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1. The following terms are used to describe how substances move into or out of cells.

- Active transport
- Diffusion
- Osmosis

Choose the correct term to complete each sentence below.

Gas exchange in the lungs occurs by .....

Water absorption by root hair cells occurs by .....

The absorption of mineral ions from the soil, using energy, occurs by

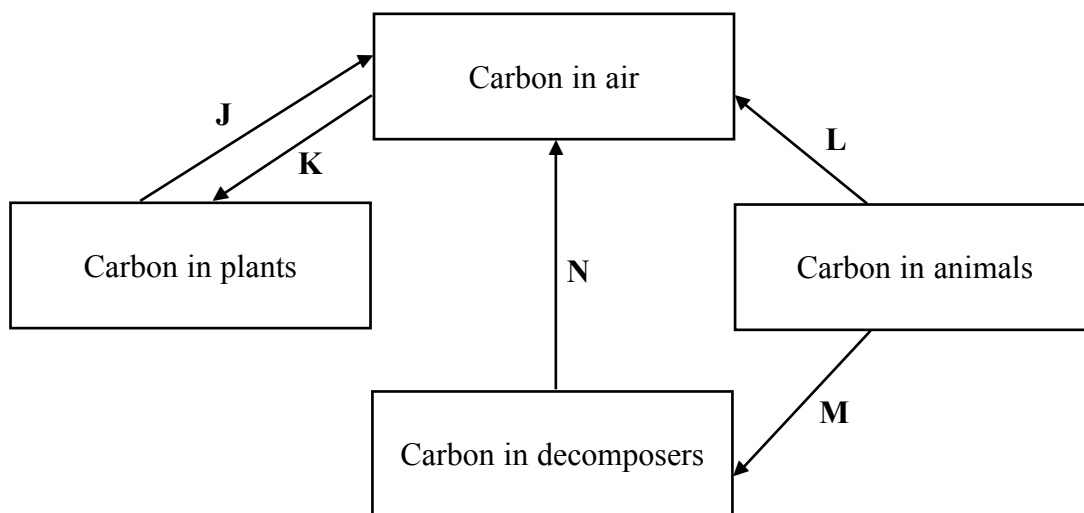
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Q1

(Total 3 marks)



2. The diagram shows the carbon cycle. The five arrows **J**, **K**, **L**, **M** and **N** represent some of the processes in the cycle.



(a) (i) The diagram is incomplete. Add **two** more arrows to represent the processes of plants being eaten and of plants being decomposed. (2)

(ii) Which arrow letter represents photosynthesis?

..... (1)

(iii) Write down the letters of all the arrows that represent respiration.

..... (1)

(b) (i) Name the substance in air that contains carbon.

..... (1)

(ii) Name **one** carbohydrate found in plants that contains carbon.

..... (1)

(iii) Name **one** type of organism that is a decomposer.

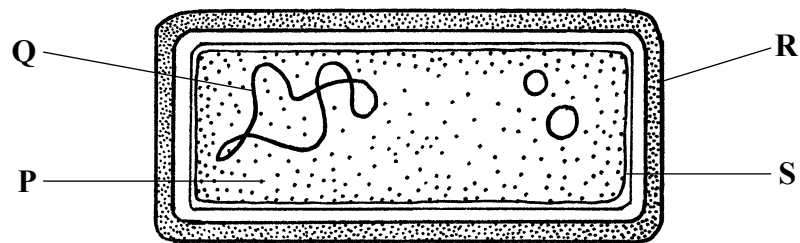
..... (1)

**(Total 7 marks)**

Q2



3. (a) The diagram shows a typical bacterium. Name the parts labelled P, Q, R and S.



P .....

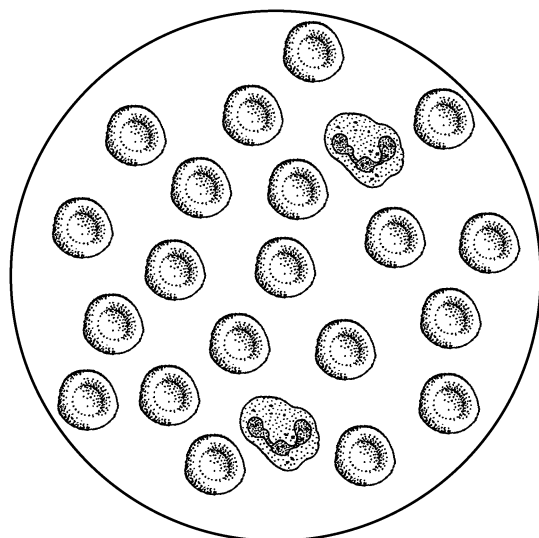
Q .....

R .....

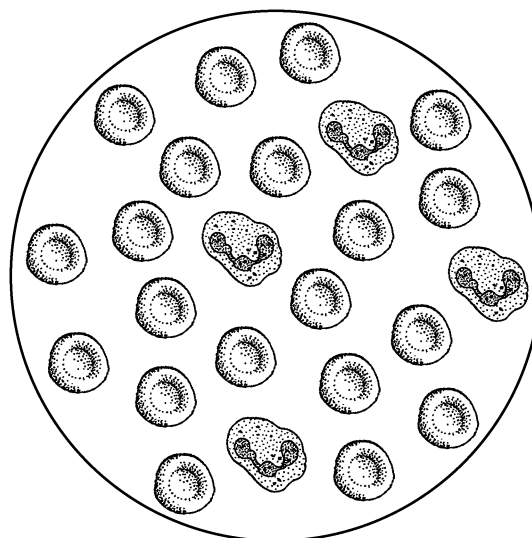
S .....

(4)

(b) A person became ill from an infection caused by a bacterium. The diagrams show samples of blood taken from the person before and during the illness.



Before the illness



During the illness

There are more white blood cells in the blood sample during the illness than there were before the illness.



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(i) Calculate the percentage increase in the number of white blood cells. Show your working.

Answer .....  
**(2)**

(ii) Describe the role of the white blood cells in the blood during illness.

.....  
.....  
.....  
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.....  
**(3)**

(iii) Name the pale yellow liquid that the red and white blood cells are floating in.

.....  
**(1)**

(iv) Describe how red blood cells are adapted to carry out their function.

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**(3)**

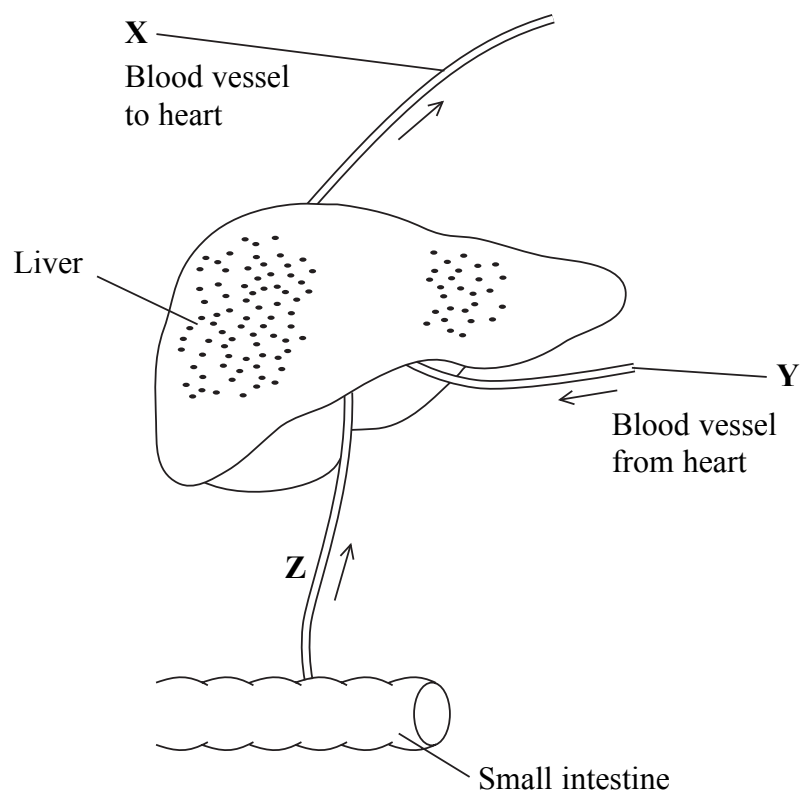
**(Total 13 marks)**

**Q3**

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4. The diagram shows the liver and three blood vessels, X, Y and Z. The arrows show the direction of blood flow.



(a) Name the blood vessels labelled X, Y and Z.

X .....

Y .....

Z .....

(3)

(b) Which blood vessel contains blood at the highest pressure?

.....

(1)

(c) After a meal, blood vessel Z contains more glucose than blood vessel X. Explain what happens to glucose in the liver.

.....

.....

.....

(2)

Q4

(Total 6 marks)



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5. The sentence below was said in a speech about how human activities can affect the environment.



Use your knowledge to explain how human activities contribute to global warming, and to suggest why it might be seen as a danger.

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**(Total 5 marks)**

**Q5**



N 2 4 6 1 6 A 0 7 2 8

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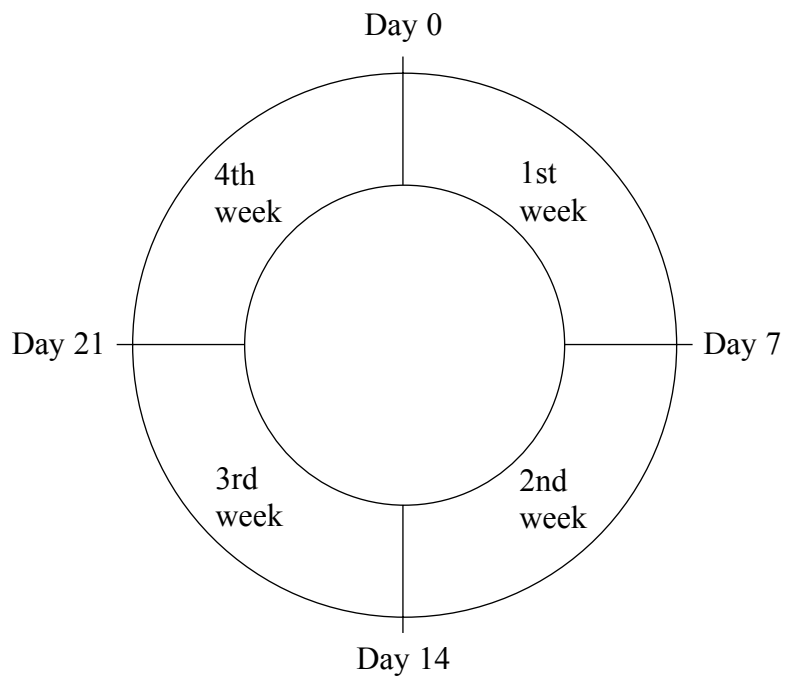
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6. The diagram shows a 28-day menstrual cycle, starting at day 0 and divided into four weeks.



- (a) (i) In which week is the lining of the uterus being repaired?

..... (1)

- (ii) Name the hormone that helps to repair the lining of the uterus.

..... (1)

- (iii) Name the organ that releases this hormone.

..... (1)

- (b) Name the hormone that is at its highest level during the 3rd week.

..... (1)

- (c) What is expected to happen on day 14?

..... (1)

(Total 5 marks)

Q6



7. Emphysema is a condition in which some of the cells of the lung are damaged. It can occur as a result of cigarette smoking.

The damage to cells is caused by a protease enzyme.

(a) (i) Describe how the action of protease would damage lung tissue.

.....  
.....  
.....

(2)

(ii) Explain the effect emphysema has on gas exchange in the lungs.

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.....  
.....

(2)

(b) A substance called A1T, produced in the liver, protects the lungs by stopping the protease enzyme from working. To help prevent emphysema, people could be treated with A1T, but large amounts of A1T are needed.

Scientists are using genetic modification to try and develop sheep that produce milk containing A1T.

The gene for making A1T is put into the nucleus of a fertilised sheep egg before it starts to divide. Every cell produced by cell division will contain the new gene.

(i) What must normally happen to an egg cell for it to be fertilised?

.....

(1)

(ii) A fertilised egg cell divides many times to produce the cells of a sheep. Name this type of cell division.

.....

(1)



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(iii) The passage describes the steps taken to produce lots of genetically identical sheep containing A1T gene. Write on the dotted lines the most suitable word or words to complete the passage.

Cells are taken from sheep containing the A1T gene.

The nucleus from one of these cells is removed. It is then placed

into an enucleated ..... cell from another sheep.

This cell divides into a ball of cells, which develops into

an ..... This is placed into

the ..... of a surrogate mother and is allowed

to develop. This mother will give birth to offspring that can produce

A1T in their ..... The process is repeated using more

surrogate mothers. All the offspring are said to be .....

because they are genetically identical.

(5)

Q7

(Total 11 marks)

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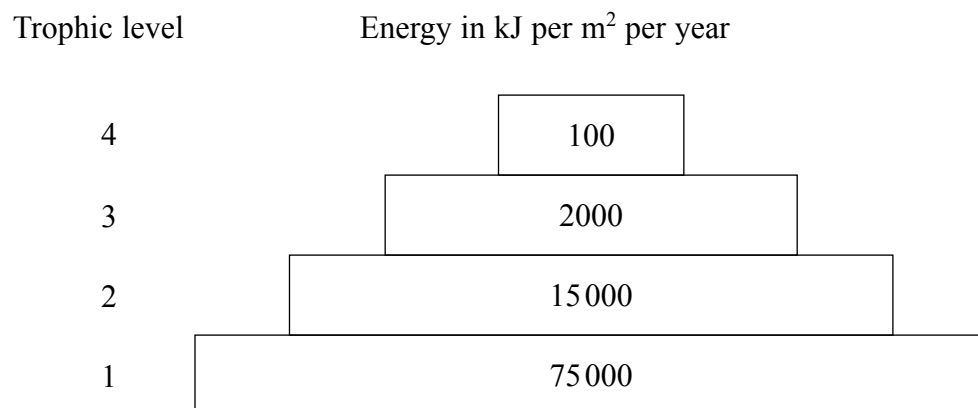
N 2 4 6 1 6 A 0 1 1 2 8

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8. The diagram shows a pyramid of energy for all organisms in a river.



(a) The organisms found in trophic level 1 are described as producers. How are the organisms in trophic level 3 described?

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(1)

(b) Between which trophic levels is energy transfer most efficient?

.....  
(1)

(c) Explain why energy transfer between trophic levels is never 100% efficient.

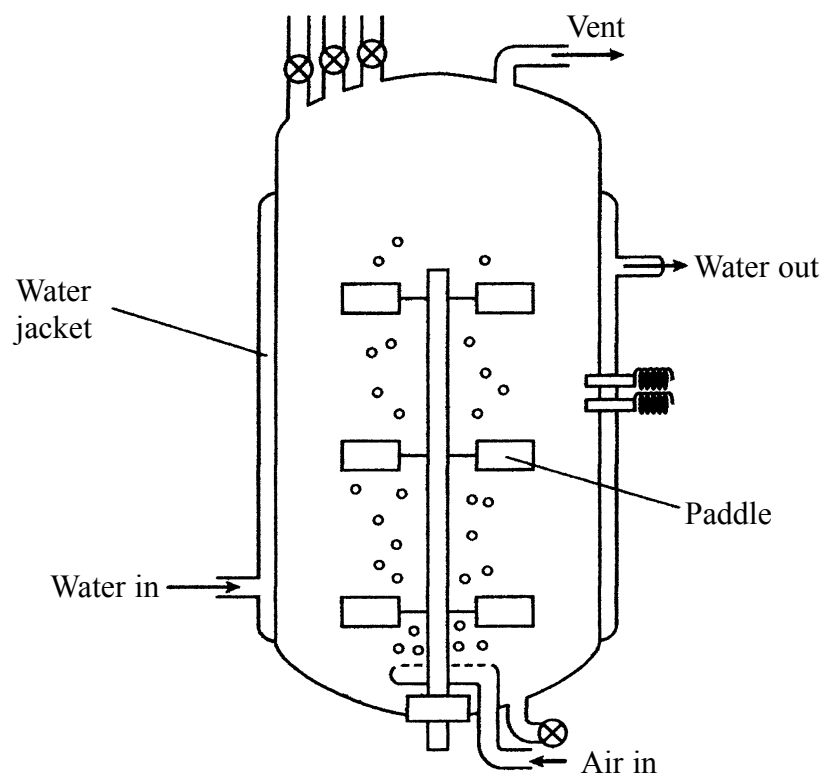
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(2)

(Total 4 marks)

Q8



9. The diagram shows a fermenter used to grow a genetically modified microorganism that makes human insulin.



(a) Explain why it is important that the paddles move.

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.....

(2)

(b) There is a water jacket around the fermenter filled with cold water. Explain the importance of this.

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(2)



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(c) The microorganisms in the fermenter require oxygen to grow.

(i) How does the oxygen get into the fermenter?

.....  
(1)

(ii) Name the process in microorganisms that requires oxygen.

.....  
(1)

(d) As part of the cleaning process, steam is passed through the fermenter between making each batch of insulin.

Suggest why steam is used to clean the fermenter.

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(2)

(e) Insulin is needed to treat diabetes in humans. Insulin can be obtained from animals. Now, most of the insulin used in treatment is human insulin from genetically modified microorganisms.

Suggest **one** reason why it is better to use human insulin from genetically modified microorganisms rather than insulin obtained from animals.

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(1)

**(Total 9 marks)**

Q9



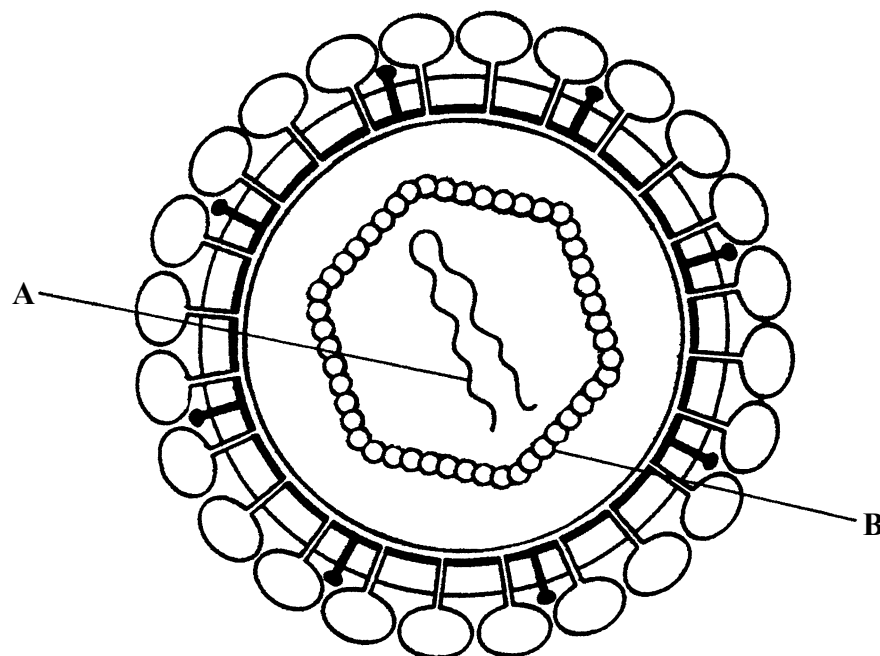
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10. The diagram shows a virus.



(a) Name the parts labelled **A** and **B**.

**A** .....

**B** .....

(2)

(b) Where do viruses reproduce?

.....

(1)

(c) Give **one** example of a virus.

.....

(1)

(Total 4 marks)

Q10



**11.** Huntington's disease is a genetic condition that affects the nervous system. Huntington's disease is caused by a dominant allele, **H**. The condition does not develop until middle age (around 40 years old).

(a) A couple plan to have children. The father is heterozygous for Huntington's disease and the mother is homozygous recessive.

(i) Draw a genetic diagram to show the genotypes of the parents, the gametes and the possible genotypes and phenotypes of their children. Use **H** to represent the allele for Huntington's disease and **h** to represent the normal allele.

(4)

(ii) What is the probability of this couple producing a child who will not develop the disease?

.....  
(1)

(b) The symptoms of the disease do not appear until middle age. Suggest why this makes it unlikely that Huntington's disease will disappear from the population.

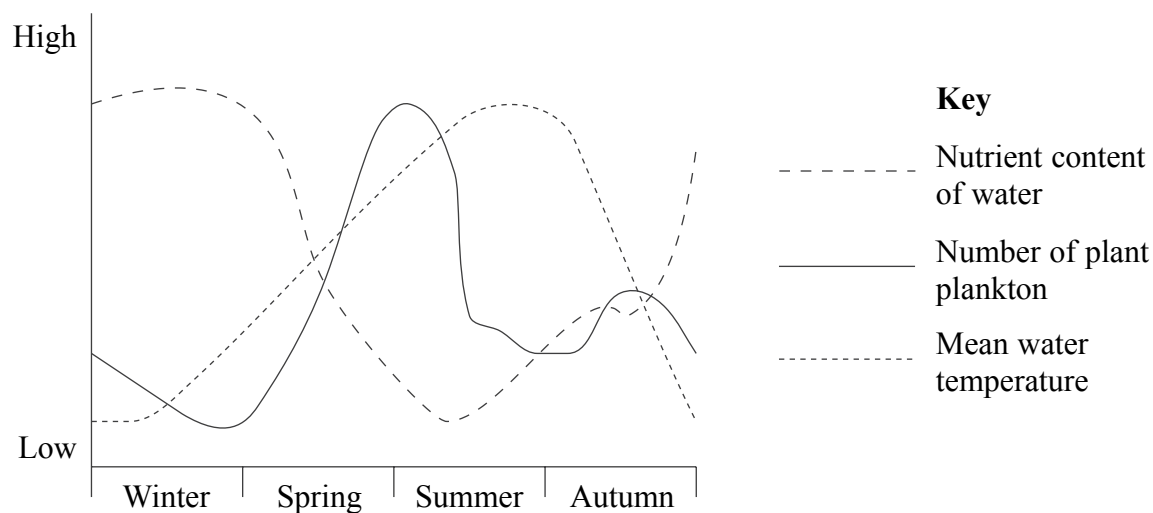
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(2)





12. Plant plankton are microscopic aquatic organisms that carry out photosynthesis.

The graph shows changes in the numbers of plant plankton, the nutrient content of the water and the mean water temperature in the Indian Ocean at different times of the year.



(a) Describe how the nutrient content of the water changes during the year.

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.....

(2)

(b) Using your knowledge of photosynthesis and the information above, explain why the numbers of plant plankton were low in winter but increased rapidly in spring.

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(3)



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(c) Many plants convert the glucose made during photosynthesis into starch for storage.

Suggest why it is an advantage to plants to store starch rather than glucose.

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(3)

Q12

(Total 8 marks)



13. Mountain biking is a popular sport and one that requires a high degree of fitness.



Many adventure holidays now offer mountain biking as an option and the cyclists pictured here are taking part in a tour across a desert. The cyclists will experience very hot conditions during the three days of the tour.

(a) When the cyclists get too hot they produce more sweat to help them to cool down. There are also changes in the blood vessels in their skin.

(i) Explain how sweating would help to cool them down.

.....  
.....  
.....  
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**(2)**

(ii) Explain how changes in the blood vessels in the skin help cyclists to cool down.

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**(3)**



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(b) As a result of sweating there will be changes in the water content of the blood.

Describe how antidiuretic hormone (ADH) regulates the water content of the blood in the cyclists.

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(4)

(c) The action of ADH is an example of homeostasis.

(i) What is meant by **homeostasis**?

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(1)

(ii) Give **one** example of homeostasis other than the action of ADH.

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(1)

(Total 11 marks)

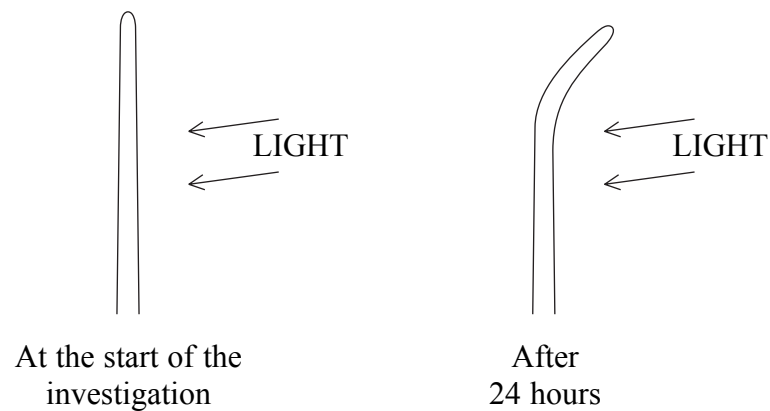
Q13

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14. A student wanted to investigate how plants respond to stimuli.

(a) First of all, she used a seedling that had a small shoot. She shone light onto one side of the shoot for 24 hours. The results of her investigation are shown in the diagram.



(i) Describe what effect the light had on the shoot.

.....  
.....  
**(1)**

(ii) What is the name of the response of this shoot to light?

.....  
**(1)**

(iii) Explain how auxin is involved in the response of this shoot to light.

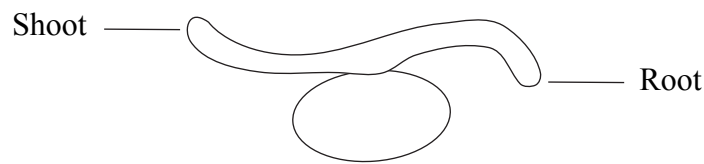
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**(2)**





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(b) The student then allowed another seed to germinate. After three days she placed the seedling on its side in the dark. The diagram shows the seedling after a further 24 hours.



(i) What is the name of the response of the seedling root?

..... (1)

(ii) Give **two** advantages to the seedling of the root growing in this way.

1. ....  
.....
2. ....  
.....
- (2)

(Total 7 marks)

Q14



15. A farmer used fertiliser to increase the yield of his crops.

(a) Explain how fertilisers increase the yield of crops.

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.....  
.....

(2)

(b) The farmer noticed that his crops were being attacked by insects. He decided to use pesticides to get rid of the insects.

(i) Give **one** advantage and **one** disadvantage of using pesticides to get rid of the insects.

Advantage .....

.....

Disadvantage .....

.....

(2)

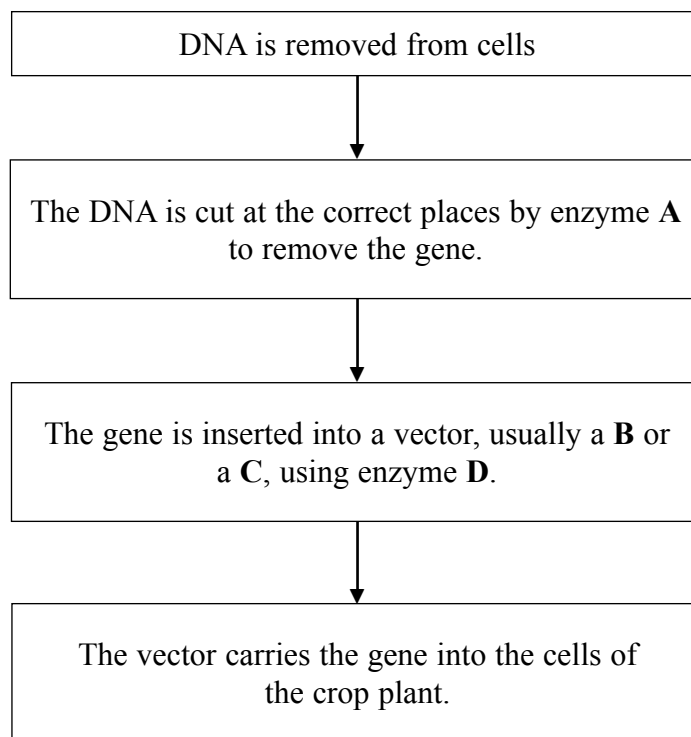
(ii) Describe a method of pest control, other than using pesticides, that the farmer could use to get rid of the insects on his crops.

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(2)



- (c) The farmer read that it was possible to grow genetically modified crops that contained a gene to make insecticide.
- (i) He wanted to learn more about how the crops were genetically modified and spoke to a friend who worked at a nearby university. The friend gave him a diagram to show how genes are transferred.



Choose suitable words for the letters **A**, **B**, **C** and **D** in the flow chart above. Write your answers below.

**A** .....

**B** .....

**C** .....

**D** .....

(4)



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(ii) Some people think that using genetically modified plants to improve food production is a good idea. Other people disagree.

Discuss some advantages and disadvantages of using genetically modified plants to improve food production.

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(4)

Q15

(Total 14 marks)

**TOTAL FOR PAPER: 120 MARKS**

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