistors, hence power dissipated between the 2 resistors lead to loss of marks.

The expected response was: *there is more current flowing through the 4 Ω resistor, hence more power dissipated.*

Question 8

(a) This question was fairly well done.

The majority of the candidates were able to identify processes ***E*** *as fractional distillation* and ***F*** *as combustion*. A minority of the candidates wrote distillation instead of fractional distillation and they lost the mark. Common wrong answers were **E**- heating and **F** – cracking.

(b) This part question was fairly done.

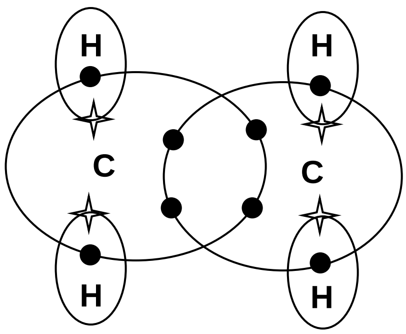
Candidates were required to explain why the steel legs in the water are covered with zinc bars. Most candidates were able to relate to sacrificial protection to prevent rusting. A common wrong response was that it prevents water from coming into contact with the steel. The correct response was: *zinc is more reactive than the iron in the steel, so zinc, instead of steel, reacts with water to prevent rusting.*

(c) This was a well done question as most candidates were able name the homologous series to which ethene belongs as *alkenes*.

(d) This was an averagely done question.

A noticeable number of candidates were able to draw the correct “dot-and-cross” structure of ethene. To earn full marks, candidates were supposed to show the double bond of carbon – carbon and the correct octet for carbon and hydrogen. A common wrong response was the structural formula for ethene.

The expected correct response:



(e) **(i)** This part question was not well done as a number of candidates failed to name the linkage present in nylon as the ***amide*** linkage. Common responses were peptide and ester.

(ii) This was another challenging part question to most candidates. The majority of the candidates failed to name ***protein*** as another polymer with the same linkage as nylon. Common wrong responses included poly-ethene, amino acids and teryllene.

Question 9

This question was on the transformer. Generally, this was a well done question.

(a) This was a well done question. Most candidates were able to name the transformer as a ***step-down*** transformer.

(b) This question was fairly well done. An average number of candidates were able recall and use the relation $V_s/V_p = N_s/N_p$. The correct substitution gave
Vs = (600 x 240)/ 30 000 = 4.8 V. A few candidates omitted the unit, V, and they lost amark.

(c) **(i)** This was another well done question as the expected response of ***I = P/V = 80 W /4.8 V = 16.7 A*** was not scarce. The use of $\boldsymbol{V_p I_p = V_s I_s}$**,** ***80 W = 4.8*** $\boldsymbol{I_s}$ was also not penalised. Candidates lost marks for failure to round-off correctly to 3 significant figures.

(ii) This question was also fairly well done as most candidates were able to score at least 1 mark out of the available 2 marks. Candidates were required to calculate the current, I_p, in the primary coil.

The expected correct response of $V_p I_p = V_s I_s$, $I_p = \frac{4.8 \times 16.7}{240} = 0.334$ A was common. Use of $\boldsymbol{V_p I_p = 80\ W}$**,**

$\boldsymbol{I_p = 80/240 = 0.333\ A}$ was also accepted as a correct response. A common wrong responses was the use of I = V/R.

(iii) This part question was well done. Candidates were required to state the assumption that was made about the transformer when calculating the current in the primary coil. **The expected answer** of *"the transformer is 100% efficient"* was very common.

Question 10

In this question candidates were given a graph of volume of hydrogen gas produced when 10 cm^3 of 1.0 mol/dm^3 of hydrochloric acid solution reacts with 3 g of magnesium ribbon.

(a) This was a fairly well done question. Candidates were able to identify ***H*** as the point where the reaction is fastest. A few candidates gave **H** and **J** and they lost the mark.

(b) This question proved to be challenging to most candidates as the correct graph was rare. Candidates were required to sketch, on the same graph, a graph that can be obtained if 1.0 mol/dm^3 of hydrochloric acid solution reacts with 3 g of magnesium powder. The expected graph was a graph starting from the origin, with a steeper gradient (above the first graph) and levelling off at the same volume as the first graph.

(c) In this part of the question candidates were given the chemical equation

$Mg + 2\ HC\ell \rightarrow MgC\ell_2 + H_2$

(i) This question was well done as most candidates were able to score both marks. The candidates were required to calculate the number of moles in 3 g of magnesium. The expected response of *n = 3/24 = 0.125* was common.

(ii) This was a poorly done question as most candidates failed to score a mark from this question. Candidates were required to calculate the number of moles in 10 cm^3 of 1.0 mol/dm^3 of hydrochloric acid solution. Some candidates who were able to recall the formula n = cv failed to convert 10 cm^3 into 0.01 dm^3. The expected response was: *n = cv = 0.01 x 1 = 0.01 moles*

(iii) This was one of the most challenging questions to the majority of the candidates in this paper. The majority of the candidates could not score any mark from this question.

The candidates were required to show that magnesium is in excess in the reaction.

The expected response was: *Mg : HCℓ*

1 : 2

x : 0.01

x = (0.01 x 1)/2 = 0.005 moles Mg.

Therefore, 0.125 mol Mg available is more than the 0.005 mol Mg required.

EGCSE PHYSICAL SCIENCE

Paper 6888/03

Practical Test

General Comments

The Practical Test paper is marked out of 40 marks. The paper assesses the ability of candidates in science practical skills. A significant number of candidates performed fairly well in the paper. The paper consists of one chemistry and one physics question, the entries in this paper were 3190 same as 2019.

The time allocated for the paper seemed to be adequate as there was no evidence of candidate not finishing the paper. There were however general weaknesses that were identified by the examiners, these include reading the scale of the thermometer correctly, not being able to distinguish between an observation and a conclusion and choosing a suitable scale to plot the given points. Candidates had difficulty distinguishing between the terms endothermic and exothermic.

Comments on Specific Questions

Question 1

This question was generally accessible to candidates as quite a number of them scored more than half the marks on offer. There is room for improvement of graphical skills of candidates and observation skills.

(a) Candidates were provided with two solutions of magnesium chloride and sodiumcarbonate

(i) Candidates had to pour $2cm^3$ of magnesium chloride solution into a test-tube labelled **A** and measure its temperature using a thermometer.

This part of the question was accessible to candidates. The candidates who lost the mark failed to read the scale of the thermometer and gave unrealistic responses such as 2.6 ^oC ,2.5 ^oC or 2.8 ^oC

The expected response: was *25^oC with a difference of 2^oC or same as the supervisor*

(ii) Candidates were asked to pour $2cm^3$ of sodium carbonate solution into a test-tube labelled **B**, measure and record the temperature.

This part of the question was generally accessible to candidates.
The expected response: was *25^oC with a difference of 2^oC or same as the supervisor.*

(iii) Candidates were asked to mix the two solutions by pouring the contents of test -tube **A** into test tube **B**. Then immediately insert the thermometer and start a stop- watch.
Candidates had to measure the temperature at 30 second intervals for 120 seconds and record the temperature readings in a given table as T_1, T_2, T_3 and T_4.

Generally, the question was accessible to candidates.
Common wrong responses included temperature readings of less than 3^oC.
The expected response: was a decrease in temperature from T_1 to T_4.

(iv) In this part of the question candidates had to describe the relationship between the time and the temperature as the reaction progresses in **(iii).**
This part of the question was accessible to candidates.
Some candidates did not earn the mark as they gave incomplete responses such as time increases / temperature decreases.
The expected response: was *temperature decreases with time.*

(v) Candidates were asked to state the type of reaction taking place between magnesium chloride and sodium carbonate solutions. Candidates had to give a reason for their response in terms of energy changes.
Some candidates could not determine the type of reaction as their results of temperature in **(iii)** had no clear trend. Some candidates could identify the reaction as endothermic, but their explanation referred to exothermic or vice versa.
The expected response: was *endothermic since heat is absorbed from the surroundings.*

(vi) In this part of the question candidates had to describe an observation that shows that the reaction of magnesium chloride solution with sodium carbonate solution is an example of a chemical change.

The question was well done. Some common wrong responses included a white substance is formed and colour change to milky.
The expected response: was *change in temperature/ white precipitate formed.*

(vii) Candidates were asked to state a precaution to be taken to ensure accurate readings when using a thermometer.

This part of the question was accessible to candidates.
The most common wrong response was read below the meniscus.
The expected response: was *thermometer not touch the sides of the container / avoid error of parallax.*

(b) In this part of the question candidates were given a table showing how the temperature of the reaction of dilute sulfuric acid with excess sodium hydroxide solution varied with time.

(i) Candidates were asked to plot the given results.
This part of the question was challenging to candidates. Quite a number of candidates chose a non-linear scale which resulted in the loss of all three marks. Some earned two marks out of the three marks as their scales covered less than half the grid.

(ii) Candidates were required to name the substance that limits the chemical reaction between dilute sulfuric acid with excess sodium hydroxide solution.

This part of the question was challenging to candidates. Some common wrong responses included solution/ sodium hydroxide.
The expected response: was *dilute sulfuric acid*.

(iii) In this part of the question candidates had to suggest the value of the temperature after four minutes (240 seconds).
This question was challenging to candidates.

Some common wrong responses included temperature values of less than 5°C/ temperature values above 33°C.

The expected response: was *33°C or slightly less by not more than 2°C.*

(c) Candidates were asked to place 2cm³ of sodium carbonate solution into a test-tube labelled **C**. Then about 2cm³ of dilute sulfuric acid were added into the tube and it closed with a stopper fitted with a delivery tube. The delivery tube was immersed in solution **D** contained in another test-tube.

(i) Candidates had to record their observations in the test- tube **C** and solution **D**.

This part of the question was accessible to candidates. Some common wrong responses included chemical change, lime water becomes cloudy.

The expected responses were:

*Test tube **C** – bubbles are formed/ effervescence*

*Solution **D** – Solution turns milky/ white precipitate*

(ii) Candidates were asked to identify solution **D**.

This part of the question was challenging to candidates. Some common wrong responses included water/ calcium carbonate/ calcium.

The expected response: was lime*water.*

(ii) Candidates had to suggest how the rate of the reaction between dilute sulfuric acid and sodium carbonate solution could be increased.

This question was accessible to most candidates.

The expected response: was i*ncrease the concentration/ increase temperature/ stirring.*

(d) Candidates had to place about 5cm³ of magnesium chloride solution into a test-tube and then add about 2cm³ of aqueous silver nitrate into the test-tube. Candidates had to describe how they could obtain a pure salt of the precipitate from the mixture.

This question was challenging to candidates as quite a number of them describe how to obtain crystals from a solution.

The expected response: was filter *the mixture, then wash/rinse residue with distilled water then dry residue.*

Question 2

This question was accessible to candidates as quite a number of candidates scored more than 10 marks out of the 20 marks on offer. Candidates were to carry out an experiment to determine an approximate volume of the material making a small beaker.

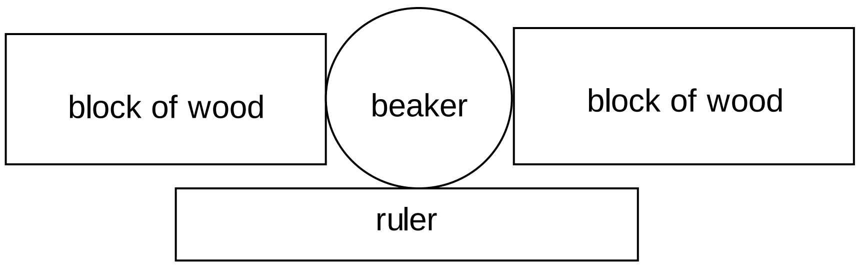
(a) Candidates had to use two blocks of wood and a ruler to measure the external diameter, *d*, of the small beaker.

This part of the question was accessible to candidates.

(b) Candidates were asked to draw a diagram showing how they used the blocks of wood and the ruler to find as accurately as possible, the value for the diameter.

This question was challenging to candidates. Some candidates lost one mark as they either had a ruler and beaker and no blocks or the beaker and blocks and no ruler. Some candidates the placements of their blocks and ruler measured the height instead of the diameter and they lost both marks.

The expected response:



(c) Candidates were asked to calculate the external radius, *r*, of the bottom of the beaker using the equation $r = \frac{d}{2}$.

This part of the question was accessible to candidates.

(e) Candidates were asked to measure and record the height, *h,* of the beaker.

This part of the question was accessible to candidates. Some candidates lost the mark as they gave unrealistic values of height above 10 cm.

(e) Candidates were asked to calculate the external volume, V_1, of the beaker using the equation $V_1 = \pi r^2 h$

Manipulation of the formula was well handled by most candidates. Some candidates did not show their working and wrote only the value of V_1. This resulted in the loss of one mark out of the 2 marks on offer.

(f) **(i)** In this part of the question candidates had to measure the internal volume, V_2, of the beaker. Candidates had to place the beaker on a flat surface and measure the volume of water that fills the beaker using a measuring cylinder.

This question was challenging. A majority of candidates seemed not understand the question hence wrote unrealistic values such as 1000, 450, etc. The most common wrong response was the value of volume calibrated on the small beaker.

(iii) In this part of the question candidates had to state one precaution to be taken when reading the volume of water in a measuring cylinder.

This question was accessible to candidates. A common wrong response was read **below** meniscus.

The expected response: was *measuring cylinder should be placed on a flat surface / reading taken at the bottom of the meniscus /avoid error of parallax.*

(f) Candidates were asked to calculate the approximate volume, V, of the glass material used to make the beaker.

This part of the question was accessible to candidates. The most common wrong response was $V_2 – V_1$

The expected response was: $V = V_1 – V_2$

(g) Candidates were asked to use the displacement can, measuring cylinder and water to find again the volume of the material used to make the beaker.

(i) Candidates had to describe how they measure the volume of the material used to make the beaker using the displacement can, water and the measuring cylinder.

Many candidates misunderstood the word ''material'' in the question and referred to the blocks. Hence, they immersed the blocks into the displacement can instead of the small beaker.

Some candidates used a beaker for collecting water displaced and this resulted in the loss of a mark.
The expected response: was *fill displacement can with water and gently lower beaker into the displacement can until fully submerged. Then collect the water displaced in a measuring cylinder.*

(ii) Candidates were asked to record the volume of the material used to make the beaker.
This part of the question was accessible to candidates. Some candidates lost a mark as they gave unrealistic values such as 110 cm^3/ 75 cm^3

(i) Candidates were asked to explain why the volume of the material used to make the beaker in **(g)** was different from the volume in **(h)(ii)**.

This question has very challenging to candidates. A handful of candidates gave the expected response, and some candidates did not attempt the question.
The expected response: was: ''*some droplets of water remain in the measuring cylinder therefore increases the internal volume / beaker is not a perfect cylinder hence cannot be filled to the top*''.

(j) Candidates were asked to calculate the mean of the two values of V in **(g)** and (**h)(ii**).

This question was accessible to candidates.
Some candidates did not understand the word ''mean'' as they only added the volumes. Some tried to find the median position.
The expected response: was $\frac{volume\ in(g)+volume\ in\ (h)}{2}$

(k) Candidates were asked to describe how to measure the mass of the water in the beaker in **(f)(i)**.
This part of the question was accessible to candidates. Some candidates lost one mark for naming an incorrect meter for measuring mass.

The expected response: was *measure the mass of the empty beaker and record. Then measure the mass of the beaker with water and record it. Then find the difference between the two masses.*

EGCSE PHYSICAL SCIENCE

Paper 6888/04

Alternative to Practical Test

General Comments

The Alternative to Practical paper provides candidates with a platform to display knowledge and skills about their practical dexterity and proficiency, premised on the assumption that experiments are conducted during learning time. It aims to holistically assess the level of acquisition and retention of the skills articulated in Assessment Objective C of the EGCSE Assessment Syllabus.

The paper accounts for a 20% weighting to the overall final mark of the candidates as per the syllabus dictates. It is marked out of 40 and consists of one Chemistry and one Physics question. The number of entries was relatively similar to the previous year at around 8400.

The paper seemed to have complied with all the important principles of assessment. It was **valid** because it was aligned to the syllabus outcomes envisaged by the syllabus and there was no evidence of any ambiguous items; **fair** and free from gender bias, social bias as well as age or disability bias; **inclusive** in being able to assess a range of abilities to cater even for gifted learners and accommodating learners with special needs; as well as being **transparent** since all assessment items were based on the syllabus.

The performance of the candidates was generally better than in previous years. The main indicator for this was a significantly high number of candidates obtaining marks in excess of 80% relative to previous years. The highest mark obtained was 88% which is significantly higher than the marks obtained in other years. However, it proved to be fairly discriminating as a number of candidates obtained marks on the low end of the performance continuum with a number of candidates obtaining zeros.

The Examiners noted with concern that a number of candidates neglected to provide themselves with calculators and wasted time manually making calculations which inherently led to loss of marks and probably time. It is still a general concern that candidates have challenges when they have to explain concepts using English even though an effort was made not to disadvantage them for this as per the guidelines of marking. It is worth mentioning that at times it becomes a bit of a challenge to understand the science from the expression of some candidates.

Comments on Specific Questions

Question 1

(a) (i) Candidates were required to describe the relationship between time and temperature, using the table given.

This was generally well done by the candidates. The expected response was that temperature decreases with time.

The main challenge of the candidates was that they responded as though time was dependent on the temperature which was not true in this case. Some candidates were writing the times with the corresponding temperatures thereby failing to make a general inference from the data which was not accepted. Some were also wrongly stating that time was inversely proportional to temperature which was not accepted since these variables were not dependant.

(ii) Candidates were supposed to state the type of reaction taking place between magnesium chloride and sodium carbonate solutions and give a reason for their answer in terms of energy changes.

This question proved to be inaccessible to most candidates. While most candidates were able to state the type of reaction, a few were able to give the reason in terms of energy changes. A lot of candidates thought the reaction was a displacement reaction and aligned their reason with that which made them lose the marks. Other common wrong responses were exothermic or chemical reaction which did not earn a mark since it is rather too broad. Candidates who earned the mark noted that this was an endothermic reaction since heat was absorbed from the surrounding resulting in the decrease in temperature in the reacting vessel.

(iii) Candidates were to describe an observation that showed that the reaction of magnesium chloride with sodium carbonate was an example of a chemical change.

Most candidates seemed to use theory to answer this question neglecting the contextual observation aspect demanded by the question which made them to have challenges in competently responding to the question. Consequent to that some of the common wrong responses were that a new substance was formed, the reaction was irreversible; heat was given out and a change in colour without specifying the colour change in the experiment.

Candidates were expected to state that there was a change in temperature or refer to the formation of a white precipitate which was the evidence of the colour change and probably an indicator of irreversibility.

(iv) Candidates were expected to state one precaution to take to ensure that an accurate reading was taken using a thermometer. This question proved to be quite challenging to most candidates. A few candidates were able to correctly state that the thermometer should not touch the walls of the test- tube and also to avoid the error of parallax.

A significant number of candidates thought the thermometer had to be calibrated to zero before using it; some mentioned that the thermometer should be in solution when taking the reading which was not acceptable since that is how a thermometer is used not a precaution. Some felt the reading had to be taken at the meniscus which is not so pronounced in a thermometer, the thermometer had to be shaken before use; the thermometer had to be placed on a flat surface; eyes had to be vaguely vertical with the thermometer as well as that eyes had to be level with the liquid.

(b) (i) Candidates were required to plot the results given in Table 1.2.

The question was fairly well done by the candidates as most of them were able to obtain most of the marks. Candidates earned marks for using more than half of both axes when plotting the points, using a reasonable scale as well as plotting at least five points correctly. Problems were noted in the poor choice of a reasonable scale by a number of candidates which made them have challenges in plotting the points. Some correctly condensed the scale on the vertical-axis but then did not show that they had done same which led to the loss of the mark for a reasonable scale. A few candidates linearly arranged the temperature values on the vertical-axis leading to a straight line graph which was not acceptable. Such candidates lost most of the marks.

(ii) The question required candidates to suggest a temperature value after four minutes from the values in Table 1.2 and give a reason for their answer.

This question was well attempted as most candidates were able to note that the temperature would remain constant since the reaction was complete or the sulfuric acid, as a limiting reagent, had been used up. Most candidates gave the correct value of 33°C with the correct explanation. However, some candidates failed to notice that the temperature was constant from t=150 seconds and would wrongly give values above 33 °C, stating that when the temperature increased the time also increased. Some of those who were able to realise that the temperature was 33°C, then wrongly mentioned that: the reaction had reached its optimum speed, that the substances had reached their boiling point or that the optimum temperature had been reached which made them lose the second mark. Others assumed sodium hydroxide had been used up which was incorrect since it had been stated in the question that sodium hydroxide was in excess, hence could not be the limiting reagent.

(c) **(i)** In this question, candidates were required to record their observations for the reaction between sodium carbonate and dilute sulfuric acid in test-tube **C** and in the limewater.

Most candidates were able to correctly write the expected observations as bubbles in test-tube **C** and the limewater turning milky. Effervescence and fizzing were accepted as alternative responses for the observation in test-tube **C** while a white precipitate was accepted as an alternative for the milky observation in limewater. Some candidates elected to swap the observations from the test-tubes and lost the marks. Others wrote conclusions instead of observations such as making reference to the formation of carbon dioxide gas or the formation of a gas in test-tube **C** which was not acceptable. Some candidates wrote white emulsion in the limewater which was rejected since an emulsion has fluid characteristics. A few had difficulty with the spelling of bubbles without incurring any penalties in most cases.

(ii) In this question, candidates were required to identify the product which was responsible for the observation made in limewater.

Most candidates did well in this question as they were able to give carbon dioxide as the substance responsible for the observation. Some candidates gave all the products of the reaction, i.e., sodium sulfate, water and carbon dioxide and lost the mark. Some decided to write symbols and lost marks if the symbols were written wrongly with a few writing Co_2 instead of CO_2.

(iii) Candidates were required to suggest how they would increase the rate of reaction between sodium carbonate solution and dilute sulfuric acid.

The question was fairly well attempted by the candidates. Most candidates were able to give the expected response as increasing the concentration; increasing temperature or adding a catalyst. Stirring the test-tube contents, shaking or any other form of agitation was also accepted. The most common response from the candidates who failed to earn the mark was that the reaction could be increased by increasing the volume of either sodium carbonate solution or dilute sulfuric acid. Some wrote about increasing the strength of the sulfuric acid which was not accepted as this deals with the ease of ionisation instead of acid ions per unit area. These seemed to confuse the concepts of strong and weak acids with the concentration of the acid. Some candidates wrote about increasing the surface area for the reactants yet both reactants were liquids and were duly penalised. Other candidates wrote that they would use 'pure sulfuric acid' instead of increasing the concentration of sulfuric acid.

(d) **(i)** Candidates were expected to state the observation made when silver nitrate was reacted with magnesium chloride.

This was fairly well done as most candidates were able to give the correct answer of white precipitate. A wide range of unacceptable responses were observed in this question. Candidates would write colours like blue, pink, purple, silver, green, black, red, orange and brown. Some candidates lost the mark by writing whitish instead of white.

(ii) Candidates had to describe how pure crystals could be obtained from the reaction between silver nitrate and magnesium chloride.

This question proved to be quite challenging to the candidates. The main error was the failure of the candidates to realise that they were preparing an insoluble salt instead of a soluble salt. They made reference to processes such as crystallisation, heating to concentrate the solution in order to get a pure salt or evaporate to get crystals which led to loss of some or all of the marks on offer. It was indeed only a few candidates who earned all the three marks. Some would start by filtering but then continue with the filtrate instead of the residue and thereby lost marks. Some were confusing the filter funnel for the separating funnel. A large number of candidates took the noun filtrate to be a verb, so they would say 'I would filtrate the mixture 'instead of saying 'I would filter the mixture". There were those that thought they could get the pure salt by simple distillation which was incorrect.

The expected response was: filter to separate the insoluble salt from the soluble one; wash the insoluble salt with distilled water to remove impurities and dry it using filter papers. Alternative methods of drying the residue were acceptable.

(iii) The question expected candidates to explain why silver nitrate should not be exposed to light.

This proved to be the most difficult part of question 1 as only a handful of candidates earned the marks. A lot of candidates thought that aqueous silver nitrate was explosive and that is why it should not be exposed to light. Others wrote that silver nitrate was very reactive which is not very correct. Some candidates wrote that it was shiny and would lose its gloss, while others wrote that it was dangerous to the environment as it caused pollution. Other candidates explained in terms of radiation reflectors and emitters. Some of those who realised that a chemical reaction was taking place would explain that it would change colour without stating the colour and lost the second mark. The expected response was: silver nitrate would decompose and turn to a darker/grey/black colour. An explanation of the reduction of silver ions to form silver atoms earned all the marks.

Question 2

(a) Candidates were expected to determine the diameter of the drinking glass in Fig. 2.1.

Generally, this question was fairly well done as a reasonable number of candidates were able to correctly read off the extreme ends of the diameter shown on the ruler as 14.8 and 10.7 cm, respectively, to accurately calculate the diameter as 4.1 cm. Some candidates used alternative approaches to obtain the correct value which was also credited.

However, some candidates literally counted the sub-divisions making the diameter and came up with 41 mm but then failed to change this figure to centimetres, hence lost a mark since the units in the answer space were centimetres.

Some candidates failed to correctly count the sub-divisions coming up with 40 mm and lost both marks. Some candidates decided to draw the diameter in Fig. 2.1 and then measured it using their own rulers, probably because they could not read the given ruler and came up with wrong answers. A significant number of candidates elected not to show their working and thereby lost the first mark.

(b) Candidates had to calculate the radius of the drinking glass.

The question was well attempted as quite a number of candidates were able to correctly divide their answer in **(a)** by 2 to obtain the mark. One of the weaknesses evident from the response of the candidates was the non-adherence to 3-significant figures when writing numerical values, which was however not punished.

The expected response was 2.05. Some candidates decided to round off 2.05 to 2.5 instead of 2.1 and hence lost the mark.

(c) Candidates had to read and record the height of the drinking glass from Fig. 2.2.

The question was fairly well attempted as most candidates who were able to get **(a)** correct were able to read the height, *h*, correctly as 4.7 cm. Some did not include the base of the glass and ended up getting wrong values such as 4.1 and 4.4 cm resulting in the loss of the mark. Some, who noted that they had to measure even the base, seemed not to be sure on where to take their measurements and ended up making measurements from the inner base instead of the outer base.

(d) Candidates were given an equation they had to use to calculate the external volume, V_1, of the drinking glass.

This was also fairly well attempted by the candidates as most of them were able to correctly substitute the radius, *r*, and the height, *h*, into the formula $v = \pi r^2 h$

and came up with the expected answer of 62.05 cm^3. The correct responses ranged from 62.05 to 62.1 subject to the version of π used by the candidate. Some candidates omitted to square the radius and ended up with wrong answers thus losing both marks.

A number of candidates tried to compute the answer manually, which was evidence that they did not have calculators with them which was one of this paper's requirements. Most of these candidates could not come up with the correct answer even if they had substituted correctly in the formula hence lost the second mark. Some candidates who obtained answers with many values after the decimal point would fail to correctly round-off their values and incurred some penalties.

(e) **(i)** Candidates had to read and record the volume of water from a measuring cylinder in Fig. 2.3.

This was quite accessible to the candidates. Most of them were able to read the correct volume of the water as 60 cm^3. A few would exceed the value by 1 or 2 millilitres, probably reading the volume above the bottom of the meniscus and lost the mark. A few decided to leave blank spaces and also lost this accessible mark.

(ii) Candidates were required to state one precaution taken when reading the volume of water from a measuring cylinder.

The question was fairly well done. A significant number of candidates correctly gave the precautions as: the measuring cylinder had to be placed on a flat surface or that the reading had to be taken from the bottom of the meniscus. Some candidates vaguely wrote about taking the reading at eye level which was penalised since the eye level could be anywhere on the measuring cylinder, not necessarily at the bottom of the meniscus.
Some wrote about taking the reading at the level of the water which also incurred penalties for lack of specificity.

(f) Candidates had to calculate the approximate volume, V, of the glass material used to make the drinking glass.

The question proved to be quite challenging to the candidates. Most of them could not notice that the material used to make the drinking glass was the difference between the external volume, V_1, calculated in **(d)**, and the internal volume, V_2, calculated in **(e)(i)**. Thus the answer to **2(d)**, 62.05 had to be bigger than the answer to **(e)(i)**, 60 to get 2.05 cm^3 as the correct answer. Some of those whose answer to **(d)** was less than 60 cm^3 would then subtract it from the 60 cm^3 and lost both marks. Others would subtract the 60 cm^3 from their answer in **2(d)** but then notice that they were getting a negative volume and ignore the negative sign thus losing the second mark. Some would divide the two volumes and lost both marks. Others seemed to get confused and tried to divide mass by the density of water and lost the mark.

(g) **(i)** A description of the displacement method to determine the volume of the drinking glass was required of the candidates.

This was generally fairly well done as most candidates seemed to be familiar with the displacement method and would at least score a mark or two in this question.

Candidates were expected to describe either the use of a Eureka can and a measuring cylinder **OR** the use of a measuring cylinder.

Those who opted for the use of the Eureka were expected to mention that:

1. Water was poured into the can until they overflow through the spout to a mentioned collecting vessel until the last drop from the spout.
2. The collecting vessel was then removed and replaced by a measuring cylinder, then the glass was submerged into the can, while simultaneously collecting the overflowing water from the spout with the measuring cylinder.
3. After the last drop, the volume of the water in the measuring cylinder had to be read which would be equal to the volume of the material making the glass.

Some candidates were not familiar with the name of the instrument, Eureka can and instead called it a beaker with a spout or an overflow can.

A number of candidates forgot to mention that the water must overflow before the immersion and after the immersion of the glass and thus lost one or both of the first two marks.

Some used a beaker to collect the overflowing water and would then read the volume from the beaker, which was not acceptable since a beaker cannot accurately measure volume.

Those who opted for the use of a measuring cylinder, were expected to mention that:

1. A known volume of water had to be poured into the measuring cylinder and be recorded as V_1;
2. The glass had to be carefully submerged into the measuring cylinder and the new volume be recorded as V_2;
3. The difference between the two volumes would be equal to the volume of the material making the glass.

Some of these candidates forgot to mention the first step and lost the first mark. However, they would then imply the first step in the last step and be given credit.

Some would wrongly commit themselves on the difference saying you subtract second volume from the first which was wrong and led to loss of the third mark. Some would answer this displacement based on a stone that is immersed either in the measuring cylinder or Eureka can instead of glass and lost some marks.

(ii) Candidates were expected to explain why the volume of the drinking glass in **(f)** was more than the volume in **(g)**. This basically expected candidates to identify source of errors in their experimental procedure.

This was poorly done as almost all the candidates failed to grasp the key demand of the question as they did not notice that in **(f)** the water remaining on the walls of the glass decreased the internal volume of the glass hence the difference between the external volume in **(d)** and the internal volume in **(e)(i)** would be more by the 0.4 cm^3. Some seemed not to appreciate that the glass was small enough to fit into the measuring cylinder and their answers were premised on same which was not acceptable.

A lot of candidates wrongly attributed the difference to water that did not come out the spout in **(g)(i)** which was incorrect**.**

Some thought the glass material used in **(f)** and **(g)(i)** was different resulting in the difference in volume which was also incorrect.

A significant number of candidates thought the value in **(f)** was an estimate since it was calculated and that in **(g)** was more accurate as it had been measured which was also not entirely true since both were obtained through measurements.

(h) Candidates had to calculate the mean of the two values for the volume, V, using the values obtained in **(f)** and **(g)**.

This was also poorly done as quite a number of candidates thought the difference between the value in **(f)** and in **(g)(i)**, i.e., the 0.4 cm^3 was the volume obtained in **(g)(i)** such that they would add their answer to **(f)** to the 0.4 cm^3 and divide by two. They failed to notice that the second volume was 2.05-0.4 cm^3 which gave 1.65 cm^3. They were then expected to add the difference (1.65) to the answer to **(f)** then divide the sum by 2, i.e., $\frac{1.65+2.05}{2}$ to get 1.85.

Some used these approaches to obtain the mean. $\frac{Ans\,(f)+0.4}{2}$ or $\frac{Ans\,(f)+\,0.4+\,Ans(f)}{2}$, and lost both marks.

Some would use their mathematical skills to find the position of the mean in a given distribution, which was irrelevant, i.e., $\frac{Ans\,(f)+\,1}{2}$ and lost the marks.

(i) Candidates had to describe how they could measure the mass of the water in the drinking glass in **(e)(i)**.

The question was generally fairly well done as quite a number of candidates displayed familiarity with the measurement of a liquid and were able to get one or two marks. These were the expected responses:

1. Use of an appropriate instrument to measure mass of the empty drinking glass and record the value, maybe as M_1.

2. Add the water into the drinking glass and record the mass, maybe as M_2.

3. Take the difference between the recorded masses i.e. $M_2 - M_1$.

A number of candidates lost the first mark by not mentioning that they would measure the mass of an empty drinking glass. Some would mention the use of a spring balance to measure the mass which was punished. Some would take the wrong difference, i.e., $M_1 - M_2$ which was also punished. Quite a number of candidates seemed not to understand the demand of the question as they mentioned that they would calculate the mass from the density and volume of the water using the formula: $density\ = \frac{mass}{volume}$ instead of **measuring** the mass.