School	*Candidate's Name (PLEASE PRINT)*

WINCHESTER
COLLEGE

Election

2022

Science

BIOLOGY

THEORY SECTION

Recommended time: 20 minutes

Write all your answers in the spaces on this question paper

1 (a) Draw a typical plant cell. Only label the features that distinguish it from an animal cell.

[3]

(b) Plants are photoautotrophic organisms. Using the energy from the Sun they convert carbon dioxide into glucose to be used in cellular reactions.

Name the reaction that converts carbon dioxide into glucose, and state its importance.

Process: .....

Importance: ..... [2]

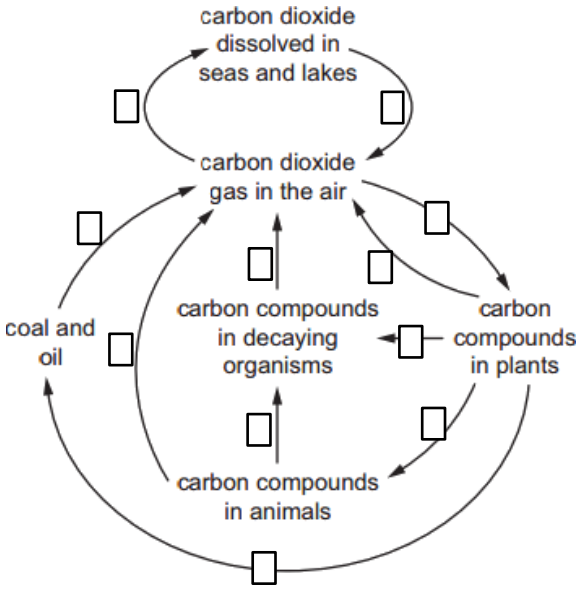

Fig 1 – The carbon cycle

(c) Mark on **Fig 1**, by placing an 'X' in the corresponding box, every arrow that shows the return of carbon atoms to the atmosphere via the process of respiration. [1]

The rate of glucose production is affected by the intensity of light. Other factors associated with the weather also affect the rate of glucose production. These factors show daily and yearly variation.

Plants can manufacture glucose over a wide range of temperatures typically between 15°C and 40°C. The temperature range of a particular plant affects where it is able to grow.

Table 1 contains the optimum and maximum temperature ranges for six crop plants. **Fig 2** shows the highest and lowest average monthly temperatures recorded in Saint Helier, Jersey.

Crop	Temperature (°C)		
	Optimum range	Maximum	Minimum
Maize	22 – 25	34	20
Potato	15 – 20	34	12
Rice	30 – 33	40	18
Soya beans	25 – 28	40	10
Wheat	20 – 25	38	5
Maize	22 – 25	34	20

Table 1 –Temperature ranges of six common crops

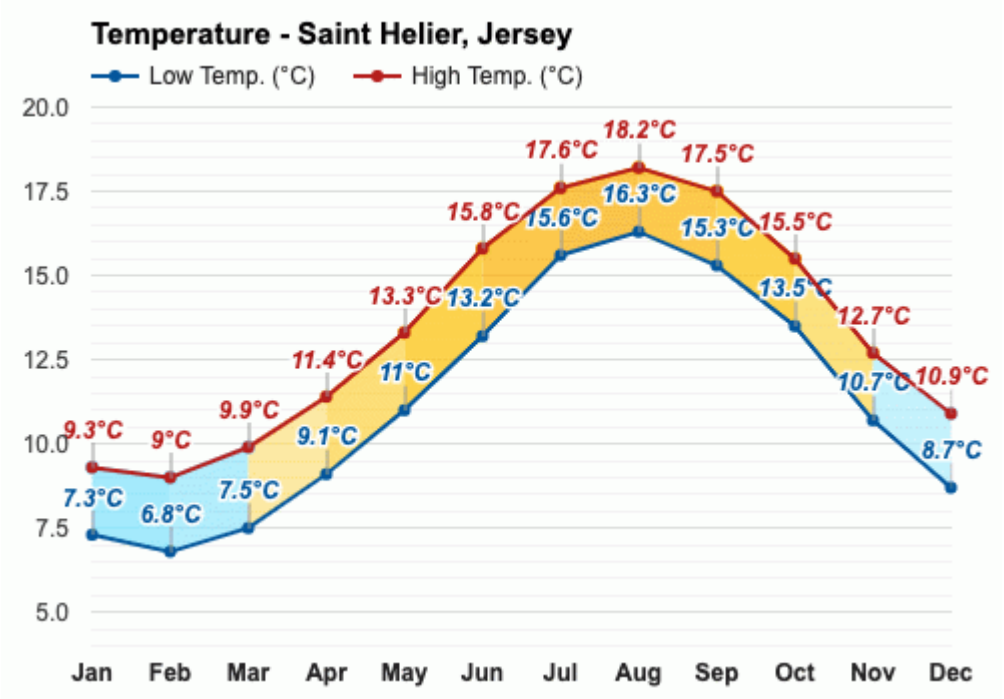

Fig 2 – Highest and lowest average monthly temperatures in Saint Helier, Jersey

(d) Using the information given in **Table 1** and **Fig 2**, state which crop a Jersey farmer should grow. Explain your answer.

.....

.....

.....

.....

.....

..... [4]

2 Carnivorous plants are adapted for capturing and digesting insects. These plants have evolved a variety of trapping mechanisms, designated as active or passive based on whether they move to capture prey. One example of an active trapping mechanism are snap traps, such as those of a Venus flytrap *(Dionaea muscipula)*. This plant uses the rapid movement of a modified leaf to catch its prey. **Fig 3** shows a leaf blade composed of two lobes hinged together by a midrib.

Fig 3 – The leaf-blade of *Dionaea muscipula*

The trapping process is divided into four distinct phases: the initial snap, the tightening phase, the sealing phase and the reopening phase.

The **initial snap** is brought about by trigger hairs on the leaf-blade. Closing of the trap requires the prey to touch one or more hairs in quick succession. Once activated the trap will close within a tenth of a second. If the initial snap is successful in capturing an insect, the trap will begin the **tightening phase**. The struggling prey will continue to touch the trigger hairs, signally the continued tightening of the leaf-blade. During the **sealing phase**, the teeth of the trap bend out allowing the rims of the lobes to seal tightly together. Once sealed, enzymes are released and digestion begins, a process that lasts between five to twelve days. Following the absorption of the digestive fluid, the trap resets in the **reopening phase**. After several captures, the trap will cease to function.

(a) Trigger hairs are visible in **Fig 3**. Suggest two reasons why a leaf-blade does not close the instant a single trigger hair is touched.

.....

.....

..... [2]

Plants can use two mechanisms to bring about movement in response to a stimulus. A **tropic response** is a growth response that involves the unequal elongation of cells in one part of the plant. A **nastic response** occurs more quickly and can be caused by changes in the water (turgor) pressure within cells.

(b) Research is ongoing about the precise mechanism by which a leaf-blade closes. Use your knowledge, and the information given above, to suggest whether the initial snap of a leaf-blade is brought about by a tropic or nastic response within the midrib cells. Justify your answer.

.....

.....

.....

..... [3]

(c) Plants take up nutrients from the soil through their roots. Suggest one of these nutrients.

..... [1]

(d) How is this nutrient taken up by normal plants?

..... [1]

(e) How might a plant without this nutrient look?

.....

..... [1]

Some species of carnivorous plants use a pitfall trap. One such plant is the purple pitcher plant, *Sarracenia purpurea*. Its pitfall traps are a hollow, hooded leaf (or pitcher) filled with liquid that passively collects and digests prey.

Fig 4 –*Sarracenia purpurea*

The pitcher shown in **Fig 4** stores rainwater. Secretions from the hood of the pitcher attract prey insects, which fall into the pitcher and drown. While the pitchers do secrete digestive enzymes, this level diminishes as the pitcher ages. Young pitchers produce the highest concentration of enzymes and also capture the most prey. Older ones become less effective.

Some mosquito larva, *Wyeomyia smithii*, live inside pitchers. Together with other organisms, they form a community shown in **Fig 5** that is beneficial to plants.

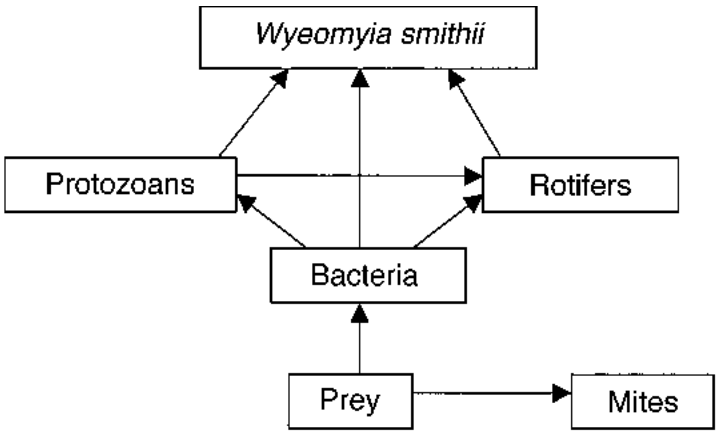

Fig 5 – A food web found in *Sarracenia purpurea* pitchers

(f) Suggest a reason why it is benefical for young pitchers to secrete the highest concentration of digestive enzymes, but as the plant gets older the quantity of enzymes goes down.

.....

.....

..... [2]

(g) Refering to **Fig 5**, explain why the *Wyeomyia smithii* can be described as both a secondary consumer and a tertiary consumer.

.....

.....

..... [2]

(h) Circle every term that can be used to describe the bacteria in **Fig 5**.

Producer **Autotroph** **Eukaryote**

Heterotroph **Decomposer** **Prokaryote**

[1]

Fig 6 shows the energy transferred to each organism in a simple food chain. The size of the arrow is proportional to the energy available to each trophic level.

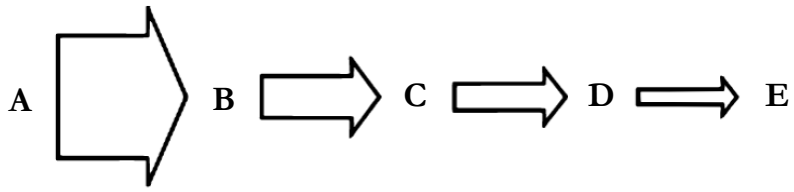

Fig 6 – The transfer of energy through a food chain

(i) Explain why the arrows in **Fig 6** get smaller in size.

.....

.....

..... [2]

End of this paper

References

Fig 1:
IGCSE Biology Paper-2 Specimen Questions with Answers 16 to 18 - ExamTestPrep
https://www.examtestprep.com/IGCSE/Biology-0610/Paper-2/Solved-Specimen-Questions/Part-7.html

Table 1:
https://www.bbc.co.uk/bitesize/guides/zx8vw6f/revision/3#:~:text=Plants%20can%20photosynthesise%20over%20a%20wide%20range%20of,and%20affects%20where%20certain%20crops%20can%20be%20grown.

Fig 2: https://www.weather-atlas.com/en/jersey/saint-helier-weather-march

Fig 3: Venus flytrap Information - FlytrapCare.com
https://www.flytrapcare.com/venus-fly-trap-information/

Fig 4: Sarracenia purpurea (Purple Pitcher Plant) (gardenia.net)
https://www.gardenia.net/plant/sarracenia-purpurea

[PDF] RESOURCE AND TOP-PREDATOR REGULATION IN THE PITCHER PLANT (SARRACENIA PURPUREA) INQUILINE COMMUNITY | Semantic Scholar

The Fascinating Microcosm of the Pitcher Plant. | The Olive Tree (wordpress.com)