CONVENT OF THE HOLY INFANT JESUS SECONDARY
Preliminary Examination in preparation for
the General Certificate of Education Ordinary Level 2023

CANDIDATE NAME

CLASS

REGISTER NUMBER

BIOLOGY

6093/02

Paper 2 Written

13 September 2023

1 hour 45 minutes

Additional Materials: Nil

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number in the spaces provided on all the work you hand in.
Write in dark blue or black ink on both sides of the paper.
You may use an HB pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, glue, correction fluid or correction tape.

Section A
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B
Answer **all** questions.
Write your answers in the spaces provided on the question Paper.
Question 8 is in the form of an Either/Or question. Only one part should be answered.

The use of an approved scientific calculator is expected, where appropriate.

You are advised to spend no longer than one hour on Section A and no longer than 45 minutes on Section B.

The number of marks is given in brackets [ ] at the end of each question or part question.

Section A
Answer **all** questions.
Write your answers in the spaces provided.

1 Some laundry detergents used to wash clothes contain enzymes.

These enzymes break down the molecules that cause stains.

(a) Suggest enzymes that may be components of a laundry detergent that will break down these stains:

(i) blood .....

(ii) fat. ..... [1]

(b) Savinase is a protease enzyme produced by genetically engineered bacteria.

The enzyme is a component of laundry detergents.

Fig. 1.1 shows the results of an investigation into the effects of temperature and pH on the rate of Savinase activity.

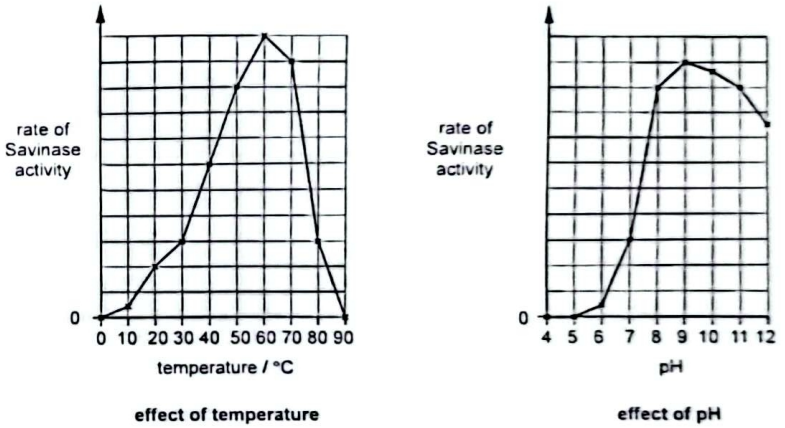

Fig. 1.1

(i) Describe how the effect of temperature on Savinase activity differs from the effect of temperature on a protease that functions in the human stomach.

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(ii) Suggest why laundry detergents that contain Savinase also contain chemicals that dissolve to form an alkaline solution.

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(iii) After washing clothes using laundry detergents, the waste water is sometimes released into the environment.

This waste water contains inorganic phosphate ions that are also found in fertilisers.

Explain the harmful effect on aquatic life of releasing this waste water into the environment.

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[Total: 10]

[Turn over

2 A scientist investigated the effect of temperature on the mass of leaves picked from a tea plant, *Camellia sinensis*.

- Three samples of leaves were picked and the mass of each sample of leaves was recorded.
- Each sample of leaves was kept at a different temperature for four hours.
- After four hours, the mass of each sample of leaves was measured and recorded again.
- The scientist then calculated the final mass as a percentage of the initial mass for each sample.

Fig. 2.1 shows the results.

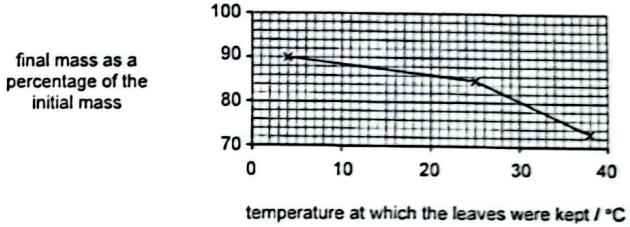

Fig. 2.1

(a) Explain the results shown in Fig. 2.1.

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(b) State one factor, other than temperature, that would increase the loss of mass from the leaves of a plant.

.....[1]

[Total: 6]

3 Fig. 3.1 shows the internal structure of the human heart and associated blood vessels.

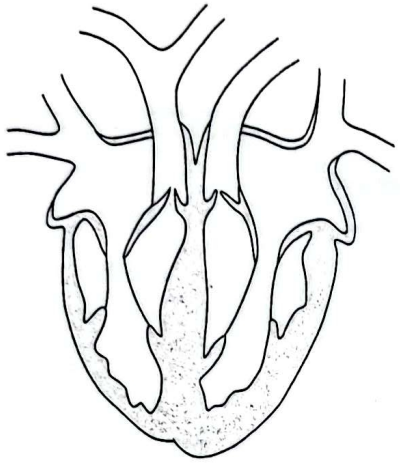
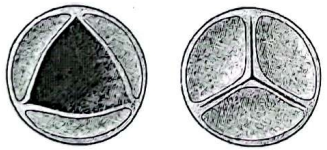


Fig. 3.1

(a) Use label lines and labels to identify on Fig. 3.1 a blood vessel(s) that carry oxygenated blood. [3]

(b) Blood flows through a valve when the left ventricle of the heart contracts. Fig. 3.2 shows this valve in the open and closed positions.

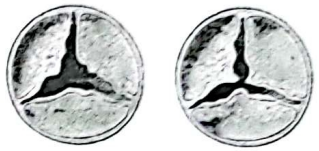


valve open valve closed

Fig. 3.2

(i) Label, using the letter X, on Fig. 3.1, the location of this valve. [1]

A small number of people develop a medical condition that causes changes to this valve. Fig. 3.3 shows the same heart valve in the open and closed positions in a person with this condition.



valve open valve closed

Fig. 3.3

(ii) Explain how this medical condition will affect the flow of blood when the left ventricle contracts and relaxes.

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(iii) Describe and explain the effect of this condition on the ability of the person to exercise.

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[Total: 11]

4 Fig. 4.1 shows how several strawberry plants can be grown commercially.

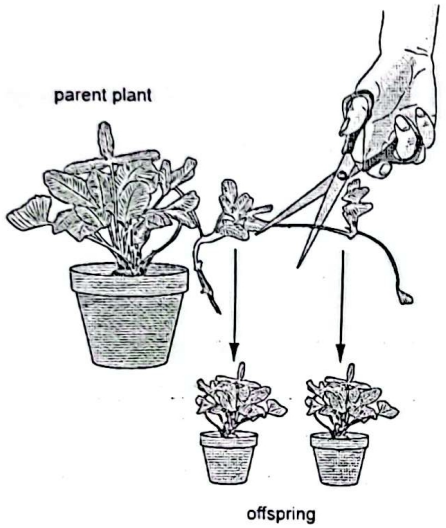

Fig. 4.1

(a) Explain the type of reproduction that produces plants by the method shown in Fig. 4.1.

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(b) Explain why plants grown commercially are often produced by the type of reproduction shown in Fig. 4.1.

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[Total: 6]

5 (a) Two tomato plants that produce red fruits were bred together.

This cross produced 71 offspring plants with red fruits and 26 offspring plants with yellow fruits.

Complete the genetic diagram to show this cross.

Select suitable letters to represent the alleles and decide which allele will need a capital letter and which allele will need a lower case letter.

letter representing the allele for red fruit .....

letter representing the allele for yellow fruit .....

parental phenotypes red fruit × red fruit

parental genotype ..... × .....

gametes ..... , ... × ..... , ...

offspring genotypes ....

expected phenotype ratio ..... red fruit : ..... yellow fruit

actual phenotype ratio 71 red fruit : 26 yellow fruit

[5]

(b) Researchers carried out some experiments on tomato plants that were homozygous for fruit colour.

State how researchers could be sure that the fruits came from homozygous plants.

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.....[1]

(c) The researchers analysed the concentration of the pigments in tomato fruits:

- before they were ready to eat (unripe)
- when they were ready to eat (ripe)

The results of the analysis are shown in Table 5.1.

Table 5.1

	chlorophyll concentration / mg per g of tomato fruit	lycopene concentration / mg per g of tomato fruit
unriped red fruit	10.0	0.0
riped red fruit	1.2	105.7
unriped yellow fruit	6.2	0.0
riped yellow fruit	0.4	0.7

Use the information in Table 5.1 to compare the changes in pigments in the red fruit and yellow fruit as they ripen.

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[Total: 9]

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6 Fig. 6.1 shows the stages involved in protein synthesis.

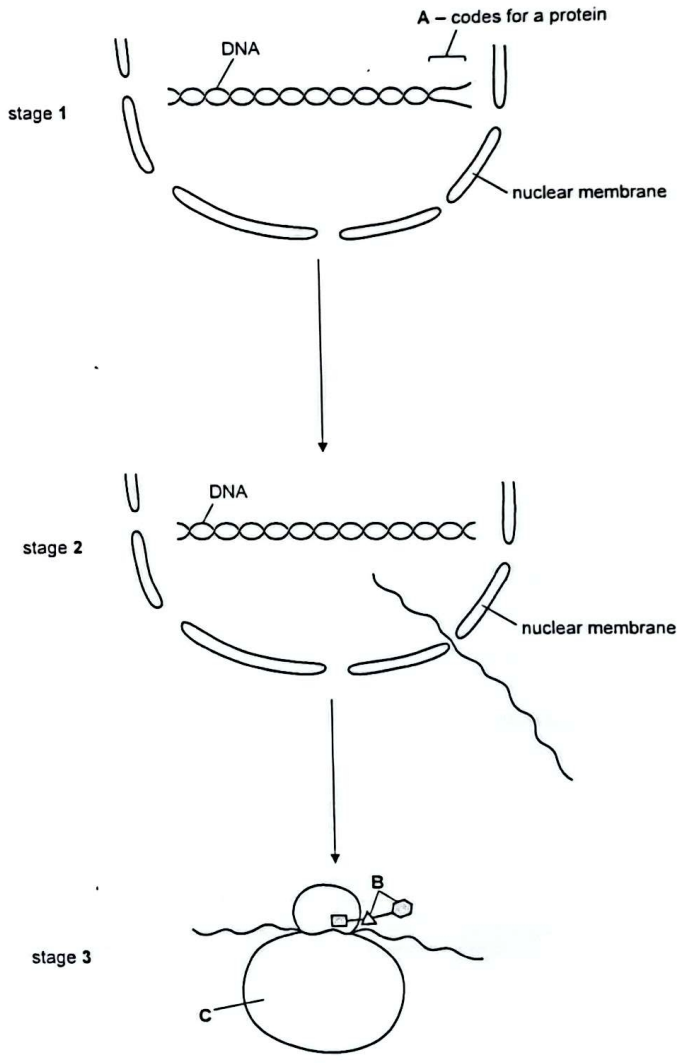

Fig. 6.1

(a) (i) State the name of the parts represented by the letters **A** and **C** in Fig. 6.1.

A .....

C .....

[2]

(ii) Describe the events that occur during stage **2** in Fig. 6.1.

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.....[2]

(iii) State what determines the order in which the parts labelled **B** are assembled.

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(b) The shape of a protein is very important for its function.

Explain the importance of shape for the function of an enzyme.

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[Total: 8]

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CANDIDATE NAME

CLASS

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Section B

Answer **three** questions.

Question **9** is in the form of an **Either / Or** question. Only one part should be answered.

Section B

Answer **three** questions.

Question **9** is in the form of an **Either / Or** question. Only one part should be answered.

7 Capsaicin is a compound that gives people the sensation of feeling hot when it is put on the skin.

Researchers applied capsaicin to the skin of some volunteers and measured blood flow through their skin at different temperatures.

Fig. 7.1 shows the results of the investigation.

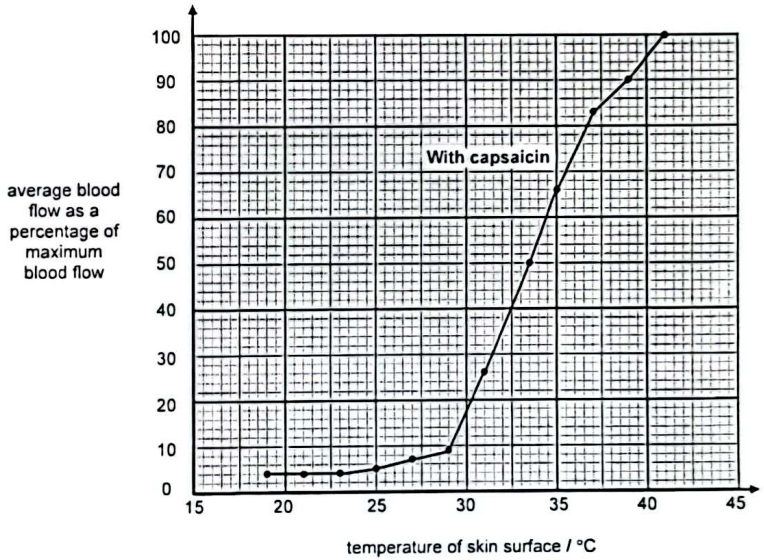

Fig. 7.1

The researchers also measured the blood flow through the skin of the volunteers without applying capsaicin at different temperatures.

Table 7.1 shows the results of the investigation.

Table 7.1

average blood flow as a percentage of maximum blood flow	temperature of skin surface / °C
4	19
4	21
4	23
5	25
5	27
6	29
9	31
13	33
20	35
30	37
54	39
100	41

(a) (i) Plot the data from Table 7.1 on Fig. 7.1. [2]

(ii) Use the information in Fig. 7.1 to describe the effect of increasing the temperature of the skin surface on blood flow to the skin **without** capsaicin.

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(b) Explain the mechanism that increases blood flow through the skin.

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(c) State the difference between average blood flow for the treatments (with and without capsaicin) at 35 ° C.

Space for working.

..... % [1]

(d) The researchers thought that capsaicin stimulated receptors in the skin.

Explain the process by which capsaicin could reach these receptors.

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[Total: 12]

8 The kapok tree is a flowering plant that grows rapidly to become one of the tallest trees in a tropical rainforest ecosystem. Climbing plants wind up its stem and the tree provides a habitat for insect-eating birds and frogs. Bats feed on the nectar from its flowers and pollinate them so they can produce small, light seeds. Insects feed on its leaves and when the leaves fall to the ground, they will come into contact with soil bacteria and fungi.

(a) Use the information provided to draw a food chain for this tropical rainforest in the space provided.

[2]

(b) Suggest and explain ways in which being tall may be helpful for the survival of this tree species.

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(c) Explain why the bacteria and fungi found in the rainforest soil are important in this ecosystem.

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[Total: 8]

Either

9 (a) The pressure in the lungs of a student before and during the start of a volleyball match was recorded.
The results are shown in Fig. 9.1.

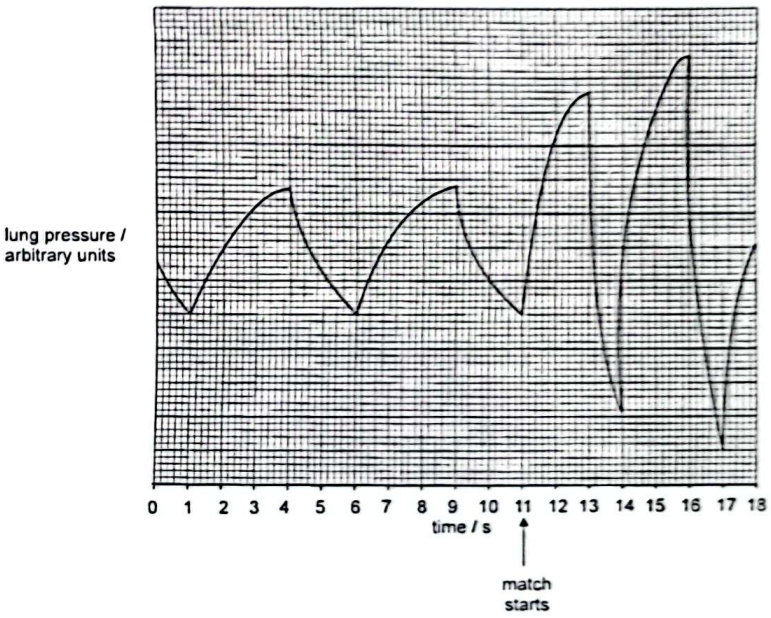

Fig. 9.1

(i) Use the results in Fig. 9.1 to calculate the breathing rate before the start of the match. Express your answer to the nearest whole number.

Show your working.

..... breaths per minute
[2]

(ii) Use the results in Fig. 9.1 to describe how the pattern of breathing during the match is different from the pattern of breathing before the match starts.

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(b) A chest injury results in muscle sprain of the intercostal (rib) muscles.

Other than pain and difficulty of breathing, suggest possible effects this would have on the process of inhalation.

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[Total: 10]

Or

9 Sea turtles are reptiles which lay eggs.

The sex of the sea turtle offspring is affected by the temperature at which the eggs are kept.

Scientists investigated the effect of temperature on the sex of sea turtle offspring.

Fig. 9.2 shows the results.

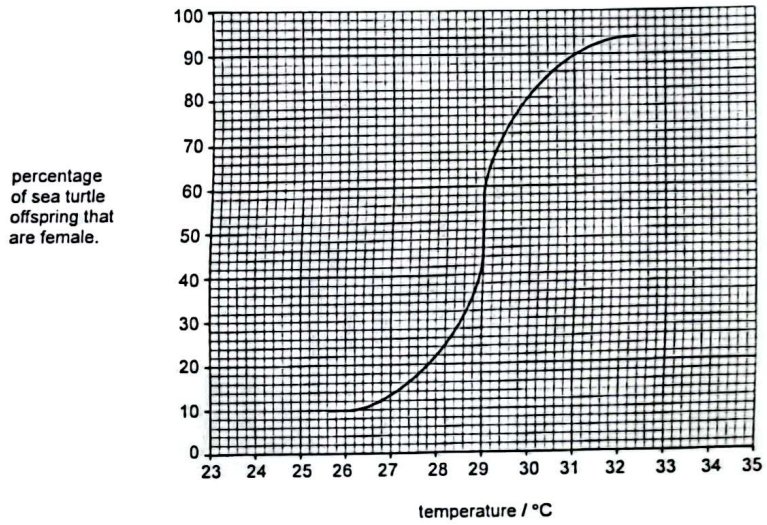

Fig. 9.2

(a) (i) State the temperature at which 22% of the sea turtle offspring are female.

..... °C
[1]

(ii) Use the data shown in Fig. 9.2 to describe the effect of temperature on the sex of the sea turtle offspring.

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(b) Placental abruption is a condition in which the placenta starts to detach from the inner wall of the uterus.

Other than pain and loss of blood, suggest possible effects this would have on the functioning of the placenta.

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[Total: 10]

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