PRINCIPAL EXAMINER'S REPORT

BOTSWANA
EXAMINATIONS
COUNCIL

BSSE GENERAL SCIENCE

2025

PAPER 1: WRITTEN PAPER

General Comments

This year's overall performance of candidates ranged from average to below average, with a few demonstrating strong understanding of scientific concepts. It was observed that some candidates have a tendency of writing their answers anywhere on the question paper. By so doing, candidates may lose marks because Examiners may not see the answers during the marking session, especially that they only interact with scanned copies of the candidates' work. In addition, some candidates have a tendency of writing words on top of each when trying to correct their mistakes.

Most candidates demonstrated weak arithmetic skills and poor understanding of mathematical notation, resulting in incorrect calculations even when substitutions were correct. Many candidates also struggled to manipulate formulas and often mixed symbols and words when writing equations. In addition, marks were frequently lost due to the omission or incorrect use of units and non-standard symbols when writing formulas. In cases where there were some calculations, candidates left some work incomplete. Example, if candidates had to multiply or divide large numbers, the problem will be left incomplete after writing correct formula. This is an indication that candidates come to the examination without calculators, or they do not know how to use them. Poor presentation, including unclear formulas, untidy working and illegible handwriting, further affected performance. Many candidates were also unable to recall standard definitions.

In Biology questions, candidates displayed confusion between Biotechnology and Genetic engineering concepts. This is evidenced by mixing information from different questions to answer other questions in these two branches of Biology. Centres are advised to make a deliberate effort to make a clear distinction between the two concepts of Biotechnology and Genetic engineering.

Candidates should be advised to write their answers within the spaces provided and not go beyond to write on bar codes. Furthermore, candidates should be encouraged to cancel and write afresh rather than to write on top of another word. Centres are further advised to screen and recommend candidates with challenges with hand writings to guidance departments so that they can be assessed and assisted by scribers since some handwritings were not legible.

Centres are advised to encourage candidates to always bring their calculators when they come to write science subjects and to give them enough practice before they write the final examination. Candidates should also be given more practise on questions that require them use words such as defining, describing and explaining. A clear distinction between these three words should also be made for candidates.

Comments on Individual Items

1 (a) This question was fairly done. Most candidates scored one mark for correctly identifying the range. However, the accuracy mark proved more challenging. A significant number of candidates gave an incorrect mass range of 60 – 70 kg and stated the accuracy incorrectly as 0.2 kg. This indicates a misunderstanding of accuracy, with candidates relying on memorised values rather than conceptual understanding. Centres are encouraged to use instruments with varying ranges so that candidates can be familiar with the concept and to strengthen their understanding of how accuracy is determined. Candidates should be given more exercises on accuracy, precision and range to prepare them for their examinations.

(b) **(i)** The question was fairly done. Many candidates do not understand prefixes, particularly that kilo means one thousand. A significant number of candidates gave incorrect answers such as 0.064 g or 6400 g, although some provided the correct response. Centres should give candidates more activities on conversion.

(ii) This question was poorly done. A common incorrect response was 64×10^3, indicating that many candidates failed to understand that in scientific notation, the numerical value should be $1 \leq n < 10$. Centres should give candidates more practise on writing quantities in scientific notation.

(c) The question was well done. Most candidates were able to state the other fundamental quantities correctly. These included length and time, which were the most popular choices, and temperature, light intensity and amount of a substance. The few candidates who performed poorly gave responses such as weight, volume, density and speed, which are not fundamental quantities.

Answers: **(a)** range: 100 / 0 – 100 kg accuracy: 2 kg **(b)** **(i)** 64 000 **(ii)** 6.4×10^4

2 **(a)** **(i)** The question was fairly done. Most candidates were able to recall the equation $F = ma$ but failed to substitute the values correctly. A common error was misinterpreting 3 m / s² as (3 m / s)², which led to the frequent incorrect answer of 45 N. Some candidates also used $F = mg$, applying 10 N / kg or 10 m / s² in their calculations, which was inappropriate for the given situation. Candidates should be given more exercises to assist them in remembering formulas and how to use them when provided with information.

(ii) Poorly done. Many candidates failed to recall the correct equation $v = u + at$ and incorrectly rearranged the variables, for example writing $u = v + at$. Candidates also struggled with computing the answer correctly and were unsure which values to apply in calculating velocity. Additionally, many wrote incorrect units, commonly using m / s² even when the correct unit was provided.

(b) The question was fairly done. The candidates were expected to describe the motion in terms of acceleration (increasing velocity) and velocity (horizontal line). Both section indicate constant motions as the graph is a straight line. In the first part of the question, common incorrect answers included terminal velocity and constant motion, while in the last part, the most frequent incorrect answer was stationary / at rest. Centres are advised to teach candidates that when asked to describe motion, they do not need to include the word “motion” in their response.

Answers: **(a)** **(i)** 15 N **(ii)** 30 m / s

3 **(a)** The question was fairly done. Most candidates missed the concluding part of the definition “per unit time” which resulted in the loss of marks. A common incorrect response was “number of waves per time taken.” Many candidates also defined other wave parameters, such as wavelength, period, or amplitude, instead of frequency.

(b) (i) The question was fairly done. Most candidates performed well, although a few were unable to recall the correct unit for amplitude. A significant number of candidates also gave 2 m as their response, showing that they either did not know what an amplitude was or they did not understand the scale used.

(ii) The question was fairly done. Most candidates were able to recall the equation $f = \frac{1}{T}$ but often failed to use standard symbols. Common responses included $f = \frac{1}{P}$, $\frac{1}{t}$, and $f = \frac{1}{\text{number of waves}}$. Furthermore, some candidates also used unconventional expressions such as "no. of complete waves" or "# of complete waves" to calculate frequency instead of the correct notation: number of waves/time taken. Centres should emphasize the importance of using standard symbols and are advised to instil the use correct symbols or notations on candidates during learning.

(iii) The question was fairly done. One mark was accessible to most candidates. A significant number of candidates were able to recall the equation $v = f\lambda$, but they often failed to use standard symbols. Common incorrect responses included $s = \frac{d}{t}$ or $S = \frac{D}{T}$, and 6 m / 4 s where 6 m is wavelength and 4 s is time to complete two waves. Centres should emphasise the importance of using standard symbols, particularly when calculating speed.

Answers: **(b) (i)** 1.5 m **(ii)** 0.5 Hz **(iii)** 3 m / s

4 (a) The question was poorly done. Most candidates failed to compare the parameters of static and current electricity. For example, many candidates incorrectly stated that static electricity is produced by friction, whereas current electricity involves the flow of charge thus stating one side of each. A common mistake was describing "electricity moving" instead of charge moving. Centres are advised to emphasize that it is charge that flows, not electricity. Candidates should be advised to always compare the same aspect e.g. when they address the aspect of cause both answers should be addressing how the type of electricity is produced.

(b) (i) The question was poorly done. Few candidates were able to recall the equation $I = I_1 + I_2$. Some candidates accessed marks using the general equation $V = IR$, but incorrect substitutions led to wrong answers. Most candidates did not attempt the question. Centres are advised to give candidates more practise in analysing electric circuits.

(ii) This question was poorly done. Few candidates recalled the equation $V = V_1 + V_2$. Most candidates did not attempt the question.

Answers: **(b) (i)** 0.5 A **(ii)** 0.5 V

5 (a) Fairly Done. Most candidates were able to identify the eye piece but failed to identify the condenser / diaphragm. The eye piece was wrongly identified as the lens, nose piece / lens. The common wrong responses for the condenser were the mirror and the illuminator. Centres are advised to spend more time in learning parts of a microscope and their functions.

(b) Fairly done. The function of the coarse adjustment knob was wrongly stated as being used for zooming / magnifying the specimen. Some candidates stated that it is used for controlling or moving the stage upwards instead of moving the stage up and down. Other candidates said it is used for focusing the microscope.

(c) **(i)** Well done. Some candidates confused the organelle (nucleus) for the name of the cell and consequently gave the name of the cell (phagocyte) instead of the nucleus.

(ii) Fairly done. The name of the cell was mostly given as a white blood cell instead of being specific to the phagocyte. When it comes to the function, many candidates wrongly said the phagocyte engulf the diseases / infections instead of it engulfing and digesting the pathogens. Some used ingestion for digestion. Others said it produces antibodies / antibiotics.

6 **(a)** This question was poorly done. Most candidates were challenged by spellings of the hormones controlling the menstrual cycle. For instance, progestrogen, progestesterone for progesterone. It seems the candidates knew only progesterone and oestrogen and did not know follicle-stimulating hormone (FSH) and luteinising hormone (LH). Centres are advised to emphasise the four hormones that control the menstrual cycle. Most candidates referred to the lining of the uterus wall as just the uterus wall. Centres should fully attend to performance criteria addressing these concepts to ensure that candidates are fully prepared for the examinations.

(b) This question was fairly done. There were some wrong responses like umbilical tube and fallopian tube.

(c) This question was fairly done. The common wrong answers included swelling of the genitals, colour of the discharge from the genitals (white) was not stated or a wrong colour such as yellow given. In some instances, the candidates did not state the area where the symptoms were.

7 **(a)** This question was well done. However, there were some common wrong answers noted. Some candidates referred to production of high-quality crops as productivity while others just described genetic engineering.

(b) This question was poorly done. Most candidates did not use a label line to label the insulin gene. Some used an arrow instead of the label line. Others just wrote without using the label line. Centres are advised to emphasise that the label line should touch the structure to be labelled.

(c) The question was poorly done. Most candidates just stated the digestive enzymes for ligases or restriction enzymes.

(d) **(i)** Fairly done. Most candidates gave binary fusion for binary fission. Some gave responses like mitosis, sexual reproduction and fermentation.

(ii) This question was poorly done. Most candidates gave general advantages of asexual reproduction. They failed to relate the question to bacterial reproduction and the production of insulin.

(e) The question was poorly done. Most candidates attributed the conversion of excess glucose to glycogen to the hormone insulin and not the liver cells. Some failed to show that it is the excess glucose that is converted. They just referred to glucose. Others mix up the spellings for glycogen and glucagon. In addition, many candidates seem not to know that insulin promotes uptake of glucose by the cells. Furthermore, some candidates referred to temperature regulation.

8 **(a)** Well done. Most candidates were able to give a value between 686 and 883 which clearly demonstrate understanding of the trend. The few candidates who could not access the mark gave values less than 686.

(b) **(i)** Fairly done. The task required candidates to understand the concept of melting and interpret the melting point given to determine that after 29 °C the substance is in liquid state until 669 °C when it reaches boiling point. Some candidates gave their response as solid, while some stated that the substance has melted.

(ii) Poorly done. Some candidates used the word 'fluctuates', whilst some described the trend as increasing with decreasing at potassium and increasing again instead of generalising. Some described trend in reactivity, melting and boiling points instead of the trend in density. Data analysis skills should be emphasised at the Centres as required by the syllabi.

(c) Poorly done. Most candidates failed to recall chlorine as diatomic, some wrote symbol for Chlorine as 'CL' despite its provision in the Periodic Table. Some candidates wrote formula for sodium chloride as $NaCl_2$ despite that it was already given in the stem of the question. A few candidates wrote the correct reaction equation but failed to balance it. Some presented the word equation instead of symbol equation. Some candidates used the equal sign (=) instead of an arrow (→) between the reactants and products. More practice on writing chemical equations is crucial. Centres are advised to emphasize the use of the Periodic Table to extract information on identity of elements.

(d) Fairly done. Some candidates swapped the particle arrangement and movement of gas particles. Some defined diffusion under movement of particles. Some candidates described the arrangement as loosely packed, apart.

(e) Poorly done. Most candidates only drew diagrams showing transfer of an electron from sodium atom to choline atom and attached charges without showing diagrams with correct electron configuration for the ions. Some candidates who drew the correct failed to correctly label the atoms/ions, e.g. sodium was labelled as S, while some failed to indicate correct charges, or swapped charges for sodium and chloride ions. In some cases, only the chloride ion was also shown as the dot and cross diagram for Sodium Chloride, and labelled $NaCl$ in the nucleus. Some candidates had drawn only the outermost shells, showing failure to follow instructions. Some failed to house the ions in brackets, while some housed the two ions in one bracket. Some candidates gave diagrams of both covalent and ionic compounds. More practice should be given to distinguish between atoms, molecules, and ions and drawing of clear 'dot' and 'cross' diagrams of compounds. Candidates should show clearly their working and the final answer in the space provided, instead of filling the whole space haphazardly. This may result in candidates losing marks unnecessarily and recklessly.

9 **(a)** Poorly done. Most candidates failed to recall the characteristics of a homologous series. Some candidates used the words 'same' and 'similar' wrongly e.g. 'similar functional group instead of same functional group', or same chemical reactions instead of similar chemical reactions. Some candidates described characteristics like gradual change in physical properties as increasing down the series, e.g. boiling points increase going down the series instead of as the number of carbon atoms increase. Candidates should be encouraged to use the correct phrasing of characteristics.

(b) **(i)** Fairly done. Most candidates failed to present correct uses of paraffin but rather wrote words like 'lamps', aeroplanes / aircrafts / jet engines, or lights. There was also a confusion between lamp and bulb, e.g. used in light bulbs. Some responses such as oil, residue, concrete, tared were given as a fraction used for road surfacing.

(ii) Poorly done. Most candidates were able to access at least 1 mark. Most candidates failed to give the correct test for unsaturation. Common responses indicated test using burning splint, lime water, red or blue litmus paper.

(iii) Poorly done. Most candidates gave structures of ethene, ethane and or gave incomplete structures, and some showing C_3H_6 structure with carbon atoms having up to 5 bonds. Centre are advised to put emphasis on the fact that carbon has 4 bonds around it.

10 **(a)** Poorly done. Most candidates gave the state symbol for calcium carbonate as (aq) showing failure to recognise lumps as solid. Some candidates wrote the state symbol for Hydrochloric acid as (l) being liquid, while a few presented it as (g) for gaseous.

(b) Fairly done. Some candidates wrote 5% as the response since they simply calculated 5.0 g as a percentage over 100. Some presented 100% which is the sum of all the percentage compositions of the three elements as their answer. Some candidates wrote percentage compositions of all the 3 elements in the answer space

(c) Fairly done. Some candidates recorded the change saying, 'limewater turns cloudy'. Some wrote the test as burning splint, glowing splint, bromine water, showing failure to relate the item to the reaction equation given. Encourage candidates to relate items to the information given.

(d) Well done. Only a few candidates attached wrong units.

(e) **(i)** Well done. Only a few candidates used wrong units.

(ii) Poorly done. Most candidates failed to record the correct answer. Common answers such as 3.01×10^{23}, 6.02×10^{23}, 7.22×10^{23}, 3.01, 6.02 were recorded. Discourage candidates from repeating units when they are already given in the answer space. Encourage candidates to use the correct units for the variables required.

Answers: **(b)** 40% **(d)** 0.05 **(e)** **(i)** 1.2 dm^3, **(ii)** 3.01×10^{22}

(f) Well done. Some candidates mentioned use of catalyst and increase in mass of calcium carbonate, increase in concentration of calcium carbonate as one of the ways to increase rate of a reaction. Some failed to clearly indicate how rate will be increased. Some candidates failed to use

comparison words to show that there is an increase, e.g. they wrote temperature alone instead of qualifying how the temperature should be varied like increase or higher temperature.

PAPER 3: ALTERNATIVE TO PRACTICAL TEST

General Comments

Generally, Candidates performed well on calculations and graphing but did not do well on definitions and explanations. Most candidates failed to differentiate between observation and conclusion i.e. making observations from conclusions and vice versa. Most candidates failed to link the tests and conclusions to come up with a correct observation.

Centres should discourage the candidates from using slashes or brackets as it has been noted that they use them wrongly for instance what is written on either side of the slash does not necessarily mean the same thing and this results in loss of marks especially with statements that contradict each other. Candidates should also be advised to write their responses well as per the lines provided or if in tabulation form, write one response in each box. The observation made was that some candidates wrote two responses on the same line where only one response was expected to appear or two responses within one box where a table was to be used, in some instances the responses were contradictory thus resulting in loss of marks. Another observation that was made was that there were a lot of spelling mistakes such as stock for stalk, flour for flower etc.

Comments On Individual Questions

1 (a) (i) Poorly done. The candidates were expected to recall the degree symbol (°) for measuring angles. Most candidates gave wrong units such as cm, mm, °C. Some candidates wrote the unit again while they were writing the values in the Table, thus making the value wrong. Centres are advised to emphasize on writing each unit once.

(ii) Poorly done. Most candidates did not measure angle *r* instead they calculated it from the trend of the values already in the table. Centres are advised to emphasize to candidates that they should always follow instructions in the question paper and to have necessary measuring instruments.

Answer: 49 ± 1°

(iii) Faily done. Most candidates managed to calculate the values of sin i and sin r. However, candidates did not record both values to two decimal places to be aligned to the values already give, a skill that is necessary when handling experimental data. Centres should put more effort on practice on data tabulation.

(b) Fairly done. Plotting of graphs requires four basic skills: labelling of axis, suitable scale, plotting of points to within half a small square and line of best fit. Most candidates managed to correctly label the axes without interchanging them but failed to use a suitable scale. Generally, plotting of points was done using correct notation (ʘ or ×). However, a few candidates used wrong notations for plotting, and some misplaced the points. Those who had a consistent scale managed to draw the line of best fit, but some did not make it touch the axes. Centres should put more emphasis on graphing skills.

(c) Poorly done. Most Candidates failed to calculate the gradient of their line which required that they select points within the line which cover more than half of the length of the line they have drawn.

Most candidates did not show the evidence appropriately on their graphs. Centres are advised to emphasise more on interpretation of the graph.

(d) Fairly done. Most candidates correctly substituted their value of *G* in the formula but did not manage to compute the value. Some had a value of *G* that was less than 1 which made it impossible for them to get a value of the critical angle. Centres are advised to put more emphasis on the development of mathematical skills.

(e) Well done. Most candidates managed to name parallax error or describe parallax error. However, centres are advised to emphasize on the correct use of terms.

(f) **(i)** Poorly done. Most candidates failed to recognise that the critical angle of a material is constant. Centres are advised to communicate to candidates that the critical angle of a material does not depend on its size.

(ii) Poorly done. Most candidates failed to realise that the critical angle of a material does not depend on its size. Centres should emphasise that the critical angle of the same material remains constant.

(g) **(i)** Poorly done. The candidates failed to define critical as the angle of incidence where angle of refraction is 90°. Most candidates failed to differentiate between the 90° angle of refraction and the critical angle. Centres are advised to emphasize more on the definition of key terms related to refraction.

(ii) Faily done. Most candidates did not fully define refraction, e.g. they were on the main saying it is the bending of light/waves without adding that it occurs when light/waves move from one medium to a different one. Centres are advised to impress upon candidates to always give definitions in detail.

2 **(a)** The question was poorly done. Most candidates failed to differentiate between conclusion and observation, they repeated the conclusion in the stem of the question. The candidates should be made aware that an observation is made mainly through the senses, in this question should be reduction in the size of the solid R. Centres are advised to thoroughly emphasize on the scientific process skills to equip candidates.

(b) **(i)** The question was fairly done. Some candidates were able to correctly identify ammonia (NH_3) as the gas produced in the conclusion. Most candidates failed to describe the test for the gas. This could be done through the use damp red litmus paper, damp universal indicator or any substance that can change colour when exposed to ammonia. Centres are advised to emphasize on the importance of correctly describing the litmus paper used in the test for ammonia as damp / moist / wet and the colour of the litmus paper used.

(ii) The question was well done. Most candidates were able to note that a white precipitate is formed under observations. A few candidates wrote a wrong colour for the precipitate. Centres are advised to emphasize on the correct spelling for the word precipitate and detach from the word cloudy referring to colour white.

(iii) The question was poorly done. Most candidates could not correctly identify nitric acid as the reagent used for acidifying. Centres are advised to emphasize on clear understanding of the purpose of acidifying when doing qualitative analysis and to conduct tests for anions starting with the acid and ending with the acid.

(c) The question was poorly done. Most candidates failed to relate colourless solution to the absence of a transition metal and stated that transition metal ion / compound was present. Centres are advised to practice more on differentiating between a conclusion and an observation for candidates to be able to draw conclusions from observations made.

(d) **(i)** The question was well done. Most candidates were able to notice that a white precipitate is formed under observation.

(ii) The question was fairly done. Most candidates demonstrated knowledge with respect to the addition of the reagent from **(d)(i)** but were let down by the spelling as they wrote access ammonia instead of excess ammonia. Most candidates also noticed that the precipitate dissolves giving a colourless solution, but some contradicted the solubility by ending with a precipitate instead of a solution. Centres are advised to put more emphasis on issues of soluble precipitates as well as correct colour of the solutions formed.

(e) The question was poorly done. Most candidates failed to identify solid R as zinc oxide. Centres are advised to emphasize practice on identification of ions in pure compounds and mixtures as well as the correct chemical names of the compounds.

(f) The question was poorly done. Most candidates failed to give the correct formula of the compound, as $NH_4C\ell$. Candidates might have failed to link the salt in solid R with the tests in Table 2.1. Candidates should be advised to always pay attention to the numbering of questions as sub-questions are linked to each other. Centres are advised to emphasize practice on identification of ions in pure compounds and mixtures as well as the correct chemical formulae of the compounds.

(g) **(i)** The question was well done. Most candidates were able to name filtration as the separation technique.

(ii) The question was poorly done. Most candidates correctly identified one apparatus needed and another apparatus which was not needed. The candidates were expected to state that filter funnel and filter paper are needed. Centres are advised to emphasize on the necessary apparatus for each separation technique.

3 **(a)** Well done. The marking criteria focuses on aspects such as size of the drawing, its cleanliness, being realistic, walls and other features like seeds. Size: Most candidates if not all adhered to the requirement of drawing larger than the size of the given photograph. Clean: There was great improvement as there was less shading by most candidates. Candidates should be advised to desist from shading. Realistic: Most candidates accessed the mark lest for a few who drew Fig 3.1(b) instead of Fig 3.1(a). Details: Most candidates got this mark, there were only a few who did not draw the double walls, and some did not show the seed sections and seeds. Quite a few candidates did not draw the seeds.

(b) **(i)** Poorly done. Candidates failed to note that the longest length was along the horizontal line. Most candidates chose sides that were not the longest like the vertical and diagonal lines. Some candidates did not indicate the line, or had many lines, or boxes. Centres are advised to teach candidates to indicate where they took measurements and show it with only one line. Small parallel lines at the ends of the line can assist greatly in determining the actual section where measurement is taken. Candidates should practice more on how to identify and check for the longest part. Measurement should either be vertical or horizontal. Candidates should be advised not to do three-dimensional diagrams.

(ii) Measurements were poorly done. The candidates were to take their measurements for the photograph within the range of 58 mm ± 2 mm. Most of the measurements were derailed by the lines that were drawn in **(b)(i)**. Candidates lost marks because of repeating units, expressing without units, wrong expression of mm. Centres to advise candidates to be more vigilant on the units to be used.

(iii) Calculation of Magnification. Magnification should be expressed with X to 1 decimal place. The second marking point was correct substitution and calculation. Fairly done. Common mistakes were measurements swapped in the equation, use of small x, use values that were not of the same units, e.g. mixed cm and mm, rounded off even when they were not supposed to, managed to substitute but couldn't correctly express the answer to 1 d.p. and X (times) sign, most candidates put units in the final answer. Candidates should advised to always pay attention to the units used in each measurement and use similar units when handling data.

Answer: **(b) (ii)** 58 ± 2 mm

(c) Fairly done. An average number of candidates were able to provide similarities like presence of seeds, skin, seed pockets and core. Some candidates simply stated the detail instead of writing in sentence form, for instance, one would just write seed. Centres should encourage candidates to pay attention to key words such as visible and as such expectation would be to response in reference to what is on the diagram not base their responses on general knowledge e.g. stating that the tomato is red in colour.

(d) Fairly done. Candidates were expected to show differences based on similar structures e.g. seeds, fruit and stalk. Centres should teach candidates on how to use antonyms e.g. big and small instead of writing phrases like "a tomato is small while the apple is not". Candidates should write in each box of the table and should not pair two responses in one box which might end up making the whole response wrong.

(e) **(i)** Poorly done. Candidates were expected to name the flower as being responsible for reproduction but instead gave responses which were parts of the flower like ovary, anther, filament and also seed. There were some who gave answers related to asexual reproduction e.g. scion

(ii) Faily done. A few candidates managed to describe the events as required. The stages involved which include pollen grains received by the stigma. The pollen tube germinates and grows a tube that enables pollen to reach the ovule for fertilisation and fruit formation. Most candidates knew the right responses but mixed concepts and ended up contradicting their

statements. Candidates gave responses such as ovule develops into a fruit or pollen grain is fertilized. Some just responded with one word like pollination and failed to describe fertilisation.

PAPER 5: ALTERNATIVE TO PROVIDER BASED ASSESSMENT

General Comments

Candidates' performance was generally lower showing insufficient investigation skills in all its forms. Even though the questions were very much similar to questions in the Alternative to Practical, the candidates did poorly in this component. Candidates showed inadequate skills by the answers they provided or the spaces that they left blank. Candidates should be given more tasks to investigate and report in a scientific format. Referencing is a requisite at all levels of education beyond BSSE hence it should really be emphasised.

Comments on Individual Questions

1 **(a)** Well Done. Most candidates were able to get this mark. They gave 8.2 cm as the correct answer. Centres are encouraged to emphasize more on scale reading and presenting measurements to the accuracy of given instruments.

(b) Data presentation: Fairly well done. Most candidates were able to draw a table, although they failed to appreciate that the table should be a 6 by 3 type. A sizeable number of candidates were unable to show all the three required quantities (force, length & extension) together with their units as the headings of each column. Most candidates failed to reflect the accuracy of the given ruler when recording length which is a key skill when doing practical tests. A great number were able to calculate the extension correctly though they failed to record it to a consistent number of decimal places. Centres are advised to encourage candidates to tabulate all the data, added, measured and calculated.

(c) Graph: Fairly done. Most candidates were able to correctly label both the axis with their respective quantity and units. Though most candidates were able to present a consistent scale, they failed to score a mark because the scales presented did not equate to half or greater than half the grid provided. Most candidates presented correctly plotted points using the correct notation, a cross or a circled dot. Most candidates were able to draw a line of best fit, which was a straight, smooth continuous line averaging all the points drawn. A few candidates failed to appreciate the need for a scale hence just took the values from their tables and used them to directly plot their graphs, effectively losing 3 marks in the process.

(d) Well done. Most candidates appreciated the fact that for the given spring extension was directly proportional to extension. Centres are advised to encourage candidates to give precise Physics relationship not generalised relationships like, "extension increases with load."

(e) **(i)** Poorly done. Surprisingly most candidates failed to appreciate the effects of net force on objects. They failed to show that force can change state of motion, change the size, change the shape and even produce a turning effect (moment).

(ii) Again, most candidates failed to recall the equation $F = ke$ to calculate the force constant. Having failed to come up with the equation they then failed to provide 5 N / cm as the correct answer. They also exhibited lack of appreciation of N / cm as the unit of the force constant.

Answers: **(a)** 8.2 cm **(e) (ii)** 5 N / cm

2 **(a)** **(i)** Fairly done. Most candidates confused and swapped independent and dependent variables, gave wrong responses for the dependent variables, omitted or wrote incomplete answers e.g. 'bubbles' instead of 'number of bubbles'. The independent variables were and of light intensity and distance of plant from light source while the dependent variables were number of bubbles produced, amount of oxygen or gas obtained and rate of bubble production.

(ii) Poorly done. Most candidates showed lack of understanding of the variables. Some used information from the diagram and used it as responses, e.g. 'Glass heat shield' instead of the expected variables which were any of temperature, concentration of carbon dioxide, surface area of the plant.

(b) **(i)** Poorly done. Most candidates gave answers that were not related to the need for the plant to acclimatise. Some gave responses such as 'to get accurate results' and 'to get correct number of bubbles, 'for photosynthesis to start, reaction to start, because one minute is the time needed for the bubbles to start, etc. Centres should emphasise the experimental requirements and procedures.

(ii) Well done. The candidates demonstrated knowledge on precautions taken when carrying out the investigation especially those dealing with handling of glassware and the use of protective clothing. However, some candidates failed to score because they left out the doing word and only provided a list e.g. 'protective clothing' instead of 'wear protective clothing'. Some confused errors for safety precautions.

(c) Fairly done. The candidates were expected to list the material and provide a justification for such material e.g. a lamp to provide light. Despite the fact that a diagram was drawn, most candidates failed to identify the expected basic materials for this investigation. Where they identified them, they failed to correctly justify their use. Generally, candidates showed a lack of knowledge of names of apparatus as they failed to correctly name apparatus e.g. 'jug' instead of 'beaker'; 'tripod stand' instead of 'retort stand'.

(d) Fairly done. Most candidates could not access the mark on logical method, mainly due to the failure to include the step of fill the test-tube with water, and to a lesser extent failure to switch on the lamp. Most candidates failed to state how to obtain the results; they wrote observe bubbles instead of count the number of bubbles. Candidates could not clearly describe how control variables are handled e.g. they wrote put glass heat shield in front of the lamp instead of put glass heat shield in front of the lamp to control temperature.

(e) Fairly done. Some of the candidates included responses like starch, carbohydrates, chlorophyll, temperature, respiration, etc instead of the expected response, 'glucose'.

3 **(a)** Fairly done. Some candidates showed lack of some mathematical skills as they failed to round off their answers correctly. They also failed to present their answers as per the requirements for data presentation in Provider Based Assessment (PBA) paper. Provider Based Assessment paper requires candidates to present results of an experiment in a consistent manner. The candidates were expected to follow the pattern given in the table and give their answer correctly rounded as per the pattern. Common responses were: 0.019, 0.021, 0.0196 and 0.02.

Answer: 0.020

(b) Poorly done. Most candidates failed to relate data given in the table with the factor under investigation (independent variable). They ended up giving tittles which were not addressing the independent variable. Some copied the statement which appears in the introduction of the question ("The rate of reaction between sodium thiosulphate solution and dilute nitric acid") as the tittle. The tittles given by the candidates were not clear and relevant to the field of study. Common responses were the rate of reaction between sodium thiosulphate and dilute nitric acid, the rate of reaction increases with time, an investigation on the rate of reaction between sodium thiosulphate and dilute nitric acid using different volumes, effect of rate of reaction, investigating the rate of sodium thiosulphate on a marked cross. Centres are advised to emphasise the difference between a tittle and objective/aim as some candidates gave tittles which starts with "to" which distorted the tittle given. This then makes the statement to be an objective/aim instead of a tittle. The title should link both the independent and the dependent variable effect of concentration on the rate of reaction.

(c) Poorly done. Most candidates failed to come up with a predictive and relevant hypothesis for the investigation. They gave hypothesis addressing the experiment and not the investigation which did not score a mark. Common responses were: sulphur is formed in the experiment and the mixture becomes cloudy, the volume of sodium thiosulphate decreases as the volume of water increases, rate of reaction increases as the volume of sodium thiosulphate increases, when the volume of sodium thiosulphate is increased the cross disappears faster. A few candidates gave a hypothesis which is predictive and relevant to the field of study by addressing independent/dependent variables. The hypothesis was the higher the concentration the greater the rate of reaction / the lower the concentration the lower the rate of reaction. Centres are advised to put emphasis on the relationship between hypothesis and independent/ dependent variables.

(d) Poorly done. Most candidates failed to explain why the total volume of the solution was kept constant. They showed lack of understanding on the purpose of control variables in an investigation. Common responses were: to obtain accurate results, to obtain correct results, is a controlled variable. Very few candidates showed understanding on the purpose of control variables as they indicated that it was for fair comparison / for fair test.

(e) Fairly done. Some candidates were able to explain, in terms of collision theory, the effect of concentration on the rate of reaction. Candidates were expected to note that a higher concentration has more particles (per unit volume) hence more collisions between particles and greater rate of reaction. Those who failed to give the correct answers, related the question to the experiment and ended up making contradictive statements as they mentioned volume of thiosulphate. The question is not about the experiment shown but the collision theory in general. Some gave other factors that can affect rate of reaction such as temperature and surface area hence failing to address what the question wants being the effect of concentration.

Common response were: the greater the volume of sodium thiosulphate the greater the surface area leading to collisions and fast reaction, the higher the temperature the faster the reaction, particles of sodium thiosulphate collide with particles of water to make a fast reaction.

(f) Poorly done. Most candidates showed lack of understanding on limitations of an experiment therefore failed to give the correct limitations and improvements of their investigation. They stated common mistakes without showing how or where they limit the investigation. Common responses

for limitations were: parallax error, human error, reaction time, zero error, shortage of equipment and chemicals, not starting the stopwatch, take the readings below the meniscus. On the other hand, common responses for improvement were: repeat the experiment, using 2 stopwatches, increase aqueous sodium sulphate in the beaker. Centres are advised to emphasize more on the differences between limitations and errors/mistakes in an experiment.

The expected responses were: limitation improvement: subjectivity in stopping the timer when the cross is no longer seen, potential inaccuracies of the time taken by the learner to stop the timer, temperature fluctuations (between the experiments), difference in brightness (in the room), Inconsistency in mixing, parallax error when measuring volume (of sodium thiosulphate/water/nitric acid using measuring cylinder).

Note: repeating the experiments and using the average time applies to all limitations. repeating the experiments and using the average time, using an instrument which can measure the time taken for the cross to be no longer seen more accurately (such as automated timing devices), carry out the experiments in a temperature-controlled laboratory, using instruments that can detect changes in light intensity (such as spectrophotometer), repeating the experiments and using the average time, repeating the experiments for the same volume (of sodium thiosulphate/water/nitric acid)

(g) Fairly done. Some candidates failed to correctly list the books used in the investigation as references. Some omitted important information while others rearranged the information given incorrectly. Most candidates couldn't write their references correctly. They didn't include punctuation marks as expected in the APA referencing.

Common responses were. GCSE chemistry, Essential science for GCSE

Some were able to arrange the books in alphabetical order of the authors given in the two references.

ANSWER:

1. Earl, B. & Wilford, L. D. R. (2001). GCSE Chemistry. (2nd ed.). John Murray.

accept (2nd ed.) written in any format,

2. Susann, L. & Patefield, J. (1998). Essential Science for GCSE. Thomas Nelson & Sons.