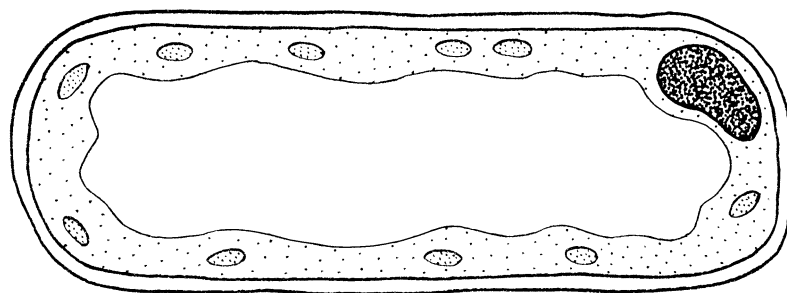


1. Plants make food in their leaves.

(a) The diagram shows a cell from a leaf.



F

(i) On the diagram, draw a line from the letter F to one of the structures where food is made. (1)

(ii) Name the part of the cell where food is made.

..... (1)

(b) To make food, plant cells need water. Water enters the plant through cells in the roots called root hair cells.

(i) In the space below, draw a root hair cell, showing how its shape would differ from the leaf cell shown in part (a).

(1)



Leave
blank

(ii) Explain how the shape of the root hair cell helps it to take in water.

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

(2)

(iii) Describe the process by which water enters the root hair cells.

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

(3)

(Total 8 marks)

Q1

2. Living organisms share certain basic characteristics, including **nutrition** and **movement**. The table below gives descriptions of some other characteristics of living organisms.

Complete the table by filling in the gaps.

Characteristic	Description
respiration	
growth	
	producing offspring

(Total 3 marks)

Q2



Leave
blank

3. A poisonous snake bites a man's toe.

The passage below describes how the snake venom travels from the toe to the brain. Use suitable words to complete the sentences in the passage.

The venom travels to the heart in the largest vein called the

The right atrium contracts and pumps the venom through the atrio-ventricular valve into the right

The muscles of this heart chamber contract and pump the venom through a valve and along the

..... artery to the

The venom returns from this organ to the left atrium of the heart in a vein. It then enters the

chamber of the heart with the thickest wall, made of

tissue. This chamber pumps the blood out of the heart into the largest artery called the

..... A branch of this blood vessel transports the venom to

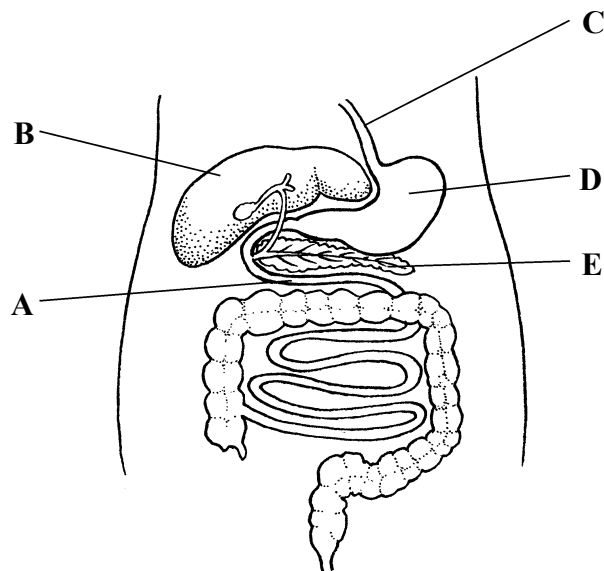
the brain.

Q3

(Total 7 marks)



4. The diagram shows part of the human digestive system.



(a) The table below lists some processes that occur in the human digestive system.

Complete the table using letters from the diagram to show where each process occurs. Write **one** letter only in each box.

Process	Letter
protein is first digested	
fat is emulsified	
bile is produced	
insulin is released	

(4)

(b) (i) Name the process by which muscles move food through the gut.

.....
(1)

(ii) What biological term describes the process of removing undigested food from the body?

.....
(1)

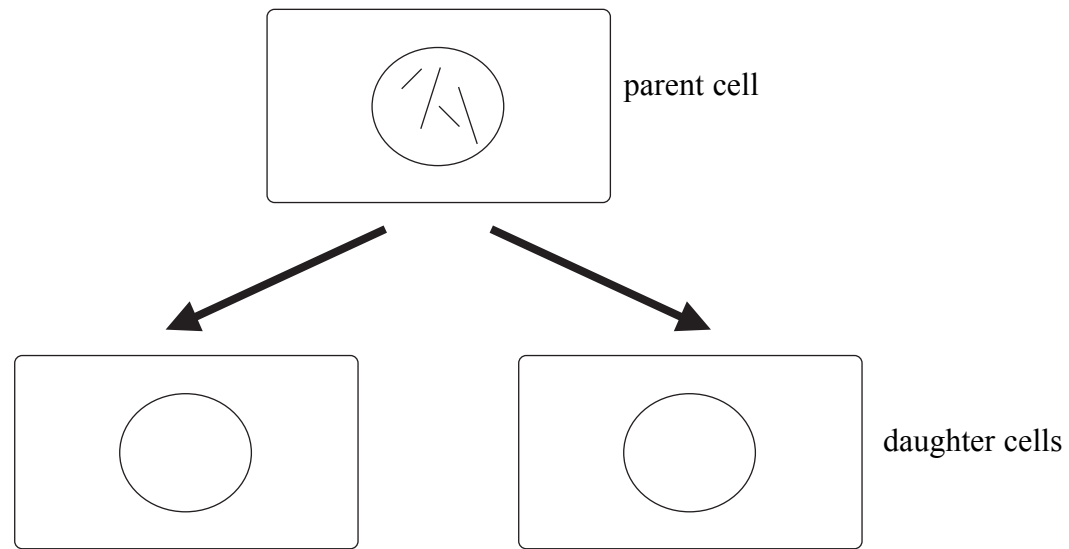
(Total 6 marks)

Q4



5. (a) Cells can divide by mitosis. The diagram below shows the chromosomes in a parent cell before mitosis takes place.

(i) Complete the diagram to show the chromosomes in each daughter cell.

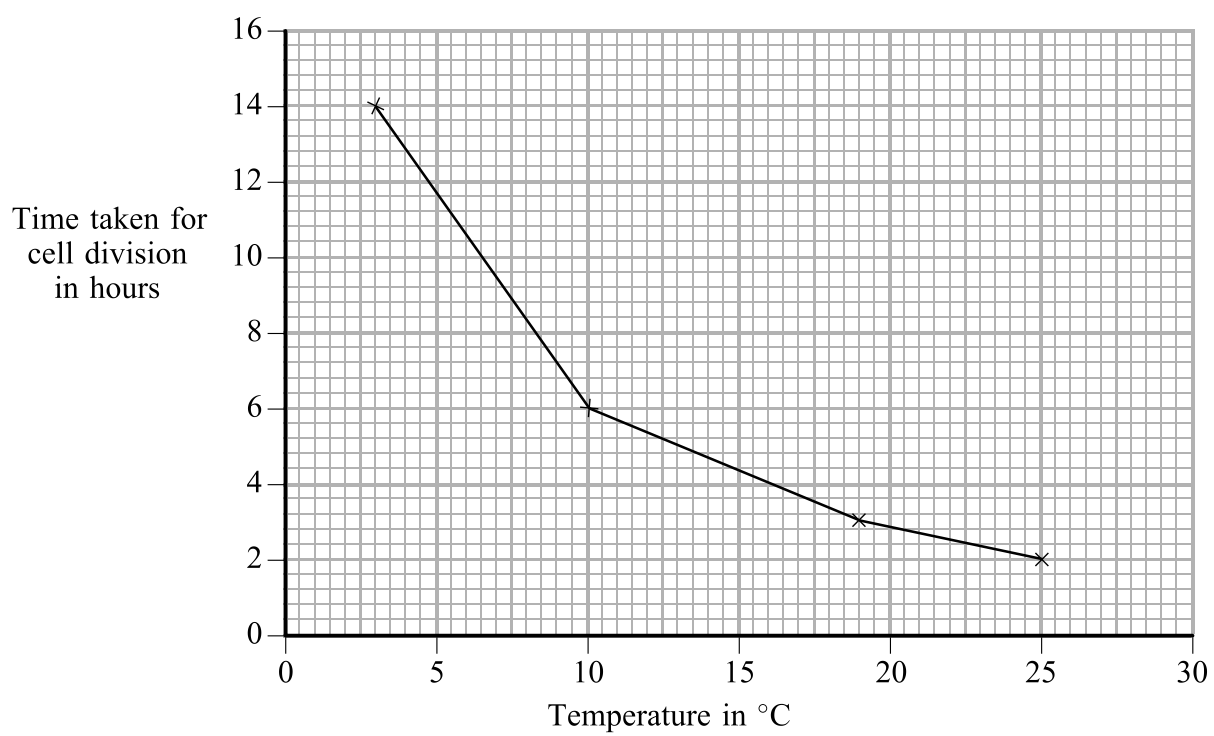


(1)

(ii) What is the diploid number of the parent cell?

..... (1)

(b) The graph below shows the time taken for cells to divide by mitosis at different temperatures.



Leave
blank

- (i) How does the increase in temperature affect the time taken for cell division to occur?

.....
(1)

- (ii) Starting with one cell, at 25 °C, how many cells would there be after

2 hours

8 hours

(2)

Q5

(Total 5 marks)



Leave
blank

6. A river is polluted by some raw sewage. This causes changes in the number of microorganisms in the river. This in turn has an effect on the number of large fish in the river.

Describe and explain these changes.

.....

.....

.....

.....

.....

.....

.....

.....

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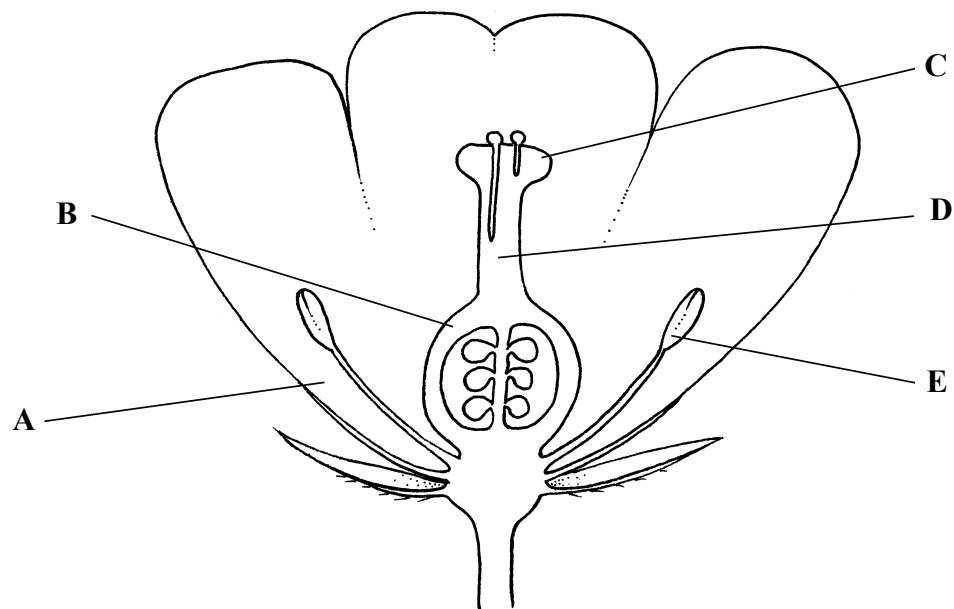
.....

Q6

(Total 5 marks)



7. The diagram shows a section through a flower.



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

A

B

C

D

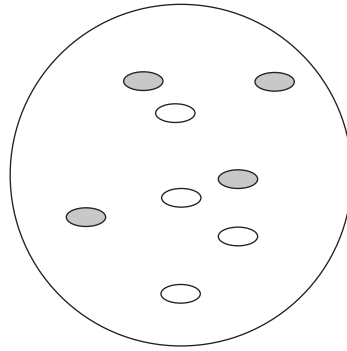
(4)




(b) Part **E** produces pollen. In some flowers the pollen grains contain starch.

The gene for making starch in the pollen grains has two alleles. The allele **B** for making starch is dominant and the allele **b** is recessive.

Some pollen grains were collected from one flower and tested to see if they contained starch. The diagram below shows the results seen using a light microscope.



Key  pollen grain containing starch

 pollen grain not containing starch

(i) Name the substance used to test for starch.

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

(ii) If the pollen grains contain starch, what colour will they be after this test?

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



(c) Pollen grains are haploid, so contain only one allele for a character.

Look at the diagram in (b) showing the pollen grains.

(i) What is the genotype of the flower that produced these pollen grains? Tick the correct answer.

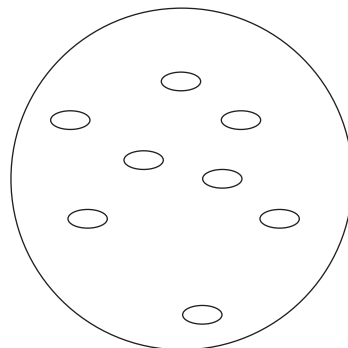
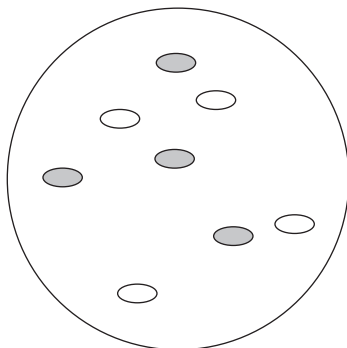
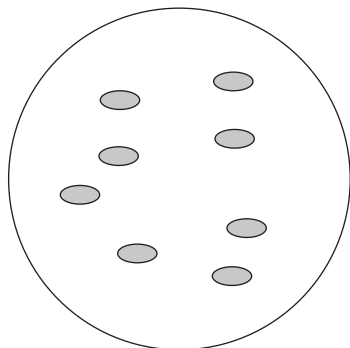
BB (homozygous dominant)

Bb (heterozygous)

bb (homozygous recessive)

(1)

(ii) Pollen is collected from a flower that is homozygous recessive and tested for starch. Which of the following shows the results you would expect to see? Tick the box under the correct answer.



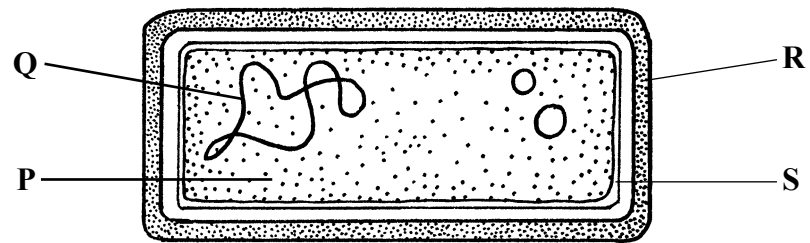
(1)

Q7

(Total 8 marks)



8. The diagram shows a typical bacterium, with parts labelled P, Q, R and S.



(a) (i) Which part is made from DNA?

.....
(1)

(ii) Which part is the cytoplasm?

.....
(1)

(b) *Lactobacillus* are bacteria that are used to make yoghurt. The table lists four stages, 1, 2, 3 and 4, and a description of what happens at each stage in the production of fruit-flavoured yoghurt.

Stage	Description
1	Raw milk is heated to 90 °C for 30 minutes
2	The milk is cooled to 40 °C and bacteria are then added
3	The mixture is kept at 40 °C for several hours until yoghurt is made
4	Fruit is sterilised and added to the yoghurt



Leave
blank

(i) Suggest why stage 1 is needed.

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

(ii) Why must the milk be cooled during stage 2?

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

(iii) Explain why the mixture is kept at 40 °C for several hours during stage 3.

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

(iv) Suggest why fruit is sterilised before being added to the yoghurt.

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

(Total 8 marks)

Q8



9.

Chemical fertilisers are used to increase crop yields. As an alternative to using chemicals seeds can be treated with “biofertiliser”.

This biofertiliser provides a way of coating seeds with nitrogen fixing bacteria before they are sown. Biofertiliser is, for example, used in parts of India to improve crop yield.

A comparison was made of the yield of a crop grown using three different treatments. The table shows the results.

Treatment used	Crop yield in tonnes per hectare
no fertiliser	4.0
chemical fertiliser	4.4
biofertiliser	5.6

(a) (i) When compared with using no fertiliser, what is the increase in crop yield using chemical fertiliser?

..... tonnes per hectare
(1)

(ii) When compared with using no fertiliser, the percentage increase in crop yield when using chemical fertiliser is 10%. Calculate the percentage increase in crop yield when using biofertiliser compared with using no fertiliser. Show your working.

Answer%
(2)



Leave
blank

(b) Explain how nitrogen fixing bacteria help the crop to grow.

.....

.....

.....

.....

.....

.....

.....

.....

(4)

(c) One disadvantage of chemical fertilisers is that they may need to be applied several times during the growth of the crop. Give **one** reason for this.

.....

.....

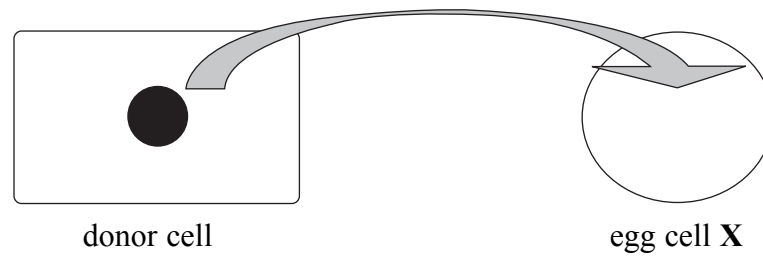
(1)

Q9

(Total 8 marks)



10. (a) The diagram shows a stage in the cloning of animals. The nucleus of an egg cell is removed and replaced with the nucleus from a body cell called the donor cell. This modified cell is shown as egg cell X.



In the table, tick the row with the correct description of the nucleus that was removed from the original egg cell and the nucleus in egg cell X that came from the donor cell.

Nucleus in original egg cell	Nucleus in egg cell X	Tick
haploid	haploid	
haploid	diploid	
diploid	haploid	
diploid	diploid	

(1)

- (b) Cloning experiments have been carried out with frogs at early stages of development. These experiments showed that the age of the donor cells used to provide the nuclei had an effect on the number of offspring that survived. The results of one experiment are shown in the table.

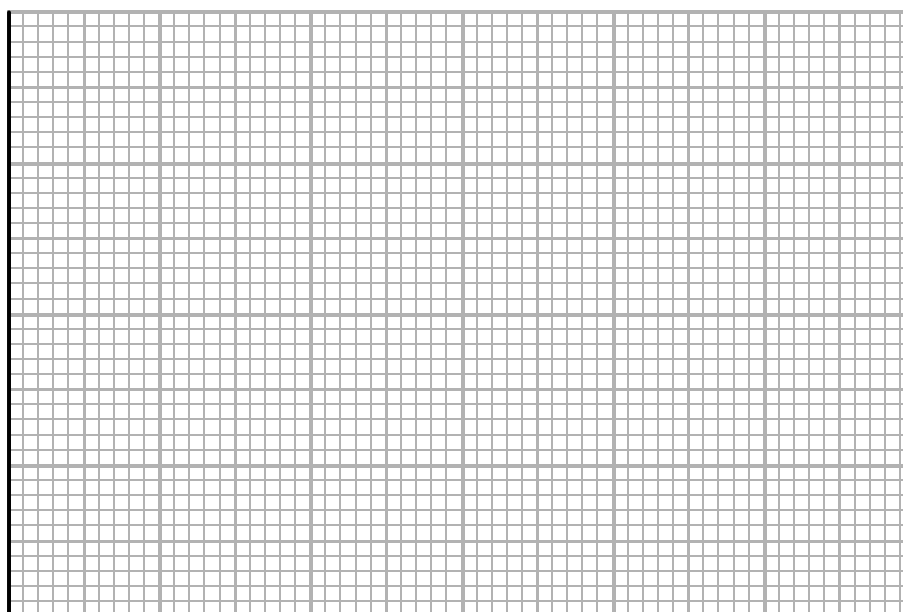
Age of donor cells in hours	Percentage of offspring that survived
6	80
12	76
24	52
38	40
58	28
120	15



Leave blank

(i) Plot the data in the table on the grid below. Join the points with straight lines.

Percentage of offspring that survived



Age of donor cells in hours

(3)

(ii) At what age did the donor cells produce 50% of offspring that survived?

.....
(1)

(iii) Describe the relationship between the age of donor cells and the percentage of offspring that survive.

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

(c) The process described in (a) can be used to make clones of transgenic animals.

What is meant by the term **transgenic**?

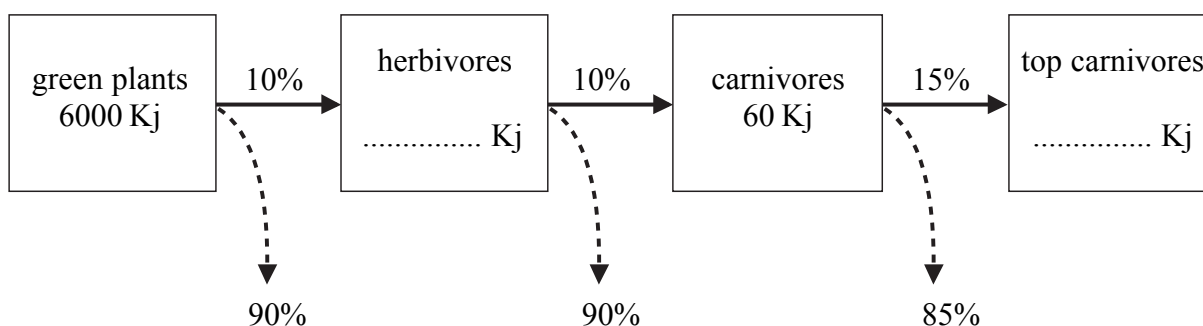
.....
.....
.....
(2)

Q10

(Total 8 marks)



12. The boxes in the diagram show the amount of energy in different trophic levels of a food chain. The numbers on the solid arrows show the percentage of energy transferred between the organisms in the different trophic levels. The numbers on the dotted arrows show the percentage of energy not transferred from one trophic level to the next.



(a) Complete the diagram by showing the amount of energy in the box for the herbivores and in the box for the top carnivores. (2)

(b) All organisms respire. One reason why 90% of the energy is not transferred from the herbivores to the carnivores is because of respiration by the herbivores.

(i) Give the balanced chemical symbol equation for respiration.

..... (3)

(ii) Give **two** reasons, other than respiration, why 90% of the energy in herbivores is not transferred to the carnivores.

1

.....

2

..... (2)

(c) Which group of organisms shown in this food chain are secondary consumers?

..... (1)

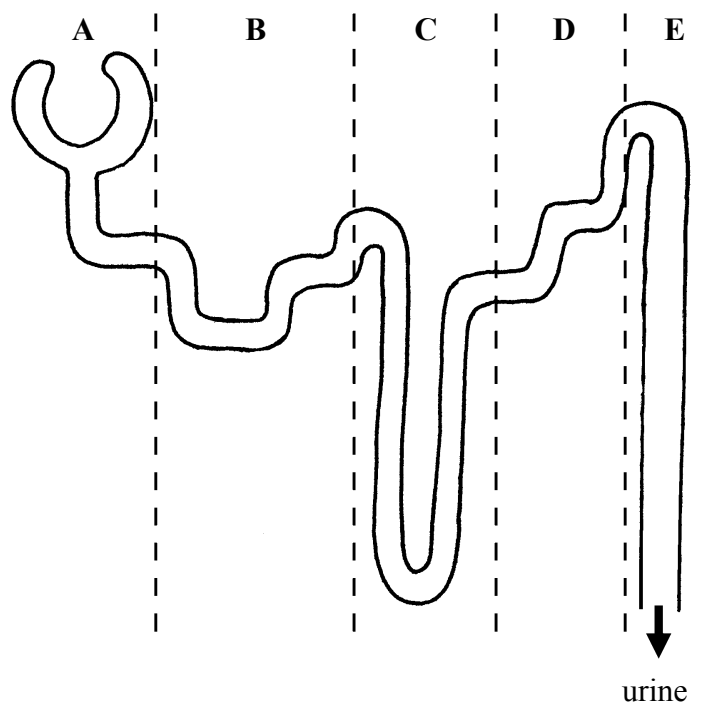
(Total 8 marks)

Q12



N 2 3 0 4 4 A 0 1 9 2 8

13. The diagram shows a kidney nephron divided into five regions labelled **A**, **B**, **C**, **D** and **E**.



(a) Choose the correct letter to complete the following sentences. Each letter may be used once, more than once, or not at all.

The Bowman's capsule is in region

Ultrafiltration occurs in region

ADH has its effect in region

Selective reabsorption of glucose occurs in region

(4)

(b) (i) Normal urine that leaves part **E** contains salts. Name **two** other substances contained in normal urine.

1

2

(2)

(ii) A person cannot make insulin. Explain why this person's urine may be different from normal urine.

.....

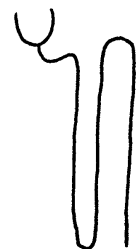

.....

.....

(2)



(c) In a nephron, the longer the tube is in region C, the more water can be reabsorbed. Look at the information in the table and then draw a nephron for a beaver.

Animal	Description of habitat	Diagram of nephron
kangaroo rat	hot deserts with little water available	
human	on land with enough water available	
beaver	rivers with lots of water available	

(1)

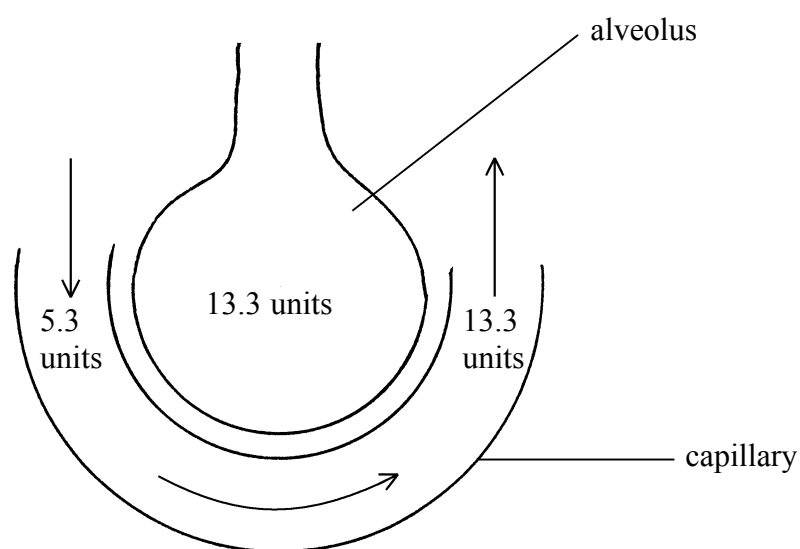
Q13

(Total 9 marks)



14. Gas exchange takes place in the lungs.

The diagram shows an alveolus and a capillary. The numbers on the diagram represent the concentration of oxygen (in arbitrary units) in the alveolus and at different places in the capillary. The arrows show the direction of blood flow in the capillary.



- (a) Explain why the concentration of oxygen in the blood changes as it travels along the capillary.

.....

(2)

- (b) The formula shows how to calculate a value that represents oxygen uptake between the lung and the blood.

$$\text{oxygen uptake} = \frac{\text{SA} \times \text{oxygen difference}}{\text{distance}}$$

SA = total surface area of alveoli in m²

oxygen difference = difference in oxygen concentration between the alveoli and the blood entering the capillary in arbitrary units

distance = distance gas molecules travel from the alveoli into the blood in mm



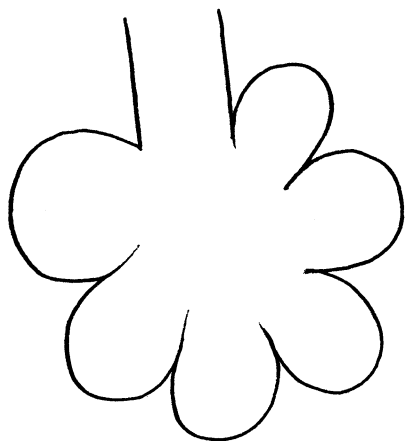
- (i) The total surface area in a normal human lung is 120 m^2 . The distance between an alveolus and the blood is 0.1 mm .

Use this information, the information in the diagram, and the formula, to calculate the value for oxygen uptake in a normal lung.

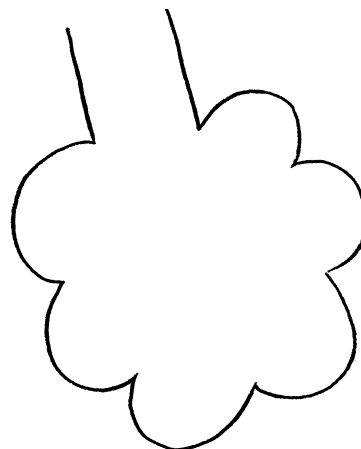
Show your working.

(2)

- (ii) Emphysema is a lung disease caused by smoking cigarettes. The diagrams below show the alveoli in a normal lung and the alveoli in the lung of a person with emphysema.



alveoli in normal lung



alveoli in the lung of a person with emphysema

What effect would emphysema have on the value for oxygen uptake?

.....
(1)

- (iii) Suggest how the air this person breathes can be altered to relieve the symptoms of emphysema.

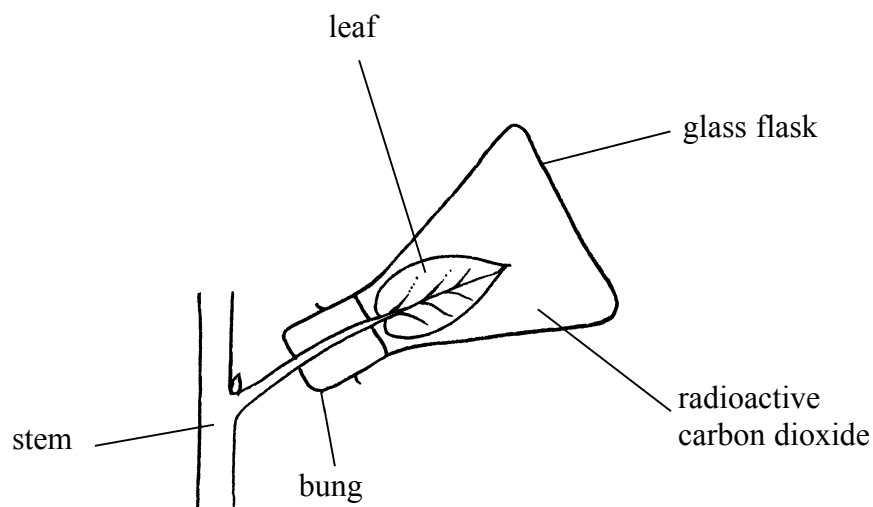
.....
(1)

(Total 6 marks)

Q14



15. A plant leaf was exposed to radioactive carbon dioxide as shown in the diagram below.



When the plant leaf is placed in the light and exposed to radioactive carbon dioxide, the carbohydrate it makes is radioactive.

(a) (i) Describe how carbon dioxide gets into the leaf.

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

(2)

(ii) Name the process that uses carbon dioxide to make the carbohydrate.

.....

(1)

(b) The amount of carbohydrate transported to other parts of the plant can be found by measuring the amount of radioactivity.

(i) Name the tissue that transports the carbohydrate.

.....

(1)

(ii) Name the carbohydrate that is transported in this tissue.

.....

(1)



16. The table gives descriptions of some biological processes.

Complete the table by giving **one** word for the correct name of each process. The first one has been done for you.

Description of process	Name of process
removal of toxic waste from the body	excretion
fusion of male and female gametes	
evaporation of water from the leaves of a plant	
maintaining a constant level of substances in the body	
growth of a plant shoot towards light	
increasing the diameter of small arteries	
adjustments made by the eye to produce a clear image on the retina	

(Total 6 marks)

Q16



17. DNA is a double helix with each strand linked by a series of paired bases. There are four bases in DNA.

The table below shows the percentage of each base found in a sample of DNA taken from a mammal. Only two of the bases have been named in the table.

(a) Complete the table to give the names of the other two bases.

Percentage of base in DNA sample	Name of base
30	thymine (T)
20	guanine (G)
30	
20	

(2)

(b) The sample of DNA contained 2000 bases. How many thymine bases would the DNA sample contain?

.....

(1)

(c) Human DNA contains the gene to make insulin. Bacteria can be modified to contain this gene. Describe the steps used to do this.

.....
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(5)

(Total 8 marks)

Q17

TOTAL FOR PAPER: 120 MARKS

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