PRINCIPAL EXAMINER'S REPORT

BOTSWANA
EXAMINATIONS
COUNCIL

JCE SCIENCE

2024

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PAPER 1: MULTIPLE CHOICE

General Comments

The candidates performed poorly in the paper. The mean mark was 16.57 which is way lower than the ideal average for a Multiple-Choice paper. There were only two (2) items where at least 70% of the candidates got the item correct and twenty-three (23) items where less than 50% of the candidates got the item correct. The rest of the items, eleven (11), had between 50% and 69% of the candidates getting the item correct. It is worth noting that there were nine (9) items in which less 25% of the candidates got the item correct, which is considered the lowest performance or guessing factor for Multiple-Choice item.

The candidates did poorly in questions where they were expected to recall simple scientific concepts or to apply their knowledge of the concept. Centres are encouraged to give candidates more opportunities when they can interact with application of the skills as outlined in the assessment guide. The item reports are given as tables that include key information as indicated:

N the number of candidates who selected each of the options

Key the option that was taken as the answer

Comments on Individual Items

Item 1: Energy Sources

Option	N	Key	Comment
A	4411	B	Well done. Most candidates were able to note that the type of energy that is matched with its source of energy is chemical energy. Options C and A were the stronger distractors. Centres should define all energy forms for candidates to understand better.
B	31079		
C	5090		
D	1653		

Item 2: Force

Option	N	Key	Comment
A	6432	C	Poorly done. The item required candidates to recall the formula $F = ma$ and rearrange it to find the formula that gives the mass correctly. Most candidates selected option D and failed to realise that the formula as is written is not correct.
B	3687		
C	14219		
D	17895		

Item 3: Measurement of Quantities - Volume

Option	N	Key	Comment
A	12744	C	Poorly done. The candidates were mainly split between options C and A. The measuring cylinder alone measures the volume of the stone. The density cannot be measured directly but requires a balance to measure the mass for the density to be calculated.
B	7064		
C	17462		
D	4963		

Item 4: Electricity

Option	N	Key	Comment
A	7576	D	Poorly done. The easiest guide to the candidates is that the live wire is always connected to the fuse. The strongest distractors were options A and B which are the neutral wire and the earth wire.
B	10693		
C	5315		
D	18649		

Item 5: Measurement of Temperature

Option	N	Key	Comment
A	11183	D	Poorly done. The proportion of candidates who got the item correct is even lower than the guessing factor with a mere 15% of the candidates getting the item correct. A larger bulb contains more liquid thus allowing for more expansion (being more sensitive) when heated while a smaller bulb reacts faster (quick response) but requires more heat for it to expand more, thus being less sensitive but covering a greater range. Options A and B were the most popular choices.
B	20680		
C	3840		
D	6530		

Item 6: Turning Effect of Forces

Option	N	Key	Comment
A	11643	C	Poorly done. The candidates were almost evenly spread across options A, C and D. The amount of friction is not dependent on the length or distance between the force and the point on rotation. The only factor which depends on the distance the force is applied from the point of rotation is the moment. The longer the spanner the smaller the effort hence a lesser force is required to turn the nut.
B	3338		
C	16225		
D	11027		

Item 7: Transverse Waves

Option	N	Key	Comment
A	10123	C	Poorly done. The candidates were spread across options A, C and D. This is a simple diagram of a transverse wave where A represents the wavelength, C is the depth or height of a crest (amplitude of the wave) and D is twice the amplitude. The amplitude is the maximum displacement of the wave particles from their rest position (represented by a horizontal line).
B	4868		
C	18554		
D	8688		

Item 8: Reflection

Option	N	Key	Comment
A	1381	C	Fairly done. Candidates were able to remember the process that causes the bouncing back of the light rays at each surface. The strongest distractor was D. Reflection is bouncing back of light while refraction is bending of light when it moves from one medium to another.
B	3120		
C	26069		
D	11663		

Item 9: Magnetism

Option	N	Key	Comment
A	18035	B	Poorly done. The candidates were mainly split between options A, B and C. Magnetic materials are attracted to magnets (plotting compass) hence the needle of the compass will move to attract the magnetic material. It seems candidates were not aware that a compass is a magnet.
B	10473		
C	8947		
D	4778		

Item 10: Methods of Making Magnets

Option	N	Key	Comment
A	21188	A	Fairly done. The method shown was stroking. Some candidates selected electro magnetisation which is the use of electricity. Candidates should be advised to study the diagrams before selecting the answer.
B	2879		
C	8428		
D	9738		

Item 11: Electric Circuits

Option	N	Key	Comment
A	12780	A	Poorly done. Majority of the candidates did not determine the total resistance of the circuit and calculated the current using either the $4\,\Omega$ or the $2\,\Omega$ resistors only. Candidates should be made aware that in series circuits they have to determine the total resistance, $R = R_1 + R_2$ and use the value to determine the current in the circuit, $V = IR$.
B	15180		
C	1540		
D	12733		

Item 12: The Eye

Option	N	Key	Comment
A	7877	B	Fairly done. Candidates should be made aware that light is focused on the retina and rays of light from a distant object are parallel to each other.
B	23711		
C	3965		
D	6680		

Item 13: Transfer of Thermal Energy

Option	N	Key	Comment
A	14717	C	Poorly done. Convection currents happen as a result of heated air molecules becoming less dense and rising up. The less dense air molecules are replaced by more dense air from the top forming a circular movement from the heater to the top and then to the heater.
B	10292		
C	9477		
D	7747		

Item 14: Measurement of Volume

Option	N	Key	Comment
A	11212	B	Fairly done. The water forms a meniscus when poured into a container. The actual volume of the water is at the bottom of the meniscus and not at the top. The other options were precautions that should be taken when using a measuring cylinder which candidates should know.
B	21018		
C	3904		
D	6099		

Item 15: Application of Expansion

Option	N	Key	Comment
A	24475	A	Fairly done. The candidates should know applications of expansion and how they can be used. Heating the wheel makes it expand increasing the size of the hole while cooling the axle makes it contract reducing its diameter. When they are in normal temperature the wheel contracts while the axle expands to return to its normal size thus fitting tightly to the wheel.
B	3104		
C	11007		
D	3646		

Item 16: Laws of Reflection.

Option	N	Key	Comment
A	13418	D	Poorly done. The angles are measured between the normal and the respective ray i.e. the angle of incidence is between the normal and the incident ray. Most candidates selected answers that showed that they were not aware that the angles have to be equal with most of them at options A and B.
B	14920		
C	4414		
D	9480		

Item 17: Sound

Option	N	Key	Comment
A	14260	D	The item was fairly done. Loudness depends on the amplitude or the displacement from the rest position. The greater the displacement the louder the sound.
B	2996		
C	3342		
D	21634		

Item 18: Evaporation

Option	N	Key	Comment
A	15794	D	Poorly done. The item was asked in the negative. Evaporation occurs when water molecules escape from the surface of the liquid. Condensation means the water vapour is converted to water hence evaporation will not take place. Most candidates went for A which is a true statement about evaporation.
B	3949		
C	8424		
D	14065		

Item 19: Atomic Structure.

Option	N	Key	Comment
A	4914	D	Poorly done. Even though the item is a simple concept where candidates were expected to know that the number of protons determine the relative atomic mass, they failed to relate the two.
B	7940		
C	13719		
D	15659		

Item 20: Test for Water

Option	N	Key	Comment
A	18331	C	Poorly done. The proportion of the candidates who selected the correct response was even lower than the guessing factor of the item. Hydrous (with water) copper sulphate is blue in colour and anhydrous (without water or dry) is white. Candidates should be exposed to simple experiments with various salts.
B	8047		
C	9570		
D	6284		

Item 21: Acids and Bases

Option	N	Key	Comment
A	13224	C	Poorly done. The two parts to the question that candidates were expected to know was whether the substance was acidic or alkaline and whether it is strong or weak. Since pH was greater than 7 it was alkaline and a weak one as it was closer to 7, the neutral position.
B	8116		
C	17616		
D	3276		

Item 22: Acids and Bases

Option	N	Key	Comment
A	7833	C	Poorly done. The proportion of candidates who got the item was lower than the guessing factor. Candidates should be able to classify substances as acids and bases first and then choose a substance that can neutralise the acid. The only alkaline substance in the list of the items given was baking soda while the others were all acidic.
B	14328		
C	9509		
D	10561		

Item 23: Chromatography

Option	N	Key	Comment
A	6961	D	Fairly done. A substance that has glucose should have at least one oval that is at the same level as glucose. There were two substances, X and Z, that had substances that were of the same level as glucose.
B	5159		
C	5828		
D	24283		

Item 24: Oxidation and Reduction.

Option	N	Key	Comment
A	25319	C	Poorly done. Oxidation is the loss of Hydrogen or gain of Oxygen. The candidates confused the two processes and selected loss of oxygen which is reduction.
B	4066		
C	7020		
D	5825		

Item 25: Rate of Reaction

Option	N	Key	Comment
A	12081	A	Poorly done. The response patterns show guess work from the candidates. The graphs indicate that the amount of gas produced was reduced hence a factor that could reduce the product should be selected. The mass of the marble chips was therefore reduced.
B	9116		
C	9855		
D	11178		

Item 26: Chemical Reactions

Option	N	Key	Comment
A	15939	A	Poorly done. Candidates should know that the gas that turns lime water milky is carbon dioxide. Carbon dioxide is obtained from a salt that has a carbonate ion. The salt with a carbonate ion was copper(II) carbonate.
B	3414		
C	8360		
D	14516		

Item 27: Change of State

Option	N	Key	Comment
A	6727	D	Fairly done. The candidates were to recall the different changes of state and how they take place. The change of state that is direct from solid to gas is sublimation.
B	6648		
C	5880		
D	22974		

Item 28: Compounds and Mixtures

Option	N	Key	Comment
A	4350	B	Poorly done. Compounds have atoms of two or more different elements. The majority of the candidates confused a molecule (group two or more atoms of the same element) with compound hence selecting C as their answer.
B	9927		
C	22201		
D	5750		

Item 29: Cells

Option	N	Key	Comment
A	21814	A	Fairly done. The candidates were able to identify the neurone as the cell from the animal. The other cells were all plant cells including the plant cell, root hair cell and stomata.
B	11135		
C	5588		
D	3690		

Item 30: Voluntary and Involuntary Action

Option	N	Key	Comment
A	4440	B	Fairly done. Most candidates identified sneezing as an involuntary action.
B	26375		
C	2939		
D	8471		

Item 31: Circulatory System

Option	N	Key	Comment
A	6098	B	Fairly done. The blood goes to the lungs where it mixes with oxygen and oxygen rich blood goes to the heart to be pumped with high pressure to other parts of the body.
B	24489		
C	8431		
D	3202		

Item 32: Excretion

Option	N	Key	Comment
A	24554	B	Poorly done. Most candidates failed to note that substance P is moving to body cells hence it cannot be carbon dioxide. The substance that moves to the body parts is oxygen while Q could be any of the waste products that is being taken out of the body.
B	10123		
C	5224		
D	2319		

Item 33: Central Nervous System

Option	N	Key	Comment
A	5395	C	Poorly done. The central nervous system has two major parts being the brain and the spinal cord. The diagram showed the spinal cord and its linkages to skin and muscles which candidates were to identify as part of the central nervous system.
B	7485		
C	15934		
D	13404		

Item 34: Hygiene

Option	N	Key	Comment
A	6040	D	Well done. One of the few items where the candidates did exceptionally well. The candidates noted that they had to wash their hands before handling food was a key practice for good personal hygiene.
B	1834		
C	1457		
D	32887		

Item 35: Digestive System

Option	N	Key	Comment
A	6565	C	Poorly done. Most of the candidates selected B as the answer. Candidates should be made aware that the chemical digestion of starch is in the mouth by salivary amylase and in small intestines by the pancreatic amylase. The chemical digestion in the stomach is for proteins and fats.
B	20522		
C	11702		
D	3429		

Item 36: Transpiration

Option	N	Key	Comment
A	19081	A	Poorly done. The candidates were to choose a structure that transports water from the roots, which should have been between xylem and phloem.
B	10020		
C	8837		
D	4277		

Item 37: Respiration and Photosynthesis

Option	N	Key	Comment
A	3448	B	Fairly done. The candidates were expected to use their knowledge on the products of respiration in animals and the reactants and products of photosynthesis in plants. Thus, the rat in Jar X produces carbon dioxide while the plant in Jar Y uses carbon dioxide for photosynthesis
B	23109		
C	5406		
D	10246		

Item 38: Excretion.

Option	N	Key	Comment
A	15551	B	Poorly done. Candidates narrowed excretion to the digestive system forgetting that excretion is broad and happens in other systems like the circulatory system and the respiratory system for removal of toxic substances.
B	20415		
C	3877		
D	2355		

Item 39: Food Nutrients

Option	N	Key	Comment
A	6084	C	Poorly done. The proportion of candidates who got the item was only 17% while the majority of the candidates settled for mineral salts. Proteins are broken down into amino acids and ammonia that contributes to increased levels of urea
B	21955		
C	7100		
D	6998		

Item 40: Skeletal System

Option	N	Key	Comment
A	6408	C	Fairly done. The two muscles have to work differently to allow for the movement of the arm. When one contracts the other relaxes.
B	3417		
C	25068		
D	6652		

PAPER 2: WRITTEN THEORY

General Comments

Generally, the 2024 cohort approach and interaction with the paper is not different from other years. They did relatively better in questions that require knowledge and understanding of science concepts but struggled with application and problem-solving questions as well as experimental and investigative questions. The use of English language to communicate is also a challenge as most candidates failed to present their work clearly for it to be understood well and there issues with correct spellings. The 2024 cohort performed a little better in demonstrating their mathematical ability hence questions that required calculations were done relatively well.

Comments on Individual Questions

Section A

1 **(a)** Fairly done. Most candidates failed to score the first marking point which required them to state that a tissue is a group of similar cells, instead, most omitted the word 'similar'. Some even referred to different types of cells. Most candidates were, however, aware that the cells work together to perform a function.

(b) Well done. Most candidates were able to state the substances in blood especially water, although some candidates referred to type of cells in blood such as red blood cells. Some provided products of metabolism.

2 **(a)** **(i)** Well done. Most candidates noted that the toothpaste neutralises the acid in the teeth which is an action of bases on acids. There were some candidates who stated that the toothpaste neutralises bacteria.

(ii) Well done. Most candidates were able to apply their knowledge on anti-bacterial agents noting that it prevents bacterial growth or acid formation. The most common correct response being 'kill bacteria'.

(b) Well done. Most candidates correctly indicated regular visits to the dentist and avoiding sugar as their answers.

(c) Faily done. Many candidates failed to state the common signs of gum disease like swollen gums, bleeding gums and falling teeth. Some candidates confused gum disease with tooth decay offering wrong responses such as *tooth ache*. Other wrong responses included dark colour on the gums or change of colour in the gums.

3 **(a)** Poorly done. The candidates were to apply their knowledge on photosynthesis and name a product of photosynthesis which is used by the plant itself. Candidates failed to interpret the diagram or failed to notice that substance U is the sugar or glucose produced by plants during photosynthesis whereby plants manufacture their own food. The most common responses were photosynthesis, oxygen and carbohydrates. Centres are advised to give candidates an opportunity to interact with questions that are not simple recall during teaching and learning.

(b) Faily done. The candidates were to note that V moves from the roots to the leaves and to the atmosphere. The process depicted by the diagram is transpiration in which water is absorbed through the roots, transported by xylem through the plant and escapes through stomata to atmosphere. The most common wrong responses included root hair cell and phloem.

(c) Poorly done. The candidates were expected to deduce that V is water and for it to be absorbed by the roots there must be high potential (outside the roots) and low potential (inside the roots) of water molecules. The majority of the candidates failed to understand the task. They appeared not to grasp the concept of osmosis. The common wrong responses were diffusion and absorption.

4 **(a)** **(i)** Well done. Most candidates were able to note that substance X was carbon dioxide, which is the gas that moves from the body cells to be released. There were some candidates who gave oxygen as their answer. Most failed to correctly interpret the graph and the direction of arrows.

(ii) Well done. Most candidates were able to note from the diagram that structure Z is the red blood cells. This is mainly indicated by the concave shape. There were some candidates who failed to notice the shape and gave answers such as blood cells only without being specific of the type of blood cells.

(b) The question was well done by almost all the candidates since they recalled that the lungs are the organ where the alveolus are found.

(c) Fairly done. The candidates were expected to note that blood that is coming in comes through the pulmonary artery and allows exchange of gases in the alveolus and then it moves to the pulmonary vein. Some candidates failed to specify the specific name of the blood vessel, instead they wrote vein instead of pulmonary vein.

5 **(a)** Fairly done. The question wanted candidates to interpret the graph and describe the trends as observed from the graph. When interpreted from 1965 there is an increase up to 1980 followed by a decrease until 1985. Some candidates just indicated that the sales of cigarettes were fluctuating, or they wrote decreasing/increasing without specifying the years. The candidates should describe each section of the graph according to the observed trend. Some lost the second marking point because they failed to properly interpret the graph, they wrote that ‘it decreased by 1985’ instead of ‘decreased from 1980’.

(b) The question was well done though some candidates failed to follow the instruction, instead they placed the letter X next to the graph instead of placing it on the graph. The candidates should be made aware that the line is the one that is the graph, and they should place a mark on the line whenever they are required to mark on a section of the graph.

(c) Fairly done. Most candidates were able to access just one mark, the common correct answer being lung cancer and breathing problems. Most candidates had an understanding that smoking has an effect on the lungs, but they failed to express themselves for their answers to be able to

address the question. The candidates gave responses such as damage to the lungs, weakening of the lungs and burning of the lungs which are a rephrase of the stem and harm the lungs, which is part of the stem and were not credit worthy.

6 (a) (i) Fairly done. The candidates were expected to identify the part of a flower that carries out photosynthesis. Photosynthesis is carried out by green plants hence candidates were to identify a green part in the flower which is W. Some candidates gave responses which indicated lack of understanding of the structure of the flower. They failed to recall that sepals are green in colour and hence they are able to carry out photosynthesis.

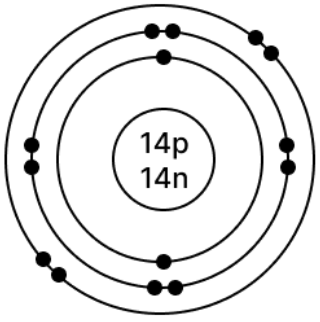
(ii) Well done. Most candidates correctly identified Y as the part with a large surface and also feathery.

(b) (i) Faily done. The candidates were to apply their knowledge on the differences between self-pollinated and insect pollinated flowers. The size of the flower is the main feature as well the position of the anther that candidates should have used to identify that it is insect pollinated. Some candidates provided self-pollinated as the response and hence failed to get the mark. Others did not give the type of pollination, instead they specified some insects with responses such as they are pollinated by bees.

(ii) Faily done. The question was not generic and hence expected candidates to use the features that they can observe from the diagram. Some candidates did not provide characteristics of insect pollinated flowers observable in the diagram. The candidates gave responses that included colourful petals, which are not observable in the diagram. Centres are advised to always consider the context of the question as it provides guidance on which answers are appropriate to that question.

7 (a) (i) Well done. Most candidates were able to give the correct symbol for silicon $^{28}_{14}Si$. Centres are advised to encourage candidates to refer to the Periodic Table to get information on the elements. Some candidates swapped the atomic mass with the atomic number. Some wrote the name of the element alongside the symbol.

(ii) Faily done. The candidates were to draw an atom with a nucleus that contains 14 protons and 14 neutrons. The atom should have three shells around the nucleus with electronic arrangements of 2, 8, 4. Some candidates lost a mark for not correctly drawing the nucleus of the atom. Some used capital P and capital N for protons and neutrons respectively. Centres are urged to emphasise correct notations.



(b) **(i)** Poorly done. The candidates failed to define an allotrope with most of them managing to note that they are different structural forms of the same element, but they failed to state that they are in the same physical state. Most, in their definitions referred to different forms instead of different structural forms. Some defined allotropes as a compound instead of an element.

(ii) Poorly done. Even though some candidates were able to recall that graphite is a good conductor of electricity, the majority of them failed to explain why it is so. Generally, good conductors of electricity have free electrons that can move freely, a property that is applicable to graphite also. The candidates referred to weak bonds between layers instead of mobile electrons.

(iii) Well done. The item was well done with most candidates noting that the structure was hard or had very high melting point. However, some candidates described the structure of diamond instead of the property, providing responses such as tetrahedral arrangement of atoms or strong bonds between its atoms. Centres are advised to differentiate between a property and the structure.

8 **(a)** **(i)** Poorly done. The candidates were expected to understand that a thermostat is used for temperature regulation, switching on and off automatically. There were some candidates who gave answers like bimetallic strip (which is a part of the thermostat), element, switch.

(ii) The item was fairly done. The candidates were to remember that when the metals in a thermostat are heated they expand differently thus making it to bend and when they cool they contract differently thus making it to be straight and switching the kettle on and off continuously. The majority of the candidates who got the item wrong gave responses such as boiling point, solid at room temperature, matter is affected by heat, high boiling point.

(b) Fairly done. Most of the candidates used the numbers provided to determine the energy. Most candidates failed to provide the formula for energy, $E = Pt$ to aid their work. The ability to recall the formula allows them to get a mark even when their answer is not correct. Some candidates failed to convert watts to kilowatts to align with the requirements of the question. Centres are encouraged to emphasize correct notations in formulars. Some candidates denoted energy with small letter '*e*' or power with small letter '*p*', symbols which have a different meaning in science.

(c) Well done. Most candidates were able to calculate the resistance correctly using the voltage and current provided. However, most of them failed to provide the formula for resistance, $R = \frac{V}{I}$ which is a requirement when solving problems that require the use of equations.

(d) The item was fairly done. Most candidates failed to notice that the question was looking for the method of heat transfer between the heating element and the water. Since the water is in contact with the heating element the method of heat transfer referred to in the question is between the heating element and water molecules in contact with it which is conduction. The most common response was convection, which happens in fluids (liquids and gases) through the movement of

the fluid. It showed guess work and not inadequate comprehension of the concept. Centres are advised to differentiate between the different forms of heat transfer.

(e) Well done. Parts K and L are the switch and the handle. Candidates noted that plastic is an insulator. One common wrong response was plastic absorbs heat some stated that plastic is a heat resistor. Centres should note that there is a difference between heat resistor and insulator of heat.

Answers: **(b)** 1 kWh **(c)** 120 Ω

9 **(a)** Fairly done. Most candidates were able to identify S as the cornea but failed to identify R which was the suspensory ligament, thus getting a mark out of the two. The most common response for R was ciliary muscle. Centres are encouraged to make the distinction between the ciliary muscles and suspensory ligaments.

(b) Well done. Most candidates were able to recall that the lens is responsible for focusing images on the retina. Candidates should be encouraged to read and understand the tasks that are given to them. A question that requires a name should be answered with a name and not a letter.

(c) **(i)** Poorly done. Most candidate wrongly described what will happen to the pupil, instead of the lens, which does not change, as indicated in the diagram. The lens changes shape to focus objects from different distances but not for light intensity. They provided responses such as it will become larger.

(ii) Poorly done. The lens is used to focus objects on the retina and its shape is affected by the distance of the object from the eye and not the amount of light entering the eye. Most candidates explained with reference to the pupil and provided responses such as to allow more light into the eye.

10 **(a)** Well done. Most candidates were able to access the marks because a spade falls under two classes of levers, X therefore can either be a pivot when Y is used as an effort to lift the load in the spade or X can be an effort when Y is used as a pivot. Most candidates were able to identify Z as load with ease.

(b) Fairly done. Some candidates did not know the function of the pivot or effort. Some provided responses such as for 'easy lifting of the spade'. Candidates could only score if the answer is consistent with the answer they have given at **10 (a)**. If they have said X is the pivot then Y is the effort. If they said X is the effort, then Y is the pivot.

(c) Well done. The candidates were able to recall the various tools including scissors and spanners that could be used as levers.

11 **(a)** Well done. Most candidates were able to identify that the circuit in the diagram is a parallel circuit.

(b) Well done. Most candidates who understood the symbol of a cell were able to count the number of cells in the battery.

(c) Poorly done. The candidates had to recall the formula for determining resistance of resistors in parallel, $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$ or $R = \frac{R_1 R_2}{R_1 + R_2}$ which they failed to do. The few who recalled the formula failed to use the formula to determine the answer with some of them calculating $\frac{1}{R}$ instead of R.

(d) Fairly done. Most candidates recalled the formula for determining the current, $V = IR$ and they benefited from error carried forward from **(c)** hence getting all the marks. However, some candidates lost a mark for giving wrong units.

(e) Fairly done. Most candidates failed to refer to charge in their definitions. Some candidates defined electric current as flow of electricity. There were some candidates who defined current as flow of electricity or flow of energy.

Answers: **(b)** 4 **(c)** 3 Ω **(d)** 4 A

12 Well done. Most candidates were able to recall the basic instruments used in exploration of galaxies that includes the camera, telescope and computers. There some candidates who gave their answer as binoculars.

Section B

13 **(a)** Fairly done. Most of candidates managed to plot all the points correctly which earned them at most three (3) marks. However, the candidates failed to use freehand to make a smooth curve or did not exclude the anomalous point when drawing the smooth curve thus failing to get all the four (4) marks. Some used a ruler to connect the plotted points, hence losing the mark for joining.

(b) Poorly done. Most candidates failed to understand why zinc was in a test tube, which was for purposes of controlling the time when the experiment is started. Some seemed to think it was in the test tube to prevent direct contact with the acid.

(c) Well done. Most candidates were able to recognise the anomalous point from the shape of the graph which was at 4 minutes. There were some candidates who just stated the figure without units, for example they wrote 4 instead of 4th minute or 4 minutes and failed to score.

(d) Poorly done. Most candidates failed to realise that the reaction is fastest in the first minute from 0 to 1 minute, that is when the slope of the graph was greatest. Most candidates stated 0 to 3 minutes, where the starts to level off showing that there is very little gas being produced.

(e) Well done. Most candidates were able to interpret the graph correctly or used the table to determine how long the reaction took to be complete. The reaction stops when the volume of gas produced remains constant even when the time increases.

(f) Poorly done. Most candidates failed to understand how a faster reaction should be represented in a graph. The candidates failed to relate the slope with the rate of reaction with a steeper slope being for a faster reaction. Similarly, the candidates failed to link the stopping of the reaction with the levelling of the graph which must be similar for both graphs. The candidates failed to score the second marking point to show that both graphs level off at the same point. Some candidates did not label the graphs as instructed hence it was not clear which graph was represented by each line. Some used dotted lines instead of a solid line to sketch the second graph. Centres are encouraged to emphasise strict following of instructions and drawing graphs properly with solid lines not dotted lines.

Answers: **(c)** 4 minutes **(d)** 0 to 1 minute **(e)** 6 minutes

14 (a) Poorly done. Most candidates failed to state Newton's second law which is about force applied being directly proportional to the acceleration. The candidates failed to express themselves and gave responses such as the force applied to an object is proportional to the mass of the object. Some candidates stated Newton's first law of motion, while some simply wrote the formula instead of stating the law in words.

(b) (i) Well done. The candidates were able to use the forces available to determine the magnitude of the resultant force, which was the difference between the two forces that were acting horizontally.

(ii) Fairly done. The candidates were expected to recall the formula for Newton's Second Law, which is $F = ma$. Though many had an idea of the formula that was to be used, they failed to rearrange the equation to determine the acceleration with some dividing the mass by the force. Centres should encourage candidates to always start with the standard formula and use it to obtain the answer.

Answers: **(b) (i)** 100 N **(b) (ii)** $2\,m/s^2$

15 (a) Poorly done. It appears candidates are not familiar with the use of microscopes since the majority of them failed to identify the slide in the diagram. The majority of the candidates gave responses such as white tile, glass, filter paper, glass slip. Centres are encouraged to demonstrate the use of microscopes including preparation of slides.

(b) (i) Fairly done. Most candidates correctly placed the letter X at the stage.

(ii) Fairly done. Most candidates were able to correctly name the part as eye piece. Common wrong response was lens.

(iii) Poorly done. Candidates should be made aware that the mirror reflects light and ensures the object can be seen clearly. Common wrong responses included to magnify the object and to reflect the sample.

(c) Fairly done. The most important precaution is to move the eye piece gently to ensure that the slide, which is very fragile, is not broken. Most candidates failed to express themselves clearly.

ISSUES FOR ATTENTION

Overall, the candidate's performance in science continues to be below expectations. It appears most candidates have deficiencies in the mastery of the content in the teaching syllabus and the skills as stated in the assessment syllabus. Centres are urged to thoroughly familiarise themselves with the assessment syllabus so that they better prepare candidates for the science examination. To help candidates perform better in the science examinations, Centres are strongly encouraged to assist candidates in sharpening their skills in the following areas:

(a) Application and Problem Solving

The Science syllabus puts emphasis on the understanding and application of science concepts and the development of high order thinking skills such as problem solving and process skills. Candidates are expected to sufficiently demonstrate their ability to solve problems, translate information from one form to another, manipulate data and identify patterns. It is evident that candidates fall short in the demonstration of these skills and Centres are urged to give learners more practice in these skills.

(b) Experiments and Scientific Investigations

The syllabus also calls for the acquisition of hands-on experience through experimentation and investigations. Most candidates still do not demonstrate the acquisition of these skills sufficiently. It is recommended that Centres give candidates more opportunities to participate in experimental activities and more practice with scientific investigations to enable them to better demonstrate knowledge, understand and interpretation of experimental setups, as well as making observations, drawing conclusions, and analysing and interpreting data.

(c) Plotting of Graphs

Most candidates do reasonably well when it came to plotting points from tables. The major challenge identified is the connecting of points with smooth curves and the use of free hand to draw graphs with the recognition of anomalous points. Centres are urged to allow learners additional time to practice the skill.

(d) Computation / Mathematical Solutions

This year, there was a slight improvement when it comes to mathematical computations especially with upper grades. Most candidates in the lower grades had challenges with calculations. Centres are advised to assist candidates develop the habit of writing down formulas prior to attempting to solve any calculation-based problems and presenting their work neatly and clearly.