PRINCIPAL EXAMINER'S REPORT

BOTSWANA
EXAMINATIONS
COUNCIL

2023

JCE GENERAL SCIENCE

Advancing learning, certifying your future

GENERAL COMMENTS

PAPER STRUCTURE

The paper consists of structured questions totaling eighty (80) marks. The paper assessed materials taught and learned during the three-year JC General science syllabus.

The items assessed candidates' ability to demonstrate the following skills:

1. Knowledge and understanding of science concepts
2. Application and problem-solving
3. Experimental and investigative skills

The paper consists of two sections.

Section A. This section is worth seventy (70) marks with compulsory items. It consists of short-answer questions designed to assess students' ability to respond to knowledge and understanding of science concepts, their application to everyday life situations, and demonstrations to solve problems.

Section B: This section is allocated 10 marks and is also compulsory. This section evaluates the candidates' abilities to transform data from one form to another and demonstrate experimental and investigative skills.

CONSIDERATIONS BY CENTRES

In order for candidates to enhance their overall performance, Centers are encouraged to assist candidates improve the following skills:

a) Experimental and investigative skills

Though majority of candidates are private and probably do home study, those who are enrolled in private schools and do private tutoring should be encouraged to practice experimental activities. Candidates continue to struggle with data interpretation and evaluation, as well as making observations and drawing conclusions.

b) Computation skills

Every year, candidates are given tasks to demonstrate achievement of the skill. In 2023, most candidates demonstrated that they could work with tasks involving numbers with ease, though changing the subject of the formula was a challenge to some candidates. Centres are also advised to assist candidates in ensuring that starting with a formula before completing any problem involving calculations is important. Candidates must also present their work in the space provided to avoid losing method marks.

c) Plotting a graph

Though candidates did relatively well in plotting of points from a table of results to a graph, they are still challenged when joining the plotted points. Candidates are expected to demonstrate appropriate skill in joining points using a line of best fit. The majority of candidates lacked this ability. Candidates were expected to use their free hand to join the points making a smooth curve, but instead majority used a ruler to join from point to point.

OVERALL PERFORMANCE BY CANDIDATES

The performance of 2023 cohort was somewhat better as compared to the previous years. Candidates were able to recall, relate scientific concepts and apply basic scientific knowledge to given situations better than the previous years. Nonetheless, candidates continue to show deficiencies in items that require science process skills, inferring relations of variables from experimental results and drawing conclusions basing on information presented on graphs and tables. Centres are encouraged to expose learners to hands on activities and items which will engage their high order thinking skills and apply themselves rather than just engage in simple recall of information.

Candidates continue to ignore mark allocation and hence continue to lose marks by leaving out certain points to get full award. Centres are also encouraged to advice candidates not to repeat the questions as this takes a lot of space for the answer.

OVERALL PERFORMANCE BY CANDIDATES

SECTION A

1	**(a) Fairly done.** Majority of the candidates were able to differentiate between magnification and making things bigger. Making an object bigger than it appears (which is to magnify) was taken to mean to making big. **(b) Fairly done.** Most candidates stated the functions of the chloroplast and cell wall instead of the vacuole. Common wrong responses were give cell shape, site for photosynthesis and transport nutrients. *Expected response:* ● *Storage* ● *Turgor pressure* ● *Regulation of pH* **(c) Poorly done.** It appears candidates were not familiar with parts of a cell, the majority labeled one of the chloroplast as a nucleus. It was also clear that candidates do not have the skill of labeling, where it is expected that draw a line and then write the name of the part. Some candidates just inserted an X at the part they were to label.

2	**Fairly done.** The concept of fertilization in humans is fairly grasped by most candidates as they were able to correctly insert the **oviduct** and **uterus** in the appropriate blanks. However, the function of the placenta and umbilical cord were interchanged and hence the majority of the candidates did not score the mark for the **placenta.**

3 (a)	**(i) &(ii) Poorly done.** It was evident that candidates were not familiar with the parts of the digestive system and their functions. Most ccandidates' could not identify what part X was, hence were unable to name the nutrient digested in it.

(b)	*Expected response: protein, the stomach has acidic condition which enables pepsin enzyme to digest proteins* **Poorly done.** Similar to (a) above most candidates could not state the function of the pancreas, hence could not access the marks. *Common wrong responses were: Produces bile, Emulsify fats.* *Expected response: Produces enzymes, Produces hormone insulin*
4 (a) (b) (c)	**Fairly done.** There is clear indication that candidates have a challenge in processing information from tables. Most candidates were able to access the mark for (i), X but were unable to identify W for (ii). **Poorly done.** Candidates just presented any nutrient test, mixing procedures for different tests. For example, describing a test for a simple sugar but giving positive results for starch test. Most candidates described the test for starch. *Expected response:* *Emulsion test: Add the food sample to 2cm³ of **ethanol**, shake and allow to settle. Add 2cm³ of distilled **water**. A **milky-white-emulsion** is a positive result.* *Translucent test: Rub the food sample on a piece of filter **paper**, allow to dry and hold the filter paper **against the light**. The presence of the t**ranslucent spot** is a positive result.* **Poorly done** Most candidates failed to state the food type and just listed other nutrients like proteins and fats. *Expected response: energy giving*

5(a) and (b)	**Poorly done.** Though there was adequate information in the diagram to use in order to identify the blood vessel as **capillary**, most candidates named it as vein or artery. Candidates were unable to recognize the **one cell thick wall** and the **movement of substances across the wal**l as shown in the diagram, features they could have used to identify the blood vessel. *Common wrong response: it is thin.*
(c)	**Poorly done.** Even though candidates were able to recognize that it is the white blood cell, they failed to explain what the cell is doing to the bacteria. Some candidates even failed to realize that N is not the cell/bacteria but the site/location in question. *Common wrong response: red blood cell is destroying the bacteria.* *Expected response: the bacteria is being engulfed by the white blood cell to fight infections.*

6 (a)	**Poorly done.** The concept of reproduction in general and being able to differentiate between asexual and sexual reproduction seemed a challenge for most candidates. They even failed to use the features (flowers) in the diagram to depict the kind of reproduction for the watermelon. *Expected response: sexual*
(b)	**Well done.** *Most candidates were able to state that it is the ovary that formed the fruit.*
(c)	**Poorly done**. Most candidates were not able to relate the bee to the process of pollination which later leads to fertilization. The concept of insect pollination seemed unknown to most candidates. Centres are urged to advise candidates to write complete responses that will match with the marks allocated. *Expected response: transfers pollen grains from the anther to the stigma, which leads to fertilization.*
(d)	**Fairly done.** Most candidates were able to state at least one of the following: *Bright coloured petals* *Scent* *Presence of nectar*

	Some candidates lost marks because of use of general terms/statements e.g. colored petals

7 (a)	**Fairly done.** Scientific facts and principles like starting a food chain with a producer are basic and not to be missed. Candidates also had a challenge in processing information from the table, hence could not link the numbers with which organism should follow which one in a food chain. *Expected response: Plants → Flea → Fish → Duck*
(b)	**Poorly done**. Common wrong response: plants cannot live without water. This was a clear indication that candidates did not understand the question. Candidates could not link the process of photosynthesis with the situation given. *Expected response: to get more direct sunlight/carbon-dioxide in order to enhance photosynthesis.*
(c)	**Well done.** Most candidates showed an understanding of the interaction of living things with each other and the environment, as they were able to state all the *possible expected responses being* ***provision of food, habitat and oxygen***.
(d)	**Poorly done**. Most candidates failed to interpret the information given in the table (identifying plants as producers and the place which had many plants than others). *Common wrong response: near the surface* *Expected response:* ***W***

8 (a)	**Well done.** Most candidates were able to correctly name the method of heat transfer as **radiation**, which was the expected response.
(b)	**Fairly done.** Majority of the candidates were able to distinguish between the terms absorption and conduction of heat, hence stated that black colour is a good conductor of heat or black attracts heat.

	Expected response: to increase absorption of heat
(c)	**Fairly done.** Emphasis should be on the name not the description of a colour. E.g. shiny and bright are not colours. **Common wrong response:** shiny *Expected response: white, silver*
(d)	**Poorly done.** Most candidates could not link the importance of the lid with methods of heat transfer and how to reduce heat loss. *Common wrong response: to keep away germs.* *Expected response: reduces heat loss by convection, reduces evaporation*
(e)	**(i) Fairly done.** Most candidates were too casual with the term "finished" and used it without considering how the meaning will be scientifically different in the context of the question. *Common wrong responses: can be replaced when finished.* *Expected response: energy resource that does not get depleted/used up.* **(i) Poorly done.** Most candidates missed the word "another" from the stem and missed the mark. *Common wrong responses: sun, solar energy* *Expected response: wind,biogas, cow-dung, hydroelectric energy*

9 (a)	**Well done.** Majority of the candidates were able to name the type of lens as Concave.
(b)	**Poorly done.** After naming the lens in (a), one would have assumed that candidates will show their knowledge of the behaviour of light passing through it, but to the contrary, most candidates converged the light rays instead.
(c)	**Poorly done.** Majority of the candidates lacked the knowledge of eye defects. The responses given were more of guess work than understanding. Use o properly drawn diagrams

	may benefit candidates to compensate practical work. *Common wrong responses: cataract, short sided, short eye defect, long sight* *Expected response: shortsightedness/ myopia*
(d)	**Poorly done.** Most candidates could not relate the diagram with refraction, hence failed to explain that light bends as it passes from one transparent medium to another, in this case from air to glass, and through glass to air. This is what they were to show at (b). *Common wrong response was explaining reflection.*

10(a)	**Poorly done.** This question required proper study of the diagram and step by step explanation of what is happening at each level of the tank. Paying attention to details. It was not enough just to say dirt is trapped by the stones and sand without differentiating the two. This led to candidates losing marks. *Common wrong responses: chlorination, distillation* *Expected responses: the description was to include the following:* ● *Insoluble large particles trapped by stones* ● *Small insoluble particles trapped by sand* ● *Clear water passes out.*
(b)	**Fairly done.** Most candidates were able to access the first part of the explanation (water collected is not safe for drinking) but failed to state the reason. *Common wrong response: water contains sand/small particles, water still has diseases.* *Expected response: contains harmful micro-organisms/ bacteria/germs.*
(c)	**Poorly done.** There was a clear indication that candidates did not grasp the concept of how hard water forms and how it can be solved. They also lacked knowledge of what kind of substances can be separated by filtration. *Common wrong responses: hard water does not lather easily; hard water still has diseases.* *Expected response: hard water contains dissolved salts which cannot be removed by filtration.*

11(a)	**Well done.** Most candidates were able to write the correct response - **lime water turns milky** *Common wrong responses: bubbles were produced, cream, relights a glowing splint.*
(b)	(i) **Fairly done.** Though majority of the candidates gave the correct response, there were still some who showed that they did not know what the scales in the hot water bottle is a carbonate which when reacted with an acid will produce **carbon-dioxide** which was the expected response. *Common wrong responses: oxygen, hydrogen and carbon-dioxide.* **(ii) Poorly done.** Even the candidates who got (i) correct, were unable to state the uses of the gas they named. Most candidates gave the uses of Oxygen. *Expected response: used in fire extinguishers, preparation of fizzy drinks, refrigeration*
(c)	**Poorly done.** Most candidates knew that vinegar contains an acid but were not familiar with the name. Since to them vinegar was the acid, the common wrong response was weak acid. *Expected response: acetic/ethanoic acid.*

12(a)	**(i) Well done.** Most candidates were able to read the scale as **8.3cm³** **(ii) Fairly done.** Some candidates struggled to calculate the mass, despite the formula given and the volume which was already determined at (i). generally, even without having to use the lengthy calculation, using the volume and the density of water as it appears in the formula, the mass was a given, equal to volume which is **8.3g**
(b)	(i) **Fairly done.** Most candidates managed to get at least two measurements correct. Some omitted the units in their response resulting in loss of marks. *Expected response: l = 3.1cm, w = 1.8cm, h = 2.1cm (with tolerance of ± 0.1)*

	(ii) Fairly done. With the formula given, candidates were to substitute which most found difficult. Some candidates who measured the dimensions in mm at (i) did not convert to cm, hence the units provided in the answer space did not match the calculations.
(c)	**Well done.** Since the units for density also gives the formula for its calculation, it was easier for candidates hence the majority got it right. *Expected response: 8.3/11.2 = 0.741g/cm³*
(d)	***(i, ii)* Poorly done.** It was evident that most candidates were not familiar with experimental errors, their causes and how they can be avoided.for those who attempted, the response did not match the situation given. *Common wrong response: human reaction error, zero error.* *Expected response: parallax error, Repeat measurements and average results*

SECTION B

13(a)	**Fairly done.** Most candidates managed to plot the points correctly. They however failed to use free hand to draw a smooth curve. Majority joined each point to the next using a ruler hence failing to come up with a smooth curve. *Expected response: All 8 points correctly plotted (3 marks)* *OR* *6 – 7 points correctly plotted (2 marks)* *OR* *3 – 5 points correctly plotted (1 mark)* *Smooth curve (1 mark)*
(b)	**Fairly done.** Candidates were expected to draw a vertical line from 20 watts until it reached the curve, and then a horizontal line from the curve to determine the number of bubbles. Most candidates gave an answer without showing the extrapolation hence losing marks. *Expected response: 37±1*

(c)	**Well done.** Majority of the candidates were able to name the gas as **oxygen** which was the expected response.
(d)	**Poorly done.** Most candidates failed to understand the demand of the question, they could not process the information presented in the table and the graph to give an appropriate explanation. *Common wrong responses: experiment has stopped* *Expected response: rate of photosynthesis has reached maximum.*
(e)	**Poorly done.** Drawing conclusions from information given in graphs and tables is still a challenge with many candidates.