

Name: _____

Index Number: _____

Class: _____



TEMASEK SECONDARY SCHOOL

Preliminary Examination 2024

Secondary 4 Express

BIOLOGY

6093/02

Paper 2

1 hour 45 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Do not open the booklet until you are told to do so.

Write your name, index number and class on all the work you hand in.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams, graphs or rough working.

Do not use staples, paper clips, glue or correction fluid.

Section A

Answer **all** questions.

Write your answers in the spaces provided.

Section B

Answer **one** question.

Write your answers in the spaces provided.

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

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

For Examiner's Use	
Section A	/70
Section B	/10
Total	/80

This document consists of **23** printed pages and **1** blank page.

SECTION A

Answer **all** questions.

- 1 Fig. 1.1 shows flowers of the sweet pea plant.



Fig. 1.1

- (a) Using information from Fig. 1.1, suggest how sweet pea flowers might be pollinated. Give a reason for your answer.

.....
[1]

- (b) Fig. 1.2 shows a developing fruit and the remains of a flower.

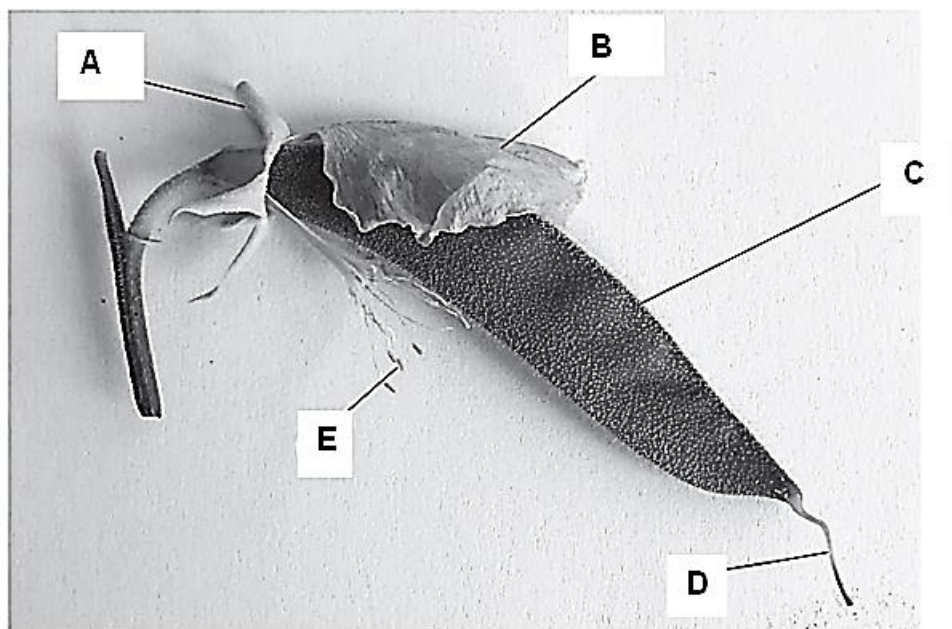


Fig. 1.2

(i) Name the parts labelled **A** to **D** in Fig. 1.2.

A.....

B

C.....

D

[2]

(ii) State the role played by part **E** during the flowering stage.

.....[1]

(iii) Circle **and** name the part of the flower on Fig. 1.2 that has a similar role to the vagina. Explain how they are similar.

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.....[2]

[Total: 6]

- 2 Tumours are groups of abnormal cells that divide uncontrollably, forming lumps or growth. Tumours that invade or spread into other tissues are called cancer.

Fig. 2.1 shows where three of the same type of tumour were found in a patient.

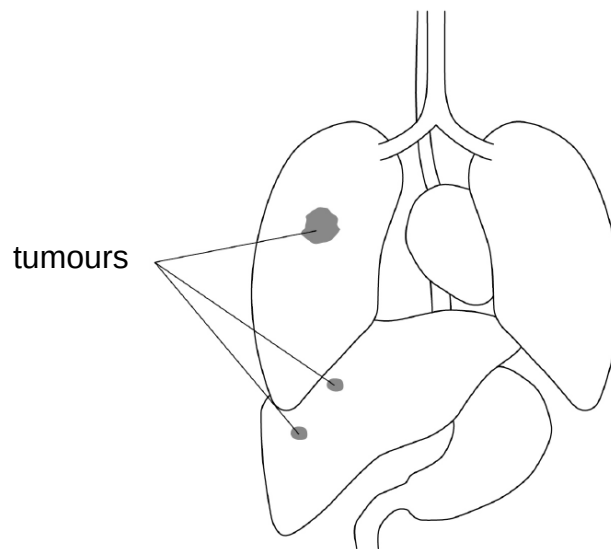


Fig. 2.1

- (a) Suggest **and** explain one of the patient's habits that could have increased his risk of lung cancer.

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.....[1]

- (b) Suggest how the tumour in the lungs affects his breathing.

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.....[3]

- (c) The tumour blocks a duct in the liver that connects it to the gall bladder.

Explain how **and** why the patient's digestion is affected.

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.....[2]

- (d) Explain whether lung cancer is an infectious or non-infectious disease.

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.....[1]

[Total: 7]

- 3 Fig. 3.1 shows a farmer using her bicep muscles in her right arm to help her lift a tool.



Fig. 3.1

- (a) Explain whether lifting her tool is a voluntary or involuntary action.

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[1]

- (b) Describe the nervous pathway to the bicep in lifting her tool.

.....

[3]

- (c) The farmer has **not** used any insecticides or artificial fertilisers on the crop.

Explain how this may help the local environment.

.....

[2]

[Total: 6]

4 Human body temperature is controlled within very narrow limits.

Scientists investigated the effect of drinking ice-cold water on:

- internal body temperature
- the rate of sweating

This is the method used.

- 1 Sit a person inside a room kept at a constant temperature of 25°C.
- 2 Measure the person's internal body temperature near the brain.
- 3 Measure the person's rate of sweating.
- 4 After 20 minutes, give the person 500 cm³ of ice-cold water to drink.
- 5 Continue to measure the person's internal body temperature and sweating rate for a further 50 minutes.

Fig. 4.1 and Fig. 4.2 show the scientists' results.

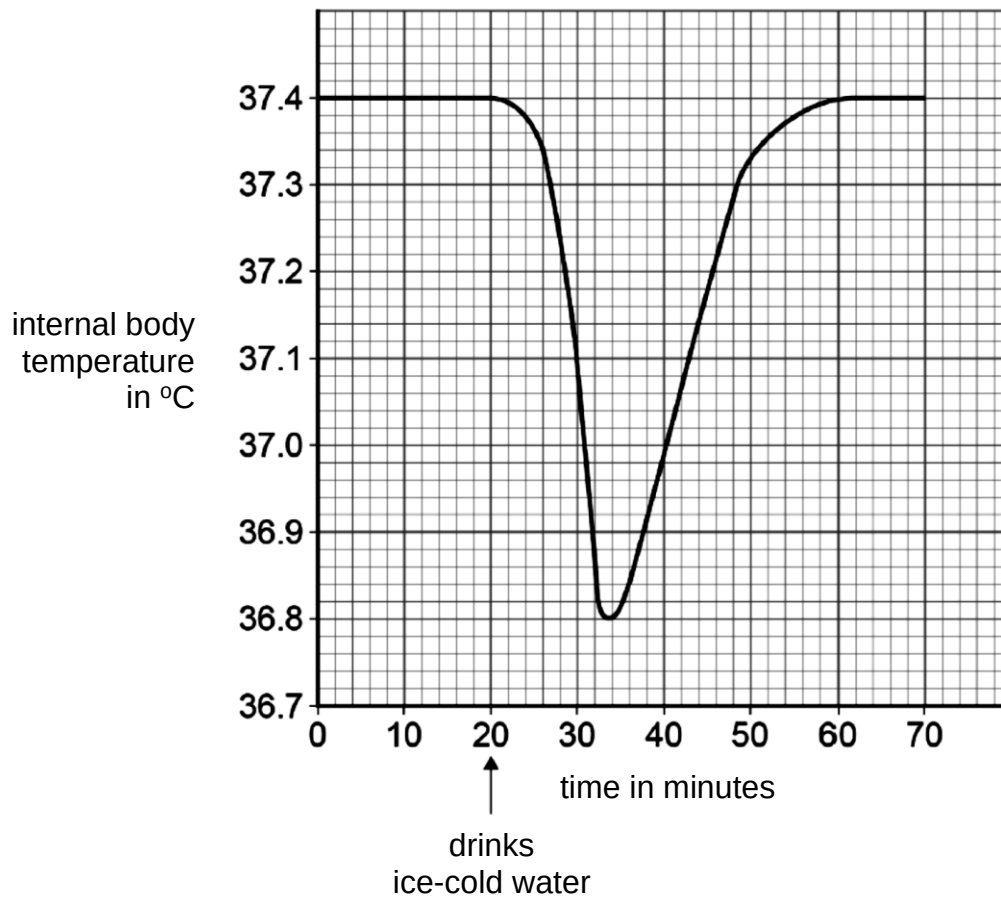


Fig. 4.1

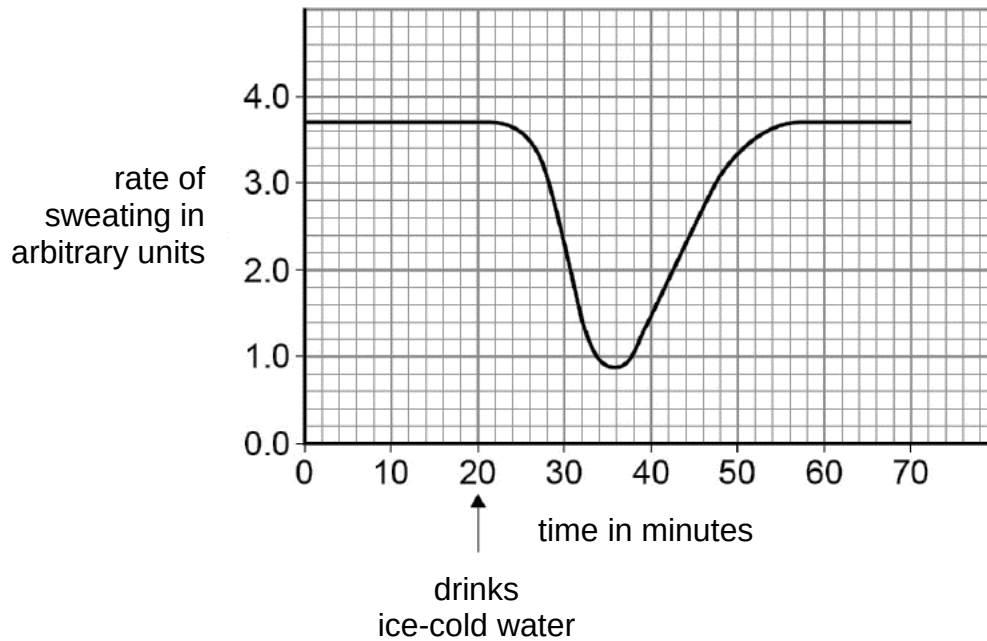


Fig. 4.2

- (a) Suggest why the person should **not** move during the investigation.

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[1]

- (b) Describe **and** explain the results shown in Fig. 4.1 on the internal body temperature, in the first 10 minutes when the ice-cold water was drunk.

.....

[2]

- (c) Name the type of receptors that detect the change in the internal body temperature and the organ these receptors are located in.

.....
[1]

- (d) The rate of sweating changes between 24 minutes and 36 minutes.

Explain how this change helps to maintain the person's normal body temperature.

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.....[2]

[Total: 6]

- 5 Mitten crabs spend most of their lives in fresh water and only return to the sea to breed.

In an investigation, mitten crabs were kept in fresh water and then moved into sea water. The water content and amino acid content in the muscle of these crabs were measured for 15 days after moving them from fresh water into sea water.

Fig. 5.1 shows the results of this investigation.

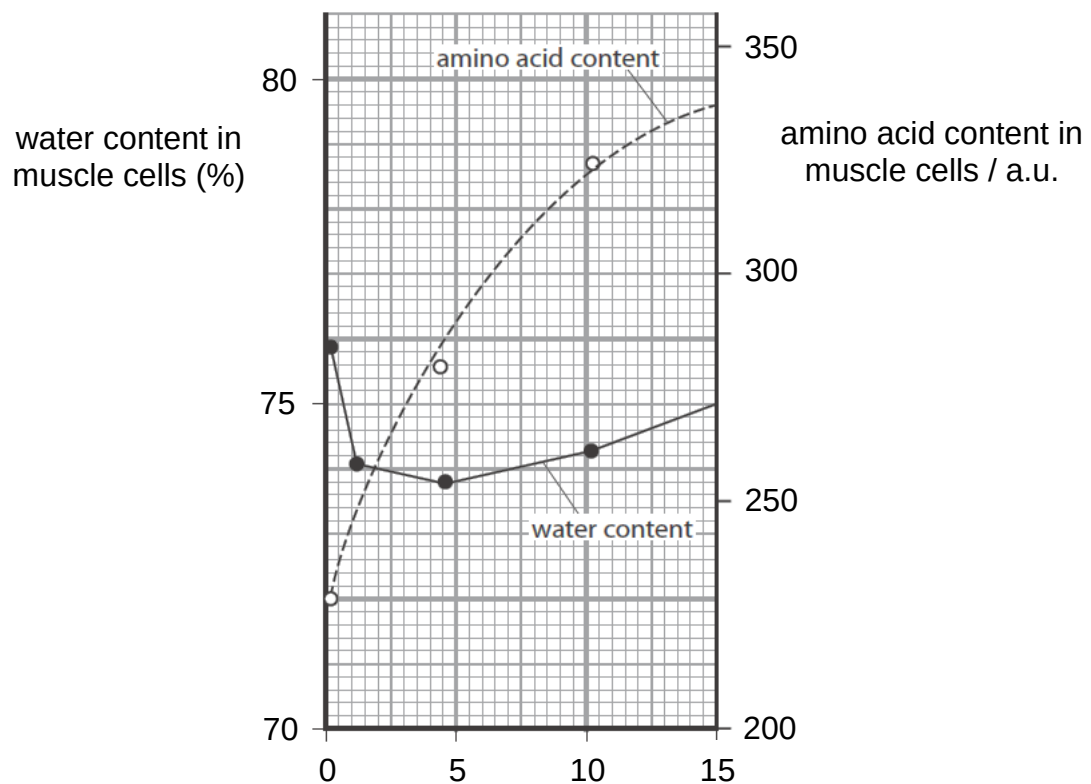


Fig. 5.1

- (a) Explain the changes in the water content in the muscle cells of the crabs as shown in Fig. 5.1.
Refer to the changes in the amino acid content in your answer.

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.....[3]

- (b) Describe the importance of amino acids to the crab when in sea water.

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.....[1]

- (c) Crab meat is a source of proteins for humans. A student just consumed a meal rich in crab meat.

Explain the difference in the blood amino acid concentration in the hepatic vein before **and** after the meal.

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.....[2]

[Total: 6]

- 6** Myoglobin is a protein pigment found in muscle tissues. Myoglobin has a higher binding affinity towards oxygen than haemoglobin, serving as an intracellular storage site for oxygen.

Different types of muscles have different myoglobin content.

Table 6.1 shows the different type of muscles and their characteristics.

Table 6.1

type of muscle	relative myoglobin content	speed of contraction	duration of contraction	ease of fatigue
fast-twitch muscle fibres	lower	rapid	shorter	fatigue easily
slow-twitch muscle fibre	higher	slow	longer	fatigue less easily

- (a)** Explain why fast-twitch muscle fibres can contract quickly but fatigue easily.

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.....[2]

- (b)** Name an organelle that is found in higher relative concentration in slow-twitch muscle fibres than in fast-twitch muscle fibres.

.....[1]

- (c) Sprinters and long-distance athletes train different types of muscles fibres, either fast-twitch or slow-twitch muscle fibres, to enhance their performances.

Explain why slow-twitch muscle fibres are more suitable for long-distance races.

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.....[3]

[Total: 6]

- 7 A scientist investigated respiration and photosynthesis using some pondweed and a pond snail.

Fig. 7.1 shows the apparatus used.

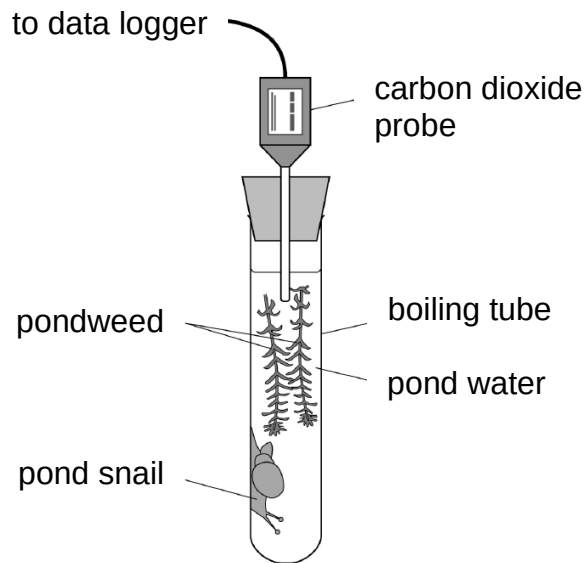


Fig. 7.1

The apparatus was left in a well-lit room for 5 days.

The data logger recorded the concentration of carbon dioxide continuously.

After 5 days, the scientist completely covered the boiling tube with black paper.

The data logger continued to record the concentration of carbon dioxide.

Fig. 7.2 shows the concentration of carbon dioxide inside the boiling tube over 15 days.

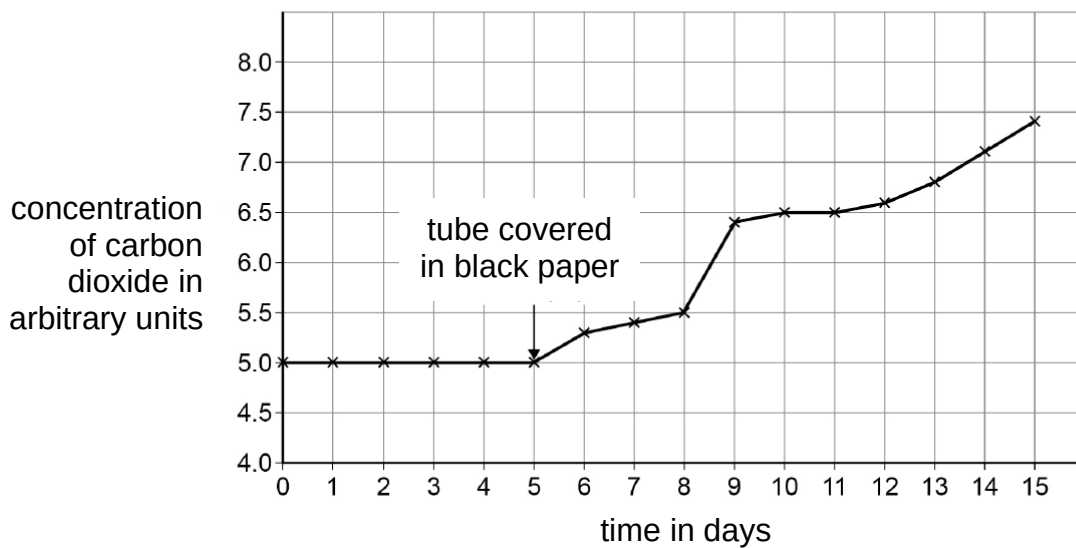


Fig. 7.2

- (a) Explain why the concentration of carbon dioxide in the tube stayed the same between **day 0** and **day 5**.

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.....[2]

- (b) Explain why the concentration of carbon dioxide increased between **day 5** and **day 10**.

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.....[2]

- (c) Hydrogen carbonate indicator is a red solution that changes colour in different concentration of carbon dioxide.

At low concentrations of carbon dioxide, indicator turns from red to purple while at high concentrations of carbon dioxide the red solution turns yellow.

At day 15, the black paper and the snail was removed. Some hydrogen carbonate indicator was then added.

State the colour change of the indicator over the next few hours.

.....[1]

[Total: 5]

- 8 Several species of birds called finches live on the Galapagos Islands. These finches are very similar to each other. In each species of finch, there is a variation in beak depth.

Fig. 8.1 shows how beak depth of the finches are measured.



Fig. 8.1

Fig. 8.2 shows the relationship between beak depth of parent birds and the beak depth of their offspring.

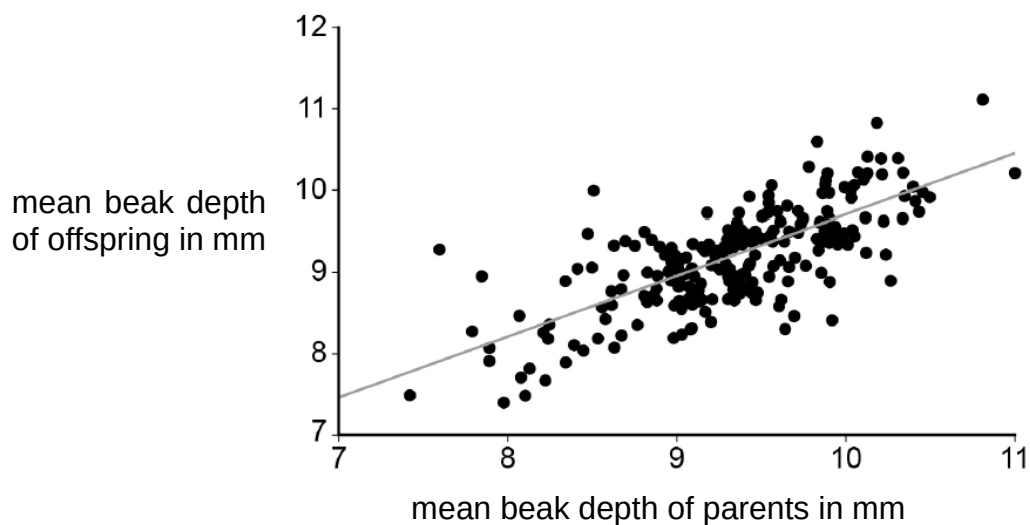


Fig. 8.2

- (a) Give evidence from Fig. 8.2 for beak depth being an inherited characteristic.

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[1]

- (b) Isabela Island is one of the biggest islands amongst the Galapagos Islands.

Fig. 8.3 shows how the beak depth of each finch species varies on each island.

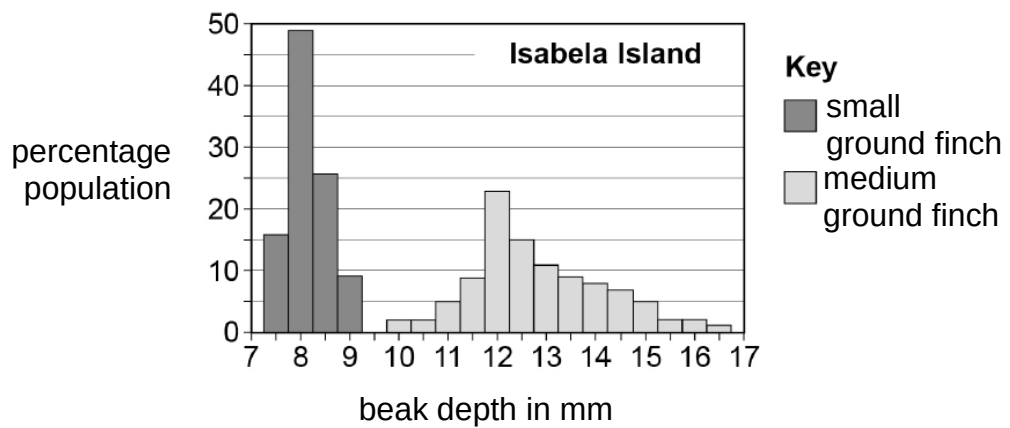


Fig. 8.3

Describe and explain the type(s) of variation as shown in Fig. 8.3.

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.....[2]

- (c)** On another island of the Galapagos Islands, Daphne Island, only the medium ground finch is found.

Fig. 8.4 shows the beak depth of the finches on Daphne Island.

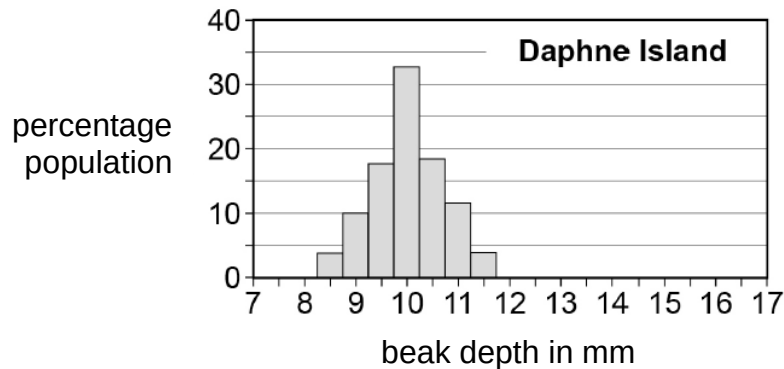


Fig. 8.4

The medium ground finches feed on seeds. The size of seeds eaten by each bird depends on the depth of the bird's beak.

The range of beak depth of **medium** ground finches on Isabela Island is different from the range on Daphne Island.

Explain what might have caused this difference.

.....[5]

[Total: 8]

- 9 Metformin is a drug used for treating people who have Type 2 diabetes.

Scientists investigated the effects of Metformin and two other drugs, **A** and **B**. The scientists wanted to see how the drugs affected the blood glucose concentrations of 220 people with Type 2 diabetes.

This is the method used.

- 1 Put the 220 people into five groups.
- 2 Treat each group with a different drug or combination of drugs for several weeks.
- 3 Give each person a meal high in carbohydrate.
- 4 Measure the blood glucose concentration of each person 30 minutes after the meal and again 3 hours after the meal.

Table 9.1 shows the scientist's results.

Table 9.1

drug used (number of people involved)	Metformin (60)	A (40)	B (25)	Metformin + A (65)	Metformin + B (30)
mean blood glucose concentration 30 minutes after the meal in mg/100 cm ³	175	180	170	215	210

- (a) Describe and explain the condition of Type 2 diabetes.

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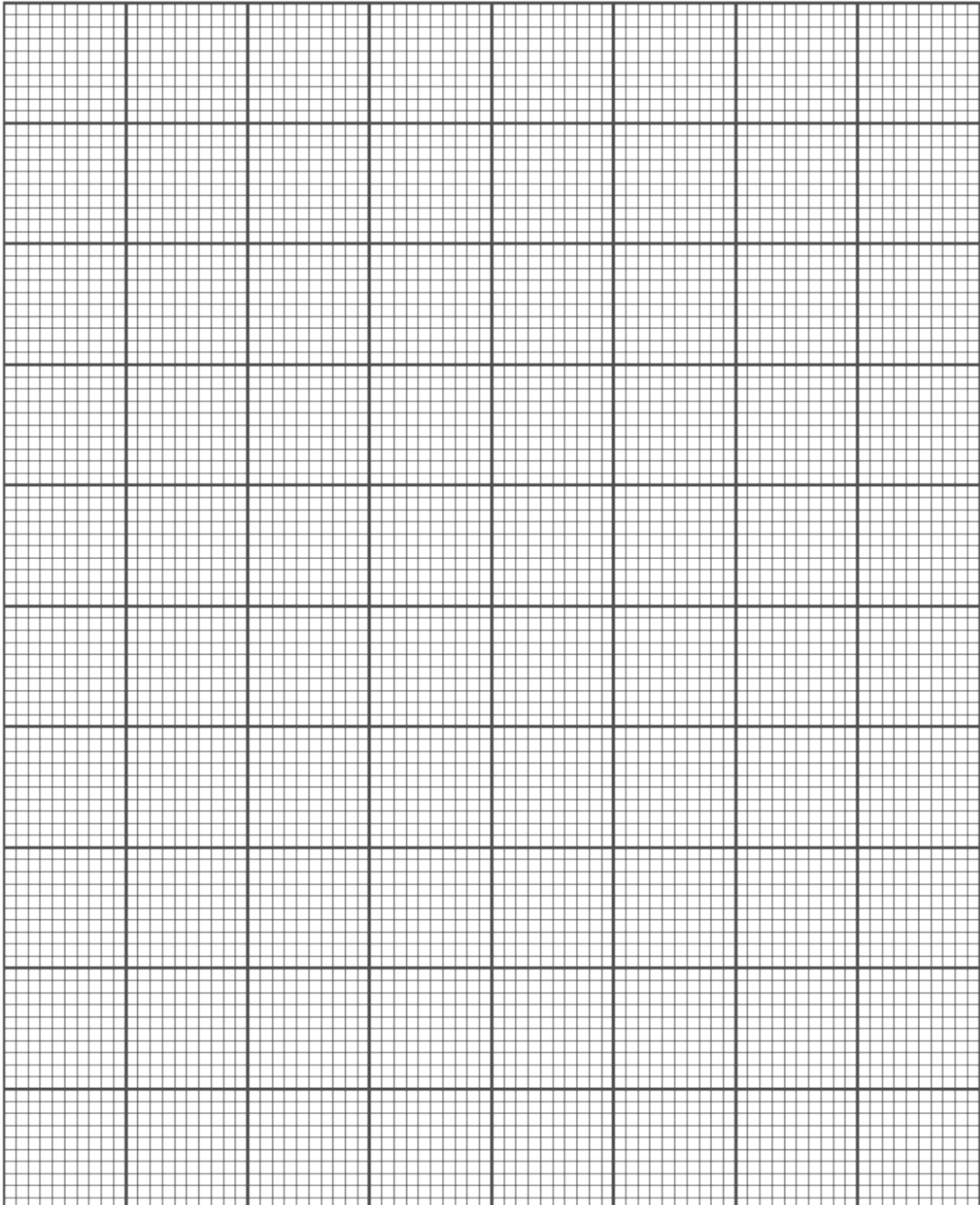
- (b) Identify **one** risk factor, **other** than unhealthy diet and sedentary lifestyle.

.....[1]

- (c) Suggest **one** variable that the scientist should control in the investigation.

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.....[1]

- (d) Use the data in Table 9.1 to plot a bar chart on the grid given below. [3]



- (e) A student looked at the scientists' method and results.

The student stated: '*Metformin works better when used with other drugs.*'

Do you agree or disagree with the student's statement? Use the given information to support your answer.

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.....[2]

[Total: 10]

10 Decay occurs in a compost heap.

Fig. 10.1 shows a compost heap.

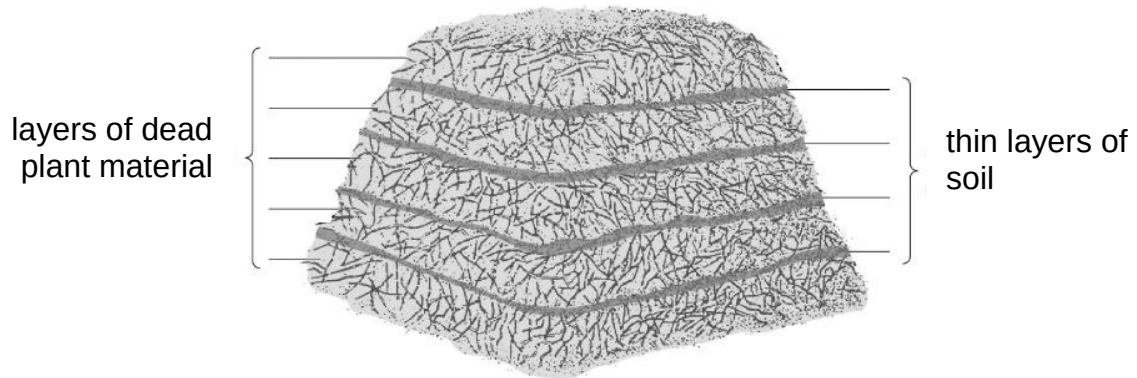


Fig. 10.1

(a) The compost heap is able to recycle chemicals but not energy.

Explain the statement above.

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.....[3]

(b) Both plants in the forests and oceans can act as 'carbon sinks'.

Describe the role of **oceans** as carbon sinks.

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.....[3]

- (c) Beautiful corals can be found in places such as the Great Barrier Reef in Australia. As part of coral reef conservation programme, people visiting coral reefs should adhere to the following guidelines.

- Avoid using sunscreen
- Avoid purchasing living corals
- Avoid polluting the coastline with trash

Discuss how adhering to the above guidelines contribute to the maintenance of biodiversity and a balanced ecosystem of coral reefs.

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.....[4]

[Total: 10]

End of Section A

Section B

Answer **one** question from this section.

- 11 (a)** Describe the sequence of events that occur after a human egg is fertilised to the formation of placenta in the uterus.

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.....[4]

- (b)** Villi are structures that can be found in both the placenta and the wall of small intestine.

Compare the structure and function of embryonic villi in placenta and intestinal villi.

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.....[6]

[Total: 10]

- 12 (a)** Compare the influenza virus and the pneumococcus bacterium in terms of
(i) their structure and
(ii) methods to reduce their transmission.

[5]

- (b)** Explain the role of antibodies and antigens in blood transfusion.

.....[5]

[Total: 10]

End of Paper