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CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

8953847275

BIOLOGY **0610/41**

Paper 4 Theory (Extended) **May/June 2025**

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **20** pages. Any blank pages are indicated.

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[Turn over

1 **(a)** Fig. 1.1 shows a pyramid of energy for an ecosystem.

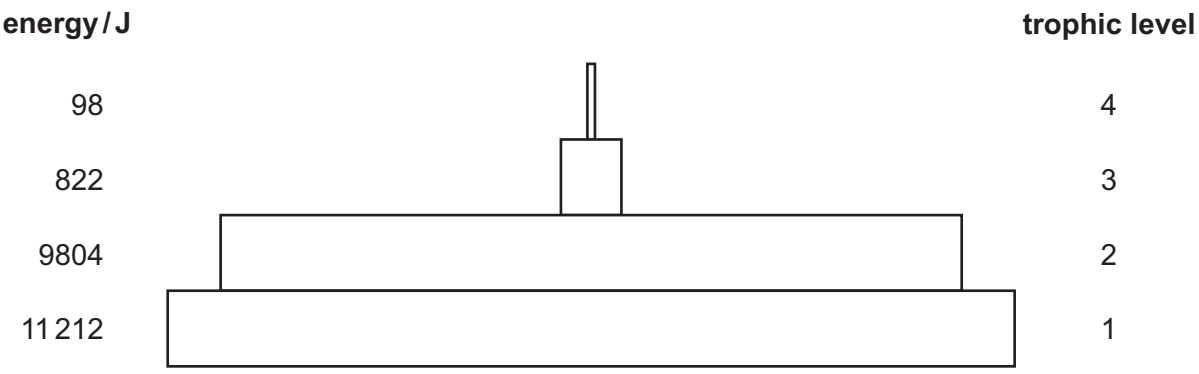


Fig. 1.1

(i) State where the organisms in trophic level 1 in Fig. 1.1 get their energy from.

..... [1]

(ii) Calculate the percentage of energy transferred between trophic levels 2 and 3 in Fig. 1.1.

Give your answer to **one** significant figure.

..... [2]

(iii) State **two** reasons why the energy decreases between trophic levels 1 and 4, as shown in Fig. 1.1.

1 .....

2 .....

[2]

(iv) Describe the advantages of representing food chains using a pyramid of energy compared with a pyramid of biomass.

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(b) A new species was introduced to an ecosystem.

Fig. 1.2 shows the changes in the population as the species established itself in the ecosystem.

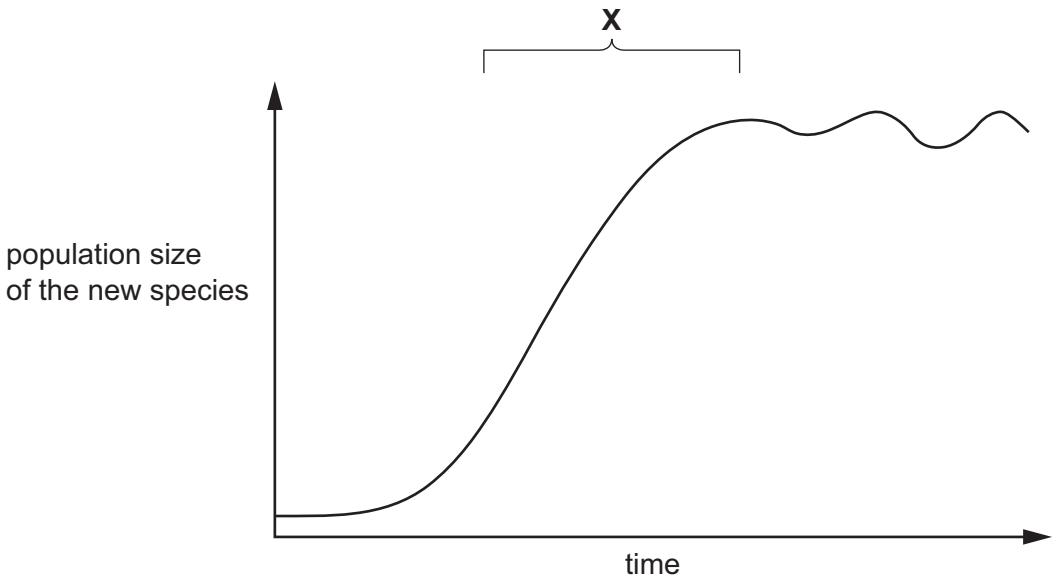


Fig. 1.2

(i) Complete the sentence to describe the term population.

A population is a group of organisms of one species living in the same ..... at the same ..... . [1]

(ii) Describe **and** explain the reasons for the shape of the graph at **X** in Fig. 1.2.

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[Total: 13]

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2 **(a)** The human retina contains receptor cells called rods and cones.

Fig. 2.1 shows the distribution of receptor cells in a human retina.

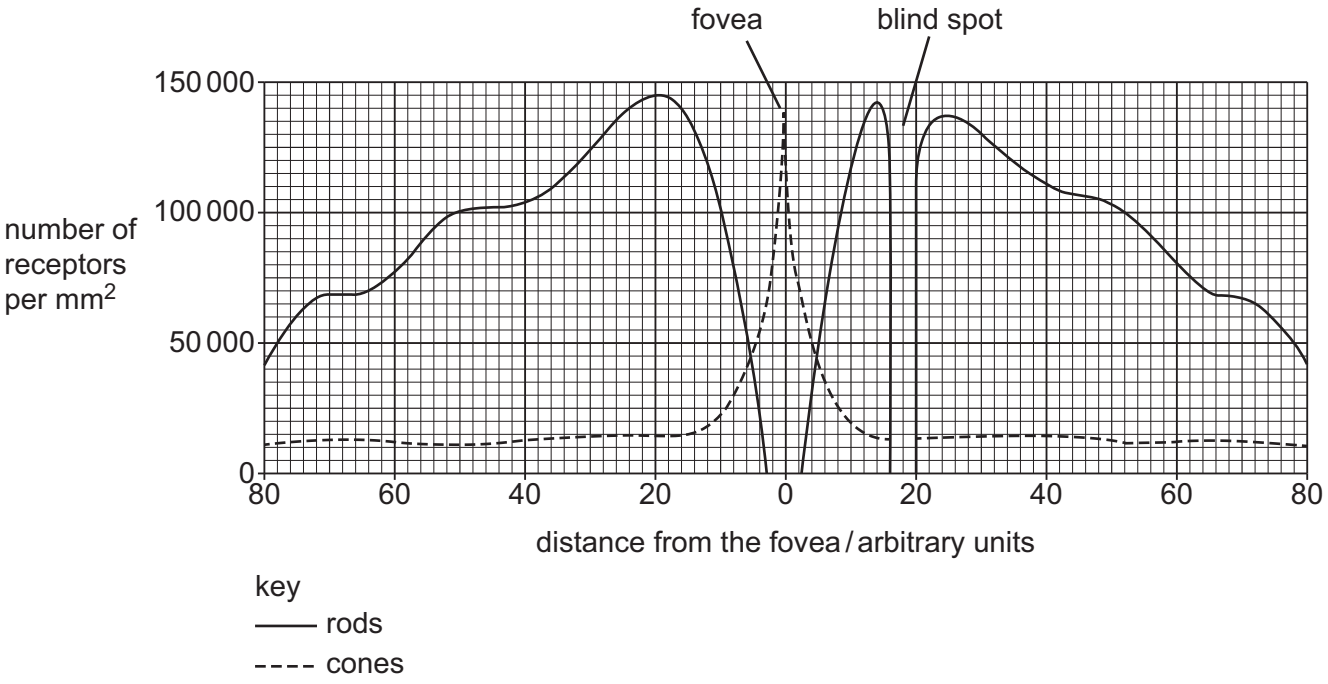


Fig. 2.1

Using the information in Fig. 2.1, describe the differences in the distribution of rods and cones.

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(b) Nocturnal animals are active at night.

Suggest how the number of receptor cells in the retina of a nocturnal animal differs from those in the retina of an animal that is active in the day.

Explain your suggestion.

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..... [2]

(c) In humans, the size of the iris increases in bright light conditions.

During this response one effector in the iris contracts and one effector relaxes.

(i) State the name of this response.

..... [1]

(ii) State the name of the effector that contracts in this response.

..... [1]

(iii) State the name of the type of action shown by the paired effectors during this response.

..... [1]

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(d) The optic nerve contains many neurones.

Fig. 2.2 shows a synapse between two neurones.

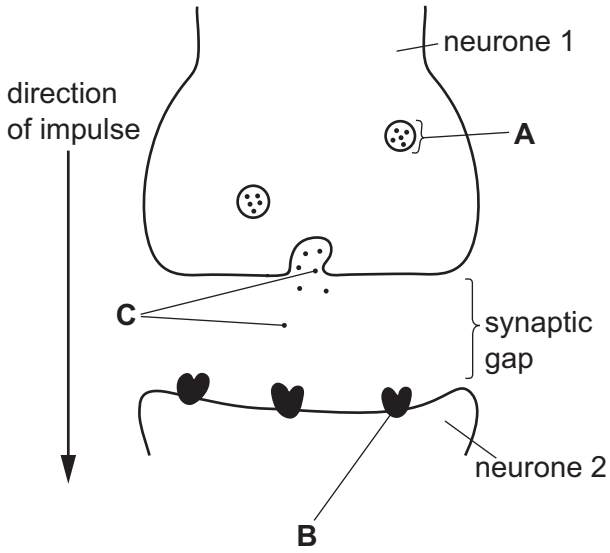


Fig. 2.2

(i) State the names of the parts labelled **A**, **B** and **C** in Fig. 2.2.

A .....

B .....

C .....

[3]

(ii) Explain how part **C** in Fig. 2.2 moves across the synaptic gap.

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[Total: 14]

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3 **(a)** Fig. 3.1 shows one stage involved in plant reproduction after pollination.

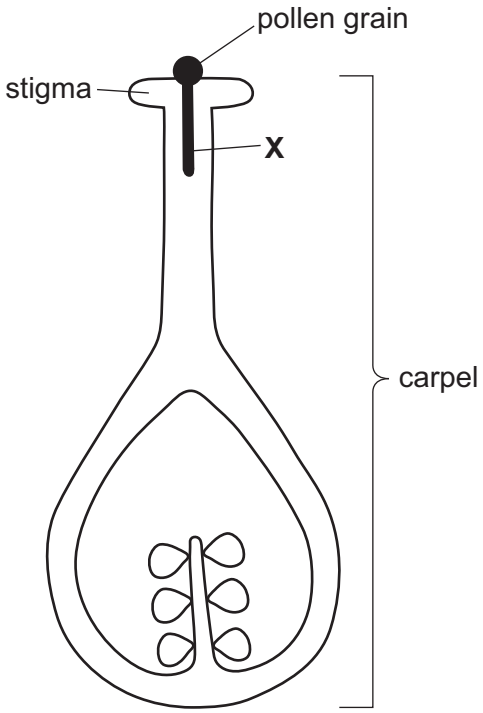


Fig. 3.1

(i) State the name of the part labelled **X** in Fig. 3.1.

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(ii) Describe the events that occur after the stage shown in Fig. 3.1 that result in fertilisation.

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(b) A species of plant can use self-pollination and cross-pollination.

(i) Suggest reasons for this species of plant to use self-pollination rather than cross-pollination.

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..... [3]

(ii) Discuss the potential effects of only using self-pollination in a population of plants.

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(c) Meiosis produces gametes and is a source of genetic variation.

State **two other** sources of genetic variation in populations.

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[2]

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(d) Describe mitosis and its roles in organisms.

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(e) State the name of the unspecialised cells that divide by mitosis.

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[Total: 17]

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4 The kidney is an organ in the excretory system.

(a) Describe what is meant by the term excretion.

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..... [2]

(b) State the name of the substance excreted by the lungs.

..... [1]

(c) Fig. 4.1 shows a simplified diagram of a cross-section of a kidney.

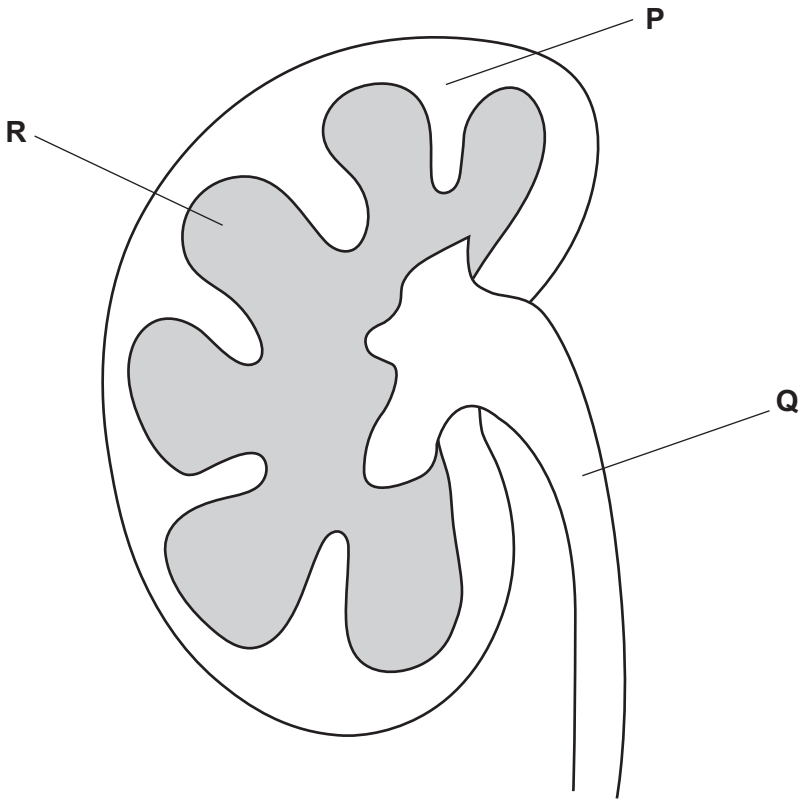


Fig. 4.1

State the names of the parts labelled **P**, **Q** and **R** in Fig. 4.1.

P .....

Q .....

R .....

[3]

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(d) Fig. 4.2 shows the structure of a kidney nephron.

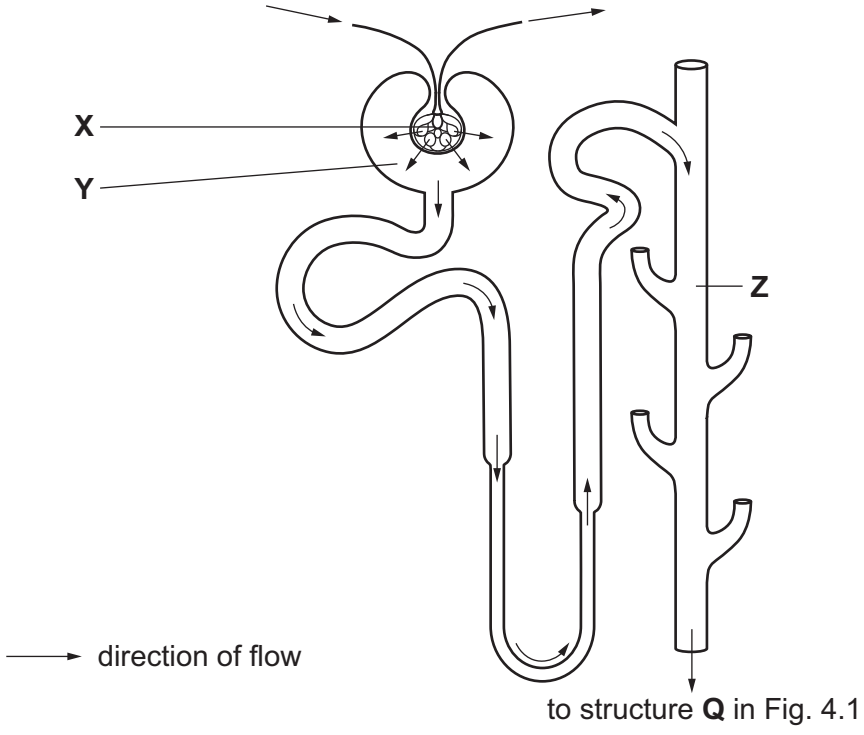


Fig. 4.2

Describe **and** explain the difference in the composition of the fluids in structures **X**, **Y** and **Z** in Fig. 4.2.

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(e) The liver is also involved in excretion.

Describe **two** ways that amino acids are processed in the liver.

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[2]

[Total: 14]

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5 **(a)** Organisms can be classified by their features and by studying the sequence of bases in their DNA.

Fig. 5.1 is a diagram showing the evolutionary relationships between some different groups of organisms.

Each branch shows the point at which organisms developed new features that classify them as a new group.

The point where the branch starts also indicates a common ancestor shared by the new groups.

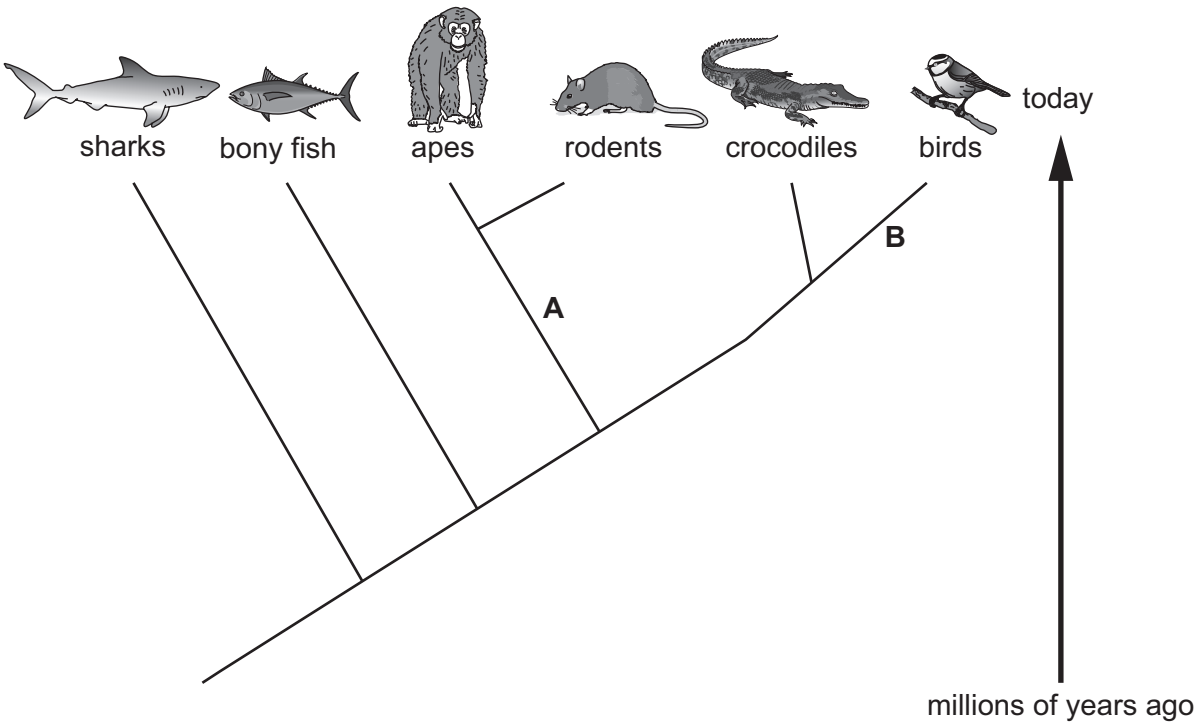


Fig. 5.1

(i) Suggest which visible features have developed at **A** and **B** in Fig. 5.1.

A .....

B .....
[2]

(ii) Identify the names of the **two** groups that share the most recent common ancestor in Fig. 5.1.

..... and ..... [1]

(iii) Suggest the groups with the most similar and least similar DNA base sequences to crocodiles in Fig. 5.1.

most similar .....

least similar .....
[2]

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(b) Describe the structure of a DNA molecule.

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(c) Outline how the base sequences in DNA control cell function.

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[Total: 12]

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6 **(a)** Some maize seeds were pinned on a board and provided with light from all directions.

The board was placed in a clinostat that rotated the board.

The board was rotated continuously as the seeds germinated and the roots grew.

Fig. 6.1 shows the apparatus and results after 5 days.

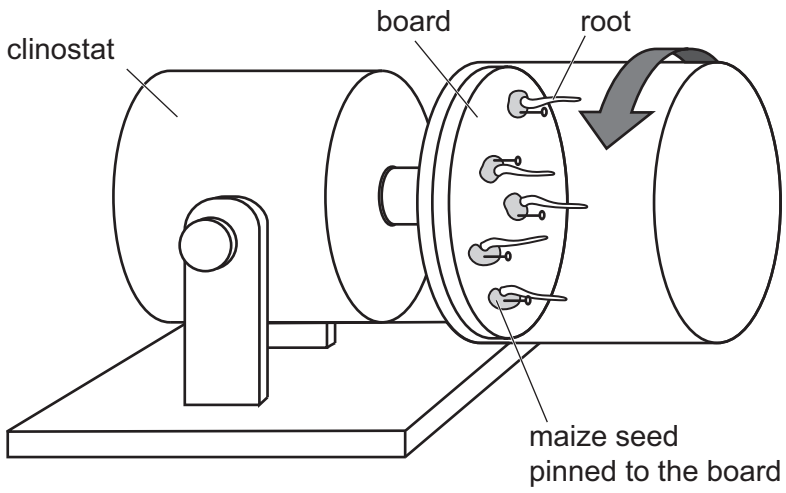


Fig. 6.1

(i) Complete the sentences to explain the root growth in Fig. 6.1.

Auxin is produced in shoot and root ..... . The auxin travels

down the root by the process of ..... .

As the clinostat rotates, the effect of ..... on all sides of the root is equal.

This causes the distribution of auxin in the root to be ..... .

Auxin stimulates cell ..... causing the roots to grow horizontally. [5]

(ii) The rotation of the clinostat was stopped.

Predict the change in growth that will occur in the germinating maize seeds in Fig. 6.1.

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..... [1]

(iii) State the name of the tropic response to light.

..... [1]

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(b) A student observed cells from a plant that had wilted.

State **and** explain the expected appearance of the cells.

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