

PRINCIPAL EXAMINER'S REPORT



BOTSWANA
EXAMINATIONS
COUNCIL

BGCSE SCIENCE DOUBLE

2023



Paper 1: Multiple Choice

Section 1: General Comments

The performance of the candidates was similar to that of the previous year. At least more than half of the candidates were selecting the correct answer in just 19 of the 60 questions. A better performance was observed in Biology and Physics as more than half of the candidates selected the correct response in 16 items while Chemistry had the worst performance as more than half of the candidates selected the correct answer in just 3 items. Candidates performed poorly even in recall questions that they are expected to know. Some of the misconceptions still remain a major issue of concern.

Section 2: Comments on Individual Items

Item 1: Well done. Majority of the candidates were able to identify the fundamental physical quantity.

Item 2: Fairly done. Majority of the Candidates who failed to get the item correct selected A as the answer. It is evident that the Candidates simply derived their answer from the zero on the graph.

Item 3: Fairly done. B was the strongest distractor.

Item 4: Poorly done. The majority of the candidates got the item wrong, they selected D as their answer.

Item 5: Poorly done. Majority of the candidates got the item wrong. The candidates treated W as equal weight to 50 N.

Item 6: Well done. The strongest distractor were B and C. The candidates were able to identify the symbols for the units of work done and power.

Item 7: Fairly done. The stronger distractor was A. Candidates failed to calculate frequency of the given waves.

Item 8: Well done. Majority of the candidates were able to identify the term that represents the maximum displacement of a particle from its rest position.

Item 9: Well done. Almost all candidates remembered the concept of good conductors of heat.

Item 10: Fairly done. Majority of the candidates failed to recognise that they are to apply the concept of ratio and proportions. The stronger distractor were B and C.

Item 11: Fairly done. The strong distractor was C. Candidates failed to relate with the cooling curve of a substance from a gaseous state.

Item 12: Well done. The strongest distractors were A and D. Candidates were able to identify the correct formula for the refractive index.

Item 13: Poorly done. The strong distractor was B. Candidates failed to identify the electromagnetic spectrum used in remote control devices. Most candidates selected Radio waves because of its association with radio but failed to conceptualise that they were to identify spectrum which is inside the remote control devices.



Item 14: Poorly done. The strongest distractors were A and B. Majority of the candidates failed to identify the metal which is attracted by a bar magnet

Item 15: Well done. Majority of the candidates recalled that current is the rate of flow of charge.

Item 16: Fairly done. The strong distractor was C. Candidates failed to compute the electric current in circuit.

Item 17: Fairly done. The strong distractor was D.

Item 18: Well done. Majority of the candidates managed to recall Ohm's law.

Item 19: Well done. Majority of the candidates managed to compute the number of turns on the primary coil given the number of turns in a secondary coil.

Item 20: Fairly done. The candidates were spread in all options with B slightly popular. Centres should help candidates to understand more about the emissions.

Item 21: Fairly done. The strong distractor was B. Candidates were not able to recall an oxide which react with both acids and bases.

Item 22: Well done. Majority of the candidates managed to recall the aqueous salt which reacts with excess aqueous ammonia to give a deep blue solution.

Item 23: Well done. Candidates were spread evenly between A and C while B was the stronger distractor.

Item 24: Fairly done. The strong distractor was C. The pattern shows guess work and candidates were not sure of the concept.

Item 25: Poorly done. The strong distractor was A.

Item 26: Well done. The strong distractor was A.

Item 27: Fairly done. The stronger distractor was B. The pattern shows guess work and candidates were not sure of the concept.

Item 28: Well done. Almost all the candidates got amino acids as a substance that is produced after the hydrolysis of proteins.

Item 29: Well done. The strong distractor was A.

Item 30: Well done. The response pattern showed that candidates evenly distributed between distractor C and D. Candidates were able to recall the description of a single covalent bond.

Items 31: Fairly done. The strong distractor was D. Centres are advised to do more on ions found in compounds.

Item 32: poorly done. Candidates were spread between A and B while D was the stronger distractor. Centres should help candidates to understand more about reducing agents.

Item 33: Well done. Candidates were able to identify the electronic structure of a boron atom. The strong distractor was C.



Item 34: Poorly done. The stronger distractor was A. The pattern shows guess work as there was equal spread across the distractors and candidates were not sure of the concept.

Item 35: Fairly done. The strong distractor was C. Most of the candidates were not able to recall the substance that is used to test for the presence of water.

Item 36: Fairly done. Most candidates were not able to recall the catalyst used during the catalytic addition of steam to ethane to form ethanol. The strong distractor was B.

Item 37: Fairly done. The pattern shows guess work as there was equal spread across the distractors and candidates were not sure of the concept. Candidates were spread evenly between B and C while D was the stronger distractor.

Item 38: Well done. The response pattern showed candidates evenly distributed between distractors C and D while A was the stronger distractor.

Item 39: Poorly done. The strong distractor was B. The pattern shows guess work as there was spread across the distractors and candidates were not sure of the property of the gas allows it to be collected by the method of experiment.

Item 40: fairly done. The pattern shows guess work as there was equal spread across the distractors and candidates were not sure of the concept. Candidates were spread evenly between B and C while A was the stronger distractor.

Item 41: Well done. Almost all candidates remembered the functions of parts of plant cell.

Item 42: Well done. The strong distractor was A.

Item 43: Well done. The pattern shows good work as almost all candidates recalled the most photosynthesising cells in a leaf.

Item 44: Well done. The response pattern showed candidates evenly distributed between distractor B, C and D.

Item 45: Well done. Candidates were able to show their knowledge by identifying the correct graph on the effect of temperature on enzyme activity.

Item 46: Well done. The candidates were able to identify the process which occurs in the mouth.

Item 47: Well done. Candidates were able to identify the food substances are present in the given solutions.

Item 48: Poorly done. The strong distractor was D. The pattern shows guess work as there was spread across the distractors and candidates were not sure of the concept.

Item 49: Well done. Almost all the candidates were able to choose the correct structure.

Item 50: Fairly done. Candidates were spread evenly between A and D while C was the stronger distractor.

Item 51: Poorly done. The strong distractor was B.



Item 52: Well done. Most candidates managed identify the correct tube with the highest concentration of oxygen after one hour.

Item 53: Fairly done. The strong distractor was A.

Item 54: Well done. Half of the candidates were able to identify the point where intra uterine device would be placed.

Item 55: Poorly done. The stronger distractor were A and B.

Item 56: Fairly done. Candidates were not able to identify the environmental condition is necessary for seed germination. The strongest distractor was B. Candidates were spread evenly between A and C while B was the stronger distractor.

Item 57: Poorly done. The stronger distractor were A and C.

Item 58: Fairly done. The strong distractor was C.

Item 59: Poorly done. The candidates were not able to recall the least effect which is likely to occur because of deforestation. Candidates were spread evenly on distractors B, C and D.

Item 60: Well done. Majority of the Candidates got the item correct. Most of the candidates showed knowledge. Candidates were sure of the concept.

1 B	2 C	3 C	4 B	5 D
6 D	7 C	8 A	9 D	10 A
11 B	12 B	13 A	14 D	15 A
16 B	17 B	18 A	19 D	20 C
21 A	22 B	23 D	24 A	25 C
26 D	27 C	28 A	29 B	30 A
31 A	32 C	33 A	34 D	35 A
36 D	37 A	38 B	39 C	40 D
41 B	42 C	43 B	44 A	45 A
46 D	47 A	48 A	49 D	50 B
51 D	52 B	53 B	54 B	55 C
56 D	57 B	58 A	59 A	60 C



Paper 3: Written Theory

Section 1: General comments

Generally, some candidates displayed poor mathematical skills. Most of them failed to correctly align ratios, presented answers with incorrect significant figures, and wrong rounding off in their responses. They also used wrong symbols for quantities they used in the formulae or equations. The questions were fairly done by most candidates. Most candidates scored more marks in recall type of Questions. On the same note, candidates seemed to struggle with continuous writing responses. On most occasions candidates would overwrite, thus distorting what could have been the correct responses. Candidates in some instance confused words such as permanent magnet to electromagnet.

Where units are given, Centres are advised to encourage the candidates not to give their own units. Centres are advised to encourage their candidates to always bring scientific calculators when writing the Science Double Award paper.

In Biology, Centres must encourage their candidates to always use a solid line not an arrowed line to label structures or parts of a scientific diagram. Candidates still have a problem with explanation and description questions. Centres are advised to give candidates more practice on questions that require explanation and description. However, a good number of candidates were able to score number of marks more than half from each question in the paper.

Section 2: Comments on Individual Questions

1 (a) Poorly done. Most candidates wrote velocity per unit time and omitted the 'change of or rate of'. They also wrote rate of change of velocity per time without unit. Some candidates misconstrued acceleration for time or distance as some of their responses mainly on "*the distance covered...*". "*The time taken...*"

(b) (i) Fairly done. Most candidates were able to score at least one (1) mark. The challenge was that most candidates could recall the equation but failed to make velocity v the subject of the formula. Some used upper case letters for acceleration and time. Some ran short of space and ended up using space elsewhere but did not indicate where their working was for that question. The other common mistake was wrong unit as they used m/s^2 .

Answer: 12 m/s

(ii) Fairly done. Most candidates were able to access the first marking point as they were able to show that acceleration was constant by means of straight line but failed to plot the correct coordinates.

(iii) Fairly done. Most candidates lost marks as they failed to calculate the correct area under the graph as most used the formula for sum of triangle and rectangle instead of a trapezium.

Answer: 70 m



- 2 (a) (i) Well done. This mark was accessible to most candidates as they noted that conduction was the process. However, there were those who stated either convection or radiation. Candidates were not able to pick the clue in the stem of the question that indicated that the heat transfer is **through the walls** of the flasks, meaning that it is transfer through a solid hence it should be conduction. This indicates that candidates need to be encouraged to read the questions thoroughly with comprehension and analytic skills.
- (ii) Poorly done. The majority of the candidates had the idea that flask A was the required flask, but they missed out on this mark as they did not know which term to use; emission, absorption or conduction. Candidates should be encouraged to use **comparative words, e.g. a good emitter, a better emitter than, etc.** In situations like these. Failure to compare the emission ability of the two surfaces lost them marks.
- (b) Fairly done. Majority of candidates managed to make a reasonable suggestion that the water in the flasks had reached temperature equilibrium with the surroundings. 24 °C and got this mark of those who did not get the mark, there were those who had the correct idea but were not able to correctly put across their ideas for them to get the mark. Some candidates demonstrated a misconception that room temperature is specific, as they would be stating that 24 °C is not room temperature.
- (c) Poorly done. A fairly small number of candidates were able to correctly describe the process of convection, which was the subject of the answer. However, the majority of Candidates did not understand the question; they were talking about the “water being heated” a clear indication that yes they were aware of the concept of the answer, convection, but perhaps, they demonstrated rote learning whereby they can only describe the process if it starts with one heating the fluid. This question also revealed the low level of expression of most candidates. The answer required that they talk about warm water being less dense and rising OR cool water being denser and sinking to gain the two marks. However, candidates would talk about warm water being less dense and cool water sinking, which did not get them the full marks. More candidates confused the densities with the movement of the fluid indicating low level of subject comprehension. Some candidates referred to evaporation, steam rising/air rising, particles expanding/ contracting.
- (d) Poorly done. Most candidates were able to correctly state that the volume would decrease but missed the other marks as they could not correctly explain why. Candidates were unable to realise that the decrease was due to the contraction of the water. Most candidates' answers were based on the diagram; they did not read and understand the question. They explained the decrease to be due to the expansion of the flask. Quite a good number said the volume would increase as the vapour in the flasks condensed. Still there was a consistent misconception as to what expands: **matter or particles!** Candidates should be made aware that the size of the particles never change but the space between the particles is the one that change.
- 3 (a) Well done. Most candidates managed to score the two marks. Those who were not able to score the two missed the second marking point it was not straight line. Centres are advised to encourage learners to use a rule when drawing a line.
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- (b) Poorly done. Most candidates were able to recall the correct formula $n = \frac{\sin i}{\sin r}$ but failed to make " r " the subject of the formula. Some candidates also used $n = \frac{i}{r}$. Those who managed to make r the subject of the formula failed to correctly round off the answer where they attempted to shorten it.

Answer: 24.18583079° / 24° / 24.2° / 24.19°

- 4 (a) Well done. Most of the candidates were able to recall voltmeter as the correct answer. However, there were those with some misconceptions with the common wrong answers were ammeter, cell, battery, galvanometer, and resistor.

- (b) Well done. Most candidates were able to access the two marks. Those who did not score all the marks was due to wrong units. The common wrong unit was **amps**. They also used wrong symbol for current as they used C instead of I . Centres are advised to encourage candidates to use standard symbols and units.

Answer: 8.0 A or 8.0 ampere(s)

- (c) Well done. Most candidates were able to note that electrical is being converted into heat.

- (d) Well done. Most candidates were able to identify both the live and the earth wires. Those who failed to access the mark was mainly because of wrong spelling of live and some used colours instead of the names.

- 5 (a) Fairly done. Several candidates could correctly name the magnet as an **electromagnet**. Those who missed it gave a common response of **temporary magnet**. Centres are encouraged to teach candidates that the name is ELECTROMAGNET not temporary magnet.

- (b) Fairly done. A good number of candidates had an idea on what they could do to test the rod, like bringing magnetic materials close to the rod but they would leave their responses incomplete like that without concluding on what would be observed that would indicate that indeed the rod is magnetised. This denied them some of the available marks. Centres are encouraged to help candidates to master the scientific process and how to give complete responses.

- (c) Poorly done. There was a confusion between 5(b) and 5(c). Majority of the candidates gave uses of permanent magnets instead of an electromagnet. The common responses were loudspeaker, doors of the fridge, etc.

- (d) Fairly done. A good number of candidates were able to correctly state that the copper rod will not be magnetised as it is a nonmagnetic material. However, quite a good number said that the copper rod will not be magnetised because it is a good conductor of electricity; now deviating from the concept of magnetism and diverting to its electrical properties which were not the subject of the question. For those candidates who did not get the marks, the common responses were; "the rod demagnetises", "the rod will not magnetise"



- 6 (a) Well done. However, there is still a good number of candidates who refer to gamma as a particle.
- (b) Well done. It would be better for Centres to emphasise to candidates that radiation exposure will result in “radiation burns” as opposed to skin burns.
- 7 (a) Well done. Some candidates still had problem with the spelling of ethane.
- (b) Fairly done. Candidates failed to notice that lithium was expected answer. Common responses were sodium carbonate and copper. Centres are encouraged to put more emphasis on this objective.
- (c) Well done. Most candidates managed to realise that the alloys of copper were the answer. Common response was Lithium.
- (d) Well done. Most candidates seemed to be aware that sodium carbonate is used for softening water. Common responses from the candidates were Copper(II) Sulphate, Aluminium Chloride, Calcium Nitrate.
- (e) Fairly done. Common response from the candidates were Copper(II) Sulphate, Calcium nitrate, Aluminium Chloride. Centres are encouraged to put more emphasis on test for ions / qualitative analysis of salts and clarify the use of Aluminium foil.
- (f) Poorly done. Candidates seemed to confuse the use of Aluminium foil as the test for Aluminium Chloride. Common responses are Copper(II) Sulphate, Aluminium Chloride, Sodium Carbonate, Ammonia.

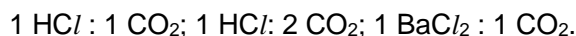
NOTE: Despite the given list of substances in the question paper, some candidates wrote wrong spellings such as sodium carbon instead of sodium carbonate. Most candidates adhered to the instructions of the questions as they wrote names of substances rather than formulae. Centres should continue to encourage candidates to write correct names as listed from the question.

- 8 (a) Fairly done. Some candidates were able to note that filtration was required process. Most candidates who failed to score a mark gave wrong responses such as fractional distillation, crystallisation, and titration.
- (b) (i) Poorly done. Most candidates failed to present their answers in correct significant figures. Some added an extra zero or omitted the other zero after the decimal place in their responses. Some failed to convert the volume, given in cm^3 to dm^3 . Others used incorrect significant figures. Some used wrong abbreviations e.g. number of moles was denoted M instead of n. Some used the wrong formulae for calculating moles from volume and concentration. Other candidates used wrong equations such as $\text{moles} = \text{mass} / \text{molar mass}$.

Answer: 0.0026 moles.



- (ii) Fairly done. Some candidates were able to score the two marks because they managed to give the correct response. Some candidates failed to score marks because they used incorrect mole ratios, e.g.,



Some used wrong equations such as moles = mass / molar mass.

Answer: 0.0013

- (iii) Well done. Most candidates were able to score the two marks because they gave the correct response. Some candidates who did not score the marks divided the number of moles by the molar gas volume instead of multiplying.

Answer: 0.0312 dm³

- (c) Fairly done. Most candidates were able to use the correct formula and present the answer as expected. Those who did not score the marks used 0.0026 for the number of moles instead of using the number of moles of carbon dioxide (0.0013). Others used concentration of HCl instead of using the number of moles, 0.0013. Others presented the wrong equation mass = moles * Ar.

Answer: 0.2704 g

- 9 (a) Fairly done. Some candidates were able to recall either ethyl ethanoate or ethyl acetate as the answer. Those who failed to get the mark gave wrong responses such as polyester / terylene/ nylon / ester linkage/ amide linkage / polymerisation / alcohol / alkanol / ethanol ethanoate / ethal ethanoate / ethyl ethanode / ethyl ethanate / ethanoate ethyl/ ethyl ethanoic.
- (b) Fairly done. Some candidates were able to give the correct structure. However other candidates lost a mark because they failed to show the single covalent bond between O and H in the hydroxyl group. The structures which did not score marks had a double bond between carbon (C) and oxygen (O), five bonds around carbon (C), three bonds around oxygen (O) and two bonds around hydrogen (H), ethane structure and structures where covalent bonds are omitted between atoms. In some structures all atoms were circled.
- (c) Poorly done. Most learners failed to give the two conditions for pressure (60 atm) and temperature (300 °C). The common wrong responses were temperature, pressure, phosphoric acid, wrong ranges of temperature and pressure. Others used wrong units such as degrees for temperature, atmospheric pressure as units for pressure, while others stated values without units.

Answer: temperature of 300 °C and pressure of 60 atm.

- (d) (i) Poorly done. A few candidates were able to give CH₃COONa as the correct formula. The common wrong responses were, C₂H₅COONa, (CH₃COO)₂Na, NaCH₂COOH. There were a few candidates did not use the periodic table for correct symbols others used lower cases for symbols of oxygen.



(ii) Fairly done. Some candidates were able to outline all the steps correctly as heating until saturation, cooling and filtering to dry. Some failed to score because they gave incomplete steps of the procedure. Some candidates gave wrong methods for drying the crystals such as use of desiccator, use of oven, sun drying, use of sandpaper, litmus, carbon, aluminium foil, cobalt chloride paper, paper.

10 (a) (i) Fairly done. Common responses were Copper sulphate, Copper solution/ ions, Copper nitrate, Copper(II) sulphate ions. The candidates should be made aware that any soluble copper(II) salt was suitable.

(ii) Well done. Common responses were Graphite, Copper(II) sulphate, Cooper, Copper(II). Centres should therefore encourage candidates to use the Periodic Table effectively especially when writing correct names and symbols / formulae of elements.

(b) Fairly done. Some candidate responses failed to show comparison, thus showing observation before and after, e.g. The use of words such as thin, short, and small. Candidates' responses were conclusions rather than observations, e.g. The anode gets finished.

(c) Poorly done. Few candidates wrote equal (=) sign instead of an arrow (\rightarrow). Some candidates wrote electrons on the wrong side of the equation while others failed to balance the equation.

Answer: $\text{Cu}^{2+} + 2\text{e}^{-} \rightarrow \text{Cu}$

11 (a) (i) Poorly done. Most candidates wrote observation instead of explanation. Some candidate wrote that copper is least / less reactive.

(ii) Well done. One of the common responses was electrical wiring / wiring. Few candidates gave explanations/ description instead of stating e.g. use to conduct electricity instead of making electric wires/ electrical conductors/rods.

(b) Fairly done. Common response was glowing splint instead of burning/ lighted splint. Candidate failed to write correct spelling of splint; some wrote spilt & split.

12 (a) Fairly done. Most candidates got a mark for the question naming the type of cell as animal cell. Common wrong responses: cell R was named as nerve cell.

(b) Fairly done. Some candidates were able to correctly compare cell S and P as cell P has no cell wall whilst cell S has a cell wall. Cell P has no vacuole whilst cell S has a vacuole. Cell P has a biconcave/ disc /circular shape whilst cell S has an elongated shape\ has a finger like projection shape. However, there were some candidates that gave responses such as cell S is rectangular shape, cell S is finger like shape instead of cell S has a finger like projection.



- (c) Fairly done. Candidates failed to identify the cell; hence common wrong responses were:- transmits nervous impulses (with no direction). Transmits electrical impulses around the body instead of transmits nervous impulses from receptors to the central nervous system\relay neurone.
- (d) Poorly done. Common responses: yellowing of leaves, no proteins, weak stems, death of a plant, Most candidates could not link that absence of nitrates leads to less / no protein synthesis, less / and less production of chlorophyll which reduces /stops growth of the cell and results in less / no photosynthesis.
- 13** (a) Poorly done. Most candidates used label lines with arrows, dotted lines instead of solid lines, placed letters in the structure to be labelled without a label line, some label lines were too short failing to touch the structure being labelled sufficiently.
- (b) Poorly done. Candidates failed to differentiate between structural and functional differences also candidates used mismatching words to compare the structures, e.g. “V has wider lumen and W has smaller lumen” or the use of words like “V has wider lumen and W has none” .This is incomplete and candidates should be encouraged to always fully compare where called upon to differentiate.
- (c) (i) Poorly done. Majority of the candidates showed no knowledge of coronary artery being the correct answer and the most popular answers given were pulmonary artery and aorta.
- (ii) Well done. Candidates should be encouraged to always specify names of nutrients and not resort to giving nutrients as an answer.
- (d) Well done. A few of the candidates failed to specify the type of diet and just wrote “poor diet”.
- 14** (a) Well done. Most candidates’ responses were transpiration, but a few common wrong responses were respiration and evaporation.
- (b) Poorly done. For the trend/ shape of graph, candidates were not able to interpret the graph, using the variables on the graph. Some were writing shape of the graph is increasing other responses were predominant wrong use of physics terminology such as: velocity increases, graph accelerating, graph decelerating. Their responses were based more on the water uptake rather than transpiration. In justifying the trend on the graph, candidates were able to write down the environmental factors and failed justify their effects on the rate of water loss. Most of the candidates missed the key words in their answers such as more/ increased transpiration.
- (c) (i) Fairly done. Most of the candidates missed the question and left it unanswered. Common wrong responses by candidates: a drawing of a constant graph from A to C. A graph drawn above the one shown instead of a similar graph drawn below the existing one.
- (ii) Fairly done. Most of the candidates did not get a mark for concentration gradient differences. Common wrong responses were negative answers, e.g. During a rainy day the plant will not lose too much water or will not lose water. Candidate were required to explain that during a



rainy day there is decreased/reduced water loss as there is high humidity in the atmosphere which results in a low concentration gradient.

- 15 (a) Well done. Majority of the candidates were able to recall the definition of a drug as externally administered substance that affects chemical reactions in the body.
- (b) Fairly done. Most candidates did not answer the question by stating use of drug but instead wrote the names of the medicinal drugs while some gave an answer that lacked precision like “treat diseases”.
- (c) Fairly done. Many candidates failed to address the **damage** to the body required by the question and instead gave effects of alcohol like increased **reaction time**.
- (d) Poorly done. Candidates failed to capture the question and proceeded to narrate addiction and/or dependence without realising those were actually the ‘why’ of the question.



Paper 4: Alternative to Practical

Section 1: General Comments

Candidates generally show lack of experimental skills which include observation, measurement and scale reading to mention a few. Centres are advised to do lots of practice with candidates to significantly improve our alternative to practical results. The graphical skills continue to be a challenge to learners regardless of being taught on other sister subjects like mathematics. The application of the concepts theoretically clearly shows candidates cannot comprehend hence need for more practical work

Section 2: Comments on Individual Questions

- 1 (a) Poorly done. Most candidates were not able to correctly make the subtraction of the given readings on the scale to come up with the 24.0 cm required. Some learners lost the mark due to recording 24 instead of 24.0: accuracy of instrument should always be reflected on record.
- (b) Well done. Labelling of axis: Most candidates correctly labelled the axis with both the quantity and units. Scale: Some scales were inconsistent especially at the beginning resulting in loss of a mark for scale. Candidates are advised to consider consistency of the scale from the origin to the end. Points: Some candidates lost the mark for plotting points due to complicated scales chosen that they could not read. Some candidates lost marks due to not using the correct notations for plotting points. The acceptable notations are crosses and circled dots. Line of best fit: Most candidates lost this mark mostly for not making a straight line. Candidates are encouraged to use a sharpened pencil that makes one continuous, smooth line.
- (c) (i) Poorly done. Most candidates did not mark on the graph, the points that they were using to calculate the gradient. Candidates are advised to use triangle or parallel dotted lines on the graph to mark the points used to calculate gradient. Candidates are also advised to use points on the line which are more than half the line apart to calculate the gradient. Not necessarily points from the table which might not be on the line. Candidates are encouraged to recognise the units for gradient as contained in both the Y-axis and the X-axis. In this case there were no units for the gradient as they cancelled each other out.
- (ii) Poorly done. Most candidates did not correctly follow the instruction of how to calculate W . Some candidates lost the mark due to omission of units from their answers.
- (d) Poorly done. Candidates confused the 48 cm mark on the ruler with the unknown weight W being 48 cm from the pivot (50 cm mark on the metre rule) hence they failed to recognise that moment due to W will increase requiring 7.5 N to be more than 50 cm away from the pivot.
- (e) Well done. Most candidates correctly associated position of the eye in relation to the point where the reading is taken on the metre rule as one of the possible errors in this experiment.
- (f) Very poorly done. Almost all candidates got this question wrong. Candidates did not recognise that 50.5 cm could be used as the pivot or the pivot could be taken back to 50 cm mark and a small mass like Bostick could be used to balance the metre rule before carrying out the experiment.



- 2 (a) Fairly done. A fair number of candidates managed to draw the symbol of an ammeter between R-S. However, some responses showed that some candidates are struggling with circuit symbols.
- (b) Poorly done. Most candidates seemed to be clueless about variables and variable control. They could not realise that all factors affecting Resistance should be kept constant: length / temperature and only the factor under investigation is the one to be varied.
- (c) Poorly done. Most candidates failed to come up with a procedure for investigating the effect of thickness on resistance for the two wires given: Connect first wire (between RS) (and switch on) and measure I and V . Calculating R and repeating the procedure for the second wire as the last two steps. Candidates struggled to realise that the steps taken to investigate for the first wire should also be followed for the second wire then the resistances calculated be compared so that a conclusion can be reached.
- (d) Poorly done. Most candidates failed to recognise the importance of keeping the temperature constant when investigating resistance: to maintain a constant temperature to save power. They gave to cut off the power as the answer, without giving a reason why it was important to do so.
- (e) Poorly done. Most candidates could not come with other ways of improving the reliability of their results other than repeating the experiment. Very few candidates stated that more accurate or digital meters could be used: repeat experiment / use instruments of higher accuracy / use digital meters / obtain several readings and plot a graph
- 3 (a) (i) The question was fairly done with most candidates scoring more than 4 or 5 marks in this part. Candidates were able to record burette reading correctly to an accuracy of 0.1 cm^3 . They showed possession of skill on taking measurements using burette. The expected results are as shown in the table below.

titration number	1	2	3
final burette reading / cm^3	25.7	29.8	35.5
final burette reading / cm^3	0.0	3.4	10.0
volume of acid used / cm^3	25.7	26.4	25.5
best titration results (\checkmark)	\checkmark		\checkmark

There was quite a considerably number of candidates who did not do well in this question. The following mistakes were very common amongst answers of such candidates: failure to read the burette scale correctly, writing units throughout the table, swapping initial and final burette readings when recording, recording values not to the accuracy of the instrument used, failure to calculate volume of acid used and ticking the closest volumes of acid as the best results.



- (ii) This part was well done by most candidates, calculating the average volume of acid using ticked as expected. However, there were a handful number of candidates who completely failed to compute average. They calculated the sum of those two volumes or just couldn't divide the sum by 2 and get correct answer. They lacked mathematical skills of dealing with numbers.
- (iii) Candidates were to demonstrate knowledge of using average volume of acid after titration. Most of them failed this part. They were expected to describe that they will add the average volume of hydrochloric acid to 25.0 cm³ of sodium hydroxide solution to produce neutral sodium chloride solution. Instead, they provide wrong answers like adding acid to sodium chloride, reacting same volumes of hydrochloric and sodium hydroxide, or reacting sodium with hydrochloric acid.

- 3 (b) The question was poorly done. A few numbers of candidates described very well all the three steps required to get dry crystals of a soluble salt from the salt solution. Most candidates who did not score all the marks incorrectly described the process. They wrote answers like: heat the solution to evaporate all the water/heat to dryness/heat the crystals; cool the crystals; dry the crystals (without specifying how drying is done avoiding destroying the structure of the crystals).

Some candidates also failed to be direct to the answer as per the question. They attempted to describe how to produce sodium chloride solution before the can describe crystallisation. They committed some errors in their description leading to contradicting the expected answer. Provision of unnecessary information also consumed their time and filled available space for answering. Centres are advised to equip learners with practical skills of recording data taken using burette during titration, and moreover with the knowledge on using the average volume after titration such as performing quantitative analysis or preparing a soluble salt.

- 4 (a) Fairly done. Candidates were expected to conclude given the observation. Some candidates wrote incorrect formulae, some stated those compounds as products which did not score a mark. Most candidates wrote 'it contains transition metal' instead of "does not contain"
- (b) Poorly done. Candidates were expected to write down the test and observation. Some candidates misspelt the word damp (common incorrect spelling being dump or the word damp completely missing). Some candidates wrote wrong colour or no colour at all for the litmus paper. Those who scored managed to score only 1 mark under observation for colour change to blue
- (c) Fairly done. Candidates were expected to write down the test for Chloride ion. Some candidates wrote the wrong acid to acidify. Some candidates wrote the wrong reagents completely or wrote the correct reagent and another wrong reagent which did not score.
- (i) Fairly done. Candidates were expected to write down the observation. Some candidates wrote the wrong colour of the precipitate (brown, green and blue). Common incorrect responses were bubbles are formed.



- (ii) Fairly done. Candidates were expected to write down the test and observation tests. Some candidates wrote wrong incorrect tests like use of glowing splint and burning splint. Observation: Some candidates wrote observations like emulsion and cloudy which did not score a mark.
- (e) Poorly done. Candidates were expected to identify one of the salts contained in solid Z. A few candidates wrote either correct name or formula or both which both scored a mark. Some wrote correct name and wrong formula in brackets which did not score. Many candidates failed to identify any of the compounds in solid Z.
- 5 (a) Generally the question was well done. Most candidates scored a mark for the size of drawing. Cleanliness: there was a great improvement. Realistic: A few candidates still use some instruments like rulers, compass to aid them in drawing. Details: Most failed to do double wall for fruit skin.
- (b) (i) Well done. Common mistakes were failure to draw line on corresponding dimensions and drawing radius instead of diameter
- (ii) Fairly done. Common mistakes: wrong accuracy, no or wrong units
- NB: Seems like some candidates did not have a measuring instrument (ruler)
- (iii) Fairly done. Common mistakes: wrong expression of magnification i.e. use of small x and fail to express with 1 decimal place. Use of units in expression of magnification.
- (c) (i) Fairly done. Common wrong responses: failure to crush and dissolve in water/make a solution. Addition of biuret reagent; centres are advised to emphasise the use of specific solutions (Sodium Hydroxide and Copper Sulphate) for biurets test.
- (ii) Well done. Common wrong responses were the colour changes for other food tests such as blue-black and brick red.
- 6 (a) Poorly done; most candidates got the answer wrong which was 2.3 bubbles as most failed to interpret that the graph was showing number of bubbles in 20 minutes whereas the question wanted them to determine for 2 minutes. Some expressed their responses in minutes (mins), °C. Evidence on how candidates determined their answers also was lacking.
- (b) Poorly done; Key wanted to control/maintain constant temperature. Which is the function of the water bath. Most common wrong responses were 'to activate the enzymes', 'to gently heat the solution'. Some candidates also gave the safety precaution of using a water bath in the reducing sugar test as their response. Other responses included to get optimum, suitable, correct temperature. This marking point was not accessible.



- (c) Fairly done; instead of giving the answer as “to exclude/ stop entry of oxygen” most candidates mentioned the gas carbon dioxide. Some other responses were that oil and water are immiscible hence would not mix, to exclude entry of other gases instead of mentioning the gas by name.
- (d) Well done; few wrong responses were ammonia gas, oxygen, carbon monoxide and hydrogen. Emphasis on naming instead of giving chemical formulas should be done by Centres, Answer carbon dioxide.
- (e) Poorly done; Some candidates would say 10 -20, 30-40 which means they did not account for what happened at 20-30: also, a lot of 10 to 40 then talked about 50 °C leaving out 40 to 50 range. Most candidates said decrease is at 50 °C instead of after/beyond 50 °C, there were also cases of denaturing at 60 °C. The first marking point was very accessible to most candidates.

The second marking point was not very accessible since there was no mention of the reasons for the increase of bubble production, they mainly talked about more carbon dioxide produced. The marking point wanted enzyme activity increases (with increase in temperature) (10 °C – 50 °C) / increased rate of respiration / reaction / more collision of molecules / molecules gain kinetic energy/enzymes become more active

The third marking point fairly done except those who mentioned the optimum as 35 °C possibly because of experiments they had done in school and not referring to question at hand

The last marking point, fairly done except those who said at 50 °C bubbles start to decrease, and enzymes are denatured contradicting with 50 °C as optimum and those that said at 60 °C bubbles decrease, and enzymes are denatured instead of beyond 60 °C or from 50 °C to 60 °C.