FORM TP 2024054

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CARIBBEAN EXAMINATIONS COUNCIL

# CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

## BIOLOGY

### Paper 02 – General Proficiency

*2 hours 30 minutes*

744

**READ THE FOLLOWING INSTRUCTIONS CAREFULLY.**

1. This paper consists of SIX questions in TWO sections. Answer ALL questions.
2. Write your answers in the spaces provided in this booklet.
3. Do NOT write in the margins.
4. Where appropriate, answers should be illustrated with diagrams.
5. If you need to rewrite any answer and there is not enough space to do so on the original page, you must use the extra lined page(s) provided at the back of this booklet. **Remember to draw a line through your original answer.**
6. **If you use the extra page(s), you MUST write the question number clearly in the box provided at the top of the extra page(s) and, where relevant, include the question part beside the answer.**

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**DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.**

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## SECTION A

**Answer ALL questions.**

**1.** An experiment was set up as shown in Figure 1.

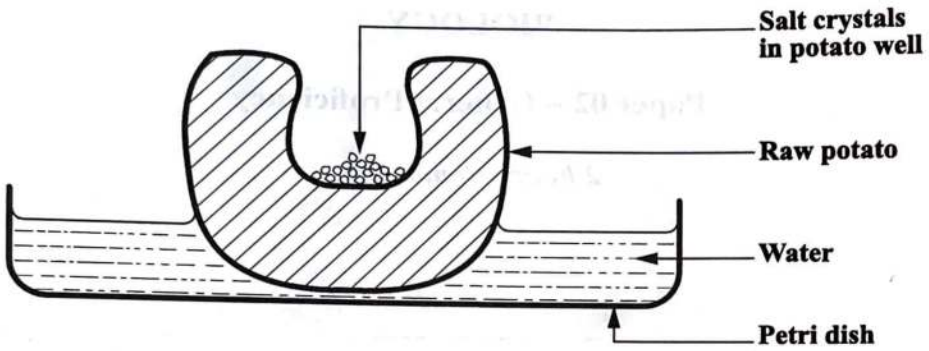



**Figure 1. Experiment**

*Source: https://ib.bioninja.com.au/standard-level/topic-1-cell-biology/12-ultrastructure-of-cells/cell-micrographs.html*

(a) Draw a large, clearly labelled diagram in the box provided **on page 5** to show what would be observed from this experiment after two hours.

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**(4 marks)**

(b) (i) Suggest a suitable title for the experiment in Figure 1.

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**(1 mark)**

(ii) Suggest a suitable hypothesis for the experiment in Figure 1.

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**(2 marks)**

(c) The raw potato in the experiment in Figure 1 is replaced by a boiled potato. However, the remainder of the procedure is unchanged.

Suggest TWO ways in which the observations may differ when the boiled potato is used.

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**(2 marks)**

(d) Table 1 lists some observations regarding diffusion and osmosis. Complete Table 1 by stating whether EACH observation occurs by diffusion or osmosis and giving a reason for your choice.

**TABLE 1: DIFFUSION AND OSMOSIS**

| Observation | Process | Reason |
|---|---|---|
| Amino acids (from digested food) pass across the wall of the small intestine. | | |
| Garden slugs shrivel when salt is sprinkled on them. | | |
| Saltwater fish die when they are placed into freshwater aquaria. | | |
| Oxygen moves from the alveoli to the blood. | | |

**(8 marks)**

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(e) At school, Mona is studying the structure of specialized plant and animal tissues such as xylem vessels and red blood cells. She notes that xylem vessels and red blood cells have unique structures.

(i) Explain to Mona TWO ways in which the structure of the xylem vessel is uniquely suited for its functions. Write your responses under the headings in Table 2.

**TABLE 2: STRUCTURE AND FUNCTION OF XYLEM VESSELS**

| Structure of xylem vessels | Explanation |
|---|---|
| 1. ..... ..... ..... | ..... ..... ..... ..... ..... |
| 2. ..... ..... ..... | ..... ..... ..... ..... ..... |

**(4 marks)**

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(ii) Explain to Mona TWO ways in which the structure of the red blood cell is uniquely suited to its functions. Write your responses under the headings in Table 3.

**TABLE 3: STRUCTURE AND FUNCTION OF RED BLOOD CELLS**

| Structure of red blood cells | Explanation |
|---|---|
| 1. ..... ..... ..... | ..... ..... ..... ..... ..... |
| 2. ..... ..... ..... | ..... ..... ..... ..... ..... |

**(4 marks)**

**Total 25 marks**

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**2.** (a) Figure 2 is a series of randomly placed diagrams, labelled A–E, showing the stages of mitosis in a plant cell.

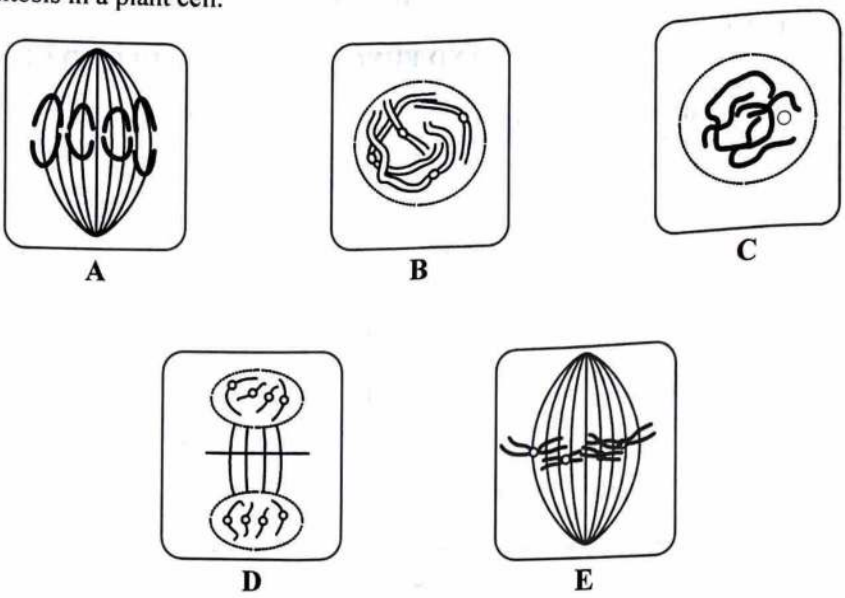



**Figure 2. Mitosis in a plant cell**

*(Holbrook Bio I, https://groups.diigo.com/group/laycomfievie/content/answers-to-mitosis-worksheet-10321668)*

(i) How many chromosomes are in the parent cell of this plant?

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**(1 mark)**

(ii) Using the letter labels A–E to show order, state the stages in the **correct** order of mitosis.

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**(2 marks)**

(iii) State TWO reasons why mitosis is important to living organisms.

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**(2 marks)**

(b) List TWO ways by which genetic variation occurs in living organisms.

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**(2 marks)**

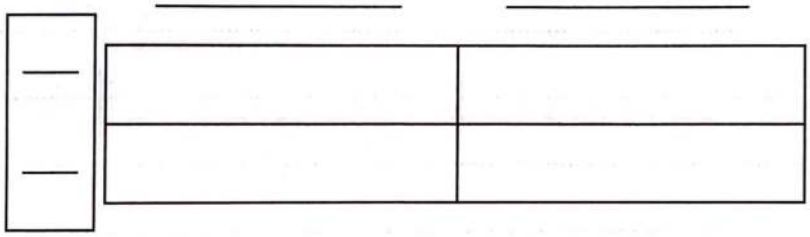
(c) "The probability of a child being male or female is the same each time a child is conceived." Determine the accuracy of this statement by completing the following genetic diagram.

Parents' phenotypes ..... X .....

Parents' genotypes ..... X .....

Gametes ..... ..... x ..... .....

Offspring genotypes



Conclusion

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**(6 marks)**

(d) List the TWO possible genotypes of a female whose father is a haemophiliac and whose mother carries the allele for haemophilia.

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**(2 marks)**

**Total 15 marks**



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**3.** (a) In the appropriate columns in Table 4,

(i) list TWO substances **other than** starch and sugar, that are stored in plants. **(2 marks)**

(ii) state where in the plant EACH substance listed in (a) (i) is stored. **(2 marks)**

**TABLE 4: PLANT STORAGE**

| **(i) Substance Stored in Plant** | **(ii) Site of Storage in Plant** |
|---|---|
| | |
| | |

(b) State THREE reasons why storing food is important to living organisms.

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**(3 marks)**

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(c) Figure 3 is a graph that shows changes in the amount of starch, sugar and protein in a seed during the pre-germination, germination and post-germination stages.

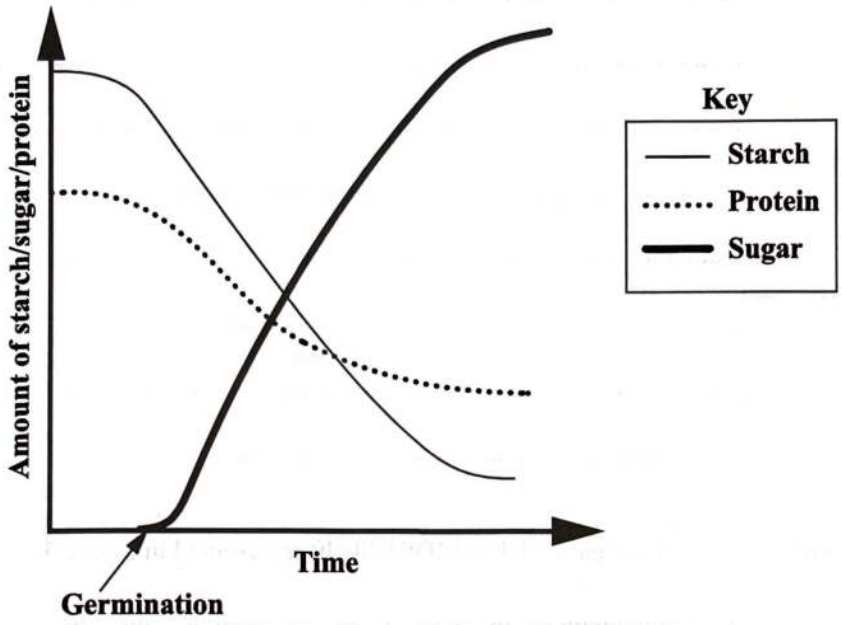



**Figure 3. Graph showing changes in the amount of starch, sugar and protein in a seed during pre-germination, germination and post-germination stages**

(i) Explain the decrease in the amount of protein in the seed as it germinates.

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**(3 marks)**



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(ii) Explain the change in the level of starch as the seed germinates.

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**(2 marks)**

(iii) Name the sugar which is MOST likely represented in Figure 3.

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**(1 mark)**

(iv) Outline ONE reason why starch is the preferred storage material in plants.

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**(2 marks)**

**Total 15 marks**

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## SECTION B

**Answer ALL questions.**

**4.** (a) Write a balanced chemical equation to show the reactants and final products of aerobic respiration.

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**(2 marks)**

(b) State TWO ways in which aerobic respiration differs from anaerobic respiration. Write your responses in the appropriate columns in Table 5.

**TABLE 5: AEROBIC AND ANAEROBIC RESPIRATION**

| Aerobic Respiration | Anaerobic Respiration |
|---|---|
| 1. ..... | ..... |
| ..... | ..... |
| ..... | ..... |
| ..... | ..... |
| ..... | ..... |
| ..... | ..... |
| 2. ..... | ..... |
| ..... | ..... |
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**(4 marks)**

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(c) James represented his school at the national sports meet and ran the 100 m race. After winning the race, James could not immediately speak with the reporters because he was gasping for air and was also feeling intense pain.

His friends helped him off the track to rest a bit and catch his breath. With time, James recovered and was able to complete his interview and celebrate with his team.

Explain why James was feeling intense pain and gasping for air after his race.

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**(4 marks)**

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(d) Mr Smith has been smoking cigarettes for ten years. During his most recent doctor visit, the doctor outlined many negative effects of smoking. Mr Smith agreed that smoking was not good for his health.

(i) Explain TWO negative effects that smoking for such a long period would have had on Mr Smith's health.

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**(4 marks)**

(ii) Suggest ONE action that governments can take to address smoking on a national level.

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**(1 mark)**

**Total 15 marks**

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5. (a) Define EACH of the following terms.

(i) Stimulus

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(ii) Response

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**(2 marks)**

(b) (i) Figure 4 shows the reflex arc diagram for the knee jerk reflex. Identify EACH of the parts labelled A, B, C and D.

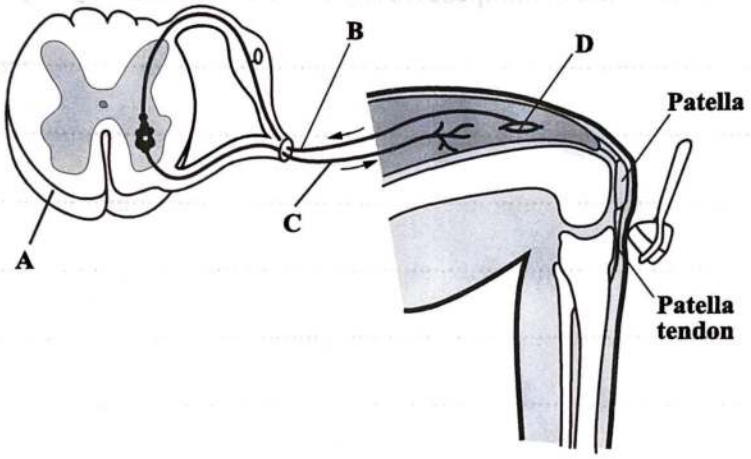



**Figure 4. Reflex arc diagram for the knee jerk reflex**

A .....

B .....

C .....

D .....

**(4 marks)**

(ii) Usually, people who undergo the knee jerk reflex test respond to the sharp tap on the patellar tendon with a sudden kicking movement of the lower leg. Timothy did not have this response and, instead, sat still during the test.

Suggest ONE biological reason why Timothy did not have the expected knee jerk reflex.

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**(1 mark)**

(c) Molly was extremely concerned when she realized that there were hundreds of millipedes in her basement. The pest control team explained to Molly that the millipedes were likely responding positively to stimuli in the basement.

Explain the response of millipedes to any TWO stimuli that may be present in the basement.

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**(6 marks)**

(d) *Daphnia* are zoo plankton invertebrates which come to the surface of the water while it is dark, so they can feed on algae. However, in nearshore communities artificial lighting is used to light the waterways such as ponds and rivers.

Suggest TWO consequences of the disruption to the water ecosystem which is caused by artificial lighting.

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**(2 marks)**

**Total 15 marks**

**6.** (a) List FOUR birth control methods.

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**(4 marks)**

(b) Janet does not want to become pregnant at this time. She is therefore seeking recommendations for a suitable birth control method.

Outline to Janet how any TWO of the methods listed in (a) work to prevent pregnancy.

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**(2 marks)**

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(c) Table 6 shows HIV and AIDS summary statistics for the Caribbean in the year 2020 obtained from a UNAIDS fact sheet.

**TABLE 6: HIV AND AIDS STATISTICS FOR THE CARIBBEAN, 2020**

| People Living With HIV | Total New HIV Infections | AIDS-related Deaths | People Accessing Treatment |
|---|---|---|---|
| 330 000 | 13 000 | 6000 | 220 000 |

*Source: UNAIDS Fact Sheet, World Aids Day, 2022. unaids.org*

(i) Calculate the percentage of HIV-positive persons in the Caribbean who did NOT access treatment in 2020.

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**(2 marks)**

(ii) Suggest TWO reasons why people, despite having HIV, may not access treatment for the disease.

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**(4 marks)**

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(iii) Persons with AIDS may sometimes die because they have an opportunistic (secondary) infection such as tuberculosis, which is caused by a bacterium. Explain why persons with AIDS may die as a result of an opportunistic (secondary) infection.

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**(3 marks)**

**Total 15 marks**

END OF TEST