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Answer ALL the questions. Write your answers in the spaces provided.

1. The table shows some characteristics of different types of organism.

Complete the empty boxes in the table by giving an example of each type of organism, and by writing the word **YES** or **NO** to show whether the type of organism is multicellular or not.

Some of the boxes have been completed for you.

| Type of organism | Example | Multicellular |
|------------------|----------------------|---------------|
| plants | | YES |
| animals | | |
| bacteria | <i>Lactobacillus</i> | |
| viruses | | NO |

(Total 5 marks)

Q1



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2. In an area of rainforest, there were plans to cut down lots of trees (deforestation) to build a new road. Some people did not want this to happen, but some people did.

(a) Suggest **two** reasons why some people wanted the road to be built.

1

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2

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(2)

(b) Describe **two** biological effects that may occur as a result of deforestation.

1

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(4)

Q2

(Total 6 marks)



3. The drawing shows a flowering plant.



(a) (i) Name the part of the flower that produces pollen.

..... (1)

(ii) Use a line and the letter P to label this part on the drawing.

(1)

(iii) Explain what is meant by the term **pollination**.

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..... (2)

(b) The stem and leaves of the plant grow upwards. Name **one** stimulus that makes them grow upwards.

..... (1)



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(c) The leaves produce glucose by photosynthesis.

(i) Write the word equation for photosynthesis.

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(2)

(ii) Describe how the structure of the leaf is adapted to help obtain the gas required for photosynthesis.

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(2)

Q3

(Total 9 marks)



4. A teacher was helping to prepare an athlete for a marathon. The teacher measured the heart rate of the athlete every ten minutes during a training session lasting one hour. The results are shown in the table.

| Time in minutes | Heart rate in beats per minute |
|-----------------|--------------------------------|
| 0 | 66 |
| 10 | 77 |
| 20 | 88 |
| 30 | 100 |
| 40 | 122 |
| 50 | 124 |
| 60 | 123 |

- (a) Describe the pattern shown by the results.

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(2)

- (b) Name the hormone responsible for the change in heart rate during exercise.

.....

(1)

- (c) How would you expect the results to be different in someone who smokes? Give a reason for your answer.

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(2)

- (d) Name **one** system in the body, other than the circulatory system, that is affected by smoking.

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(1)

Q4

(Total 6 marks)



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6. People with diabetes may not produce enough insulin and so are unable to control their blood glucose level. To overcome this, they inject themselves with insulin in the leg.

The passage below describes how the injected insulin travels from the leg to the liver. Use suitable words to complete the sentences in the passage.

The insulin travels to the heart in a blood vessel called the,
the largest vein in the body. Blood enters a chamber called the
right, and passes to the right ventricle before being pumped
in the pulmonary artery to the Backflow of blood is
prevented by atrio-ventricular and semilunar The blood
containing insulin returns to the heart in the pulmonary vein. It then leaves the heart
in the, the largest artery in the body. Finally, the insulin
is taken into the liver by the artery. When insulin reaches
the liver cells it causes the conversion of into an insoluble
carbohydrate called

Q6

(Total 8 marks)



7. The techniques of selective breeding and micropropagation (tissue culture) can be used together to produce large numbers of plants with desired characteristics.

(a) The table shows the steps taken to produce plants using selective breeding.

Complete the table by using numbers to show the correct order of the steps.

| Step | Order of step |
|---|---------------|
| repeat crosses for several generations | |
| cross parent plants to produce more offspring | |
| identify parent plants with desired characteristics | |
| select offspring with desired characteristics | |

(3)

(b) Give **two** reasons why micropropagation (tissue culture) is a useful technique to use after a selective breeding programme.

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(2)

Q7

(Total 5 marks)



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8. The table below shows the crop yield of three different crops when grown in soil and in liquid fertiliser.

| Crop grown in | Crop yield | | |
|-------------------|--------------------------|--------------------------------|------------------------|
| | Tomatoes in kg per plant | Potatoes in tonnes per hectare | Rice in kg per hectare |
| soil | 5.4 | 12.1 | 551 |
| liquid fertiliser | 9.0 | 26.3 | 1652 |

(a) Name the mineral ion in soil and in liquid fertiliser that helps plants make chlorophyll.

.....
(1)

(b) Calculate the percentage increase in the growth of tomatoes in liquid fertiliser compared to those grown in soil. Show your working.

Answer
(2)

(c) Suggest why the growth of all the crops was better in liquid fertiliser than it was in the soil.

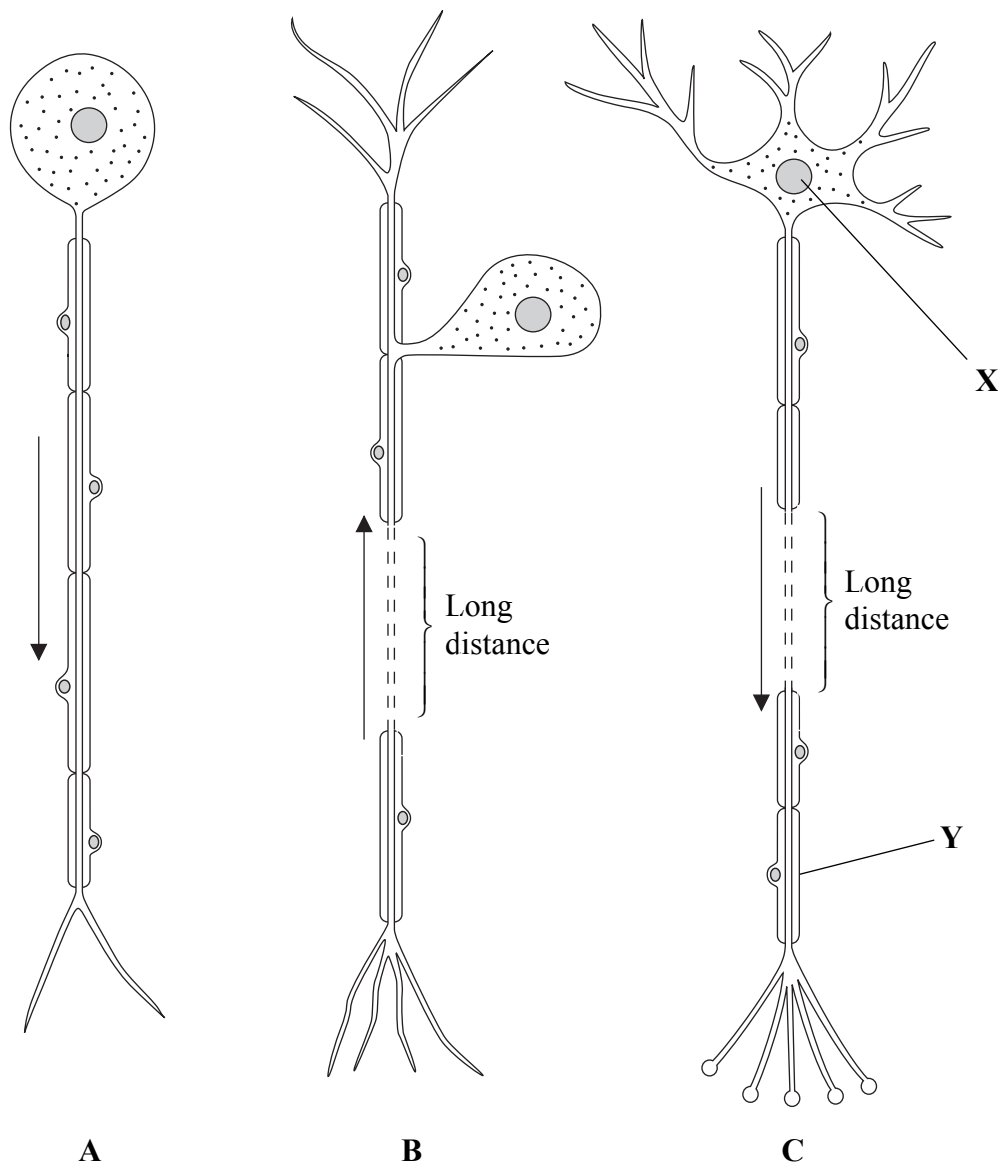
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(2)

Q8

(Total 5 marks)



9. The diagrams show three neurones (nerve cells).



(a) (i) Name the parts labelled **X** and **Y** on neurone **C**.

X

Y

(2)

(ii) Which neurone passes impulses from a receptor to the central nervous system?

.....

(1)

(iii) Which neurone is found only in the central nervous system?

.....

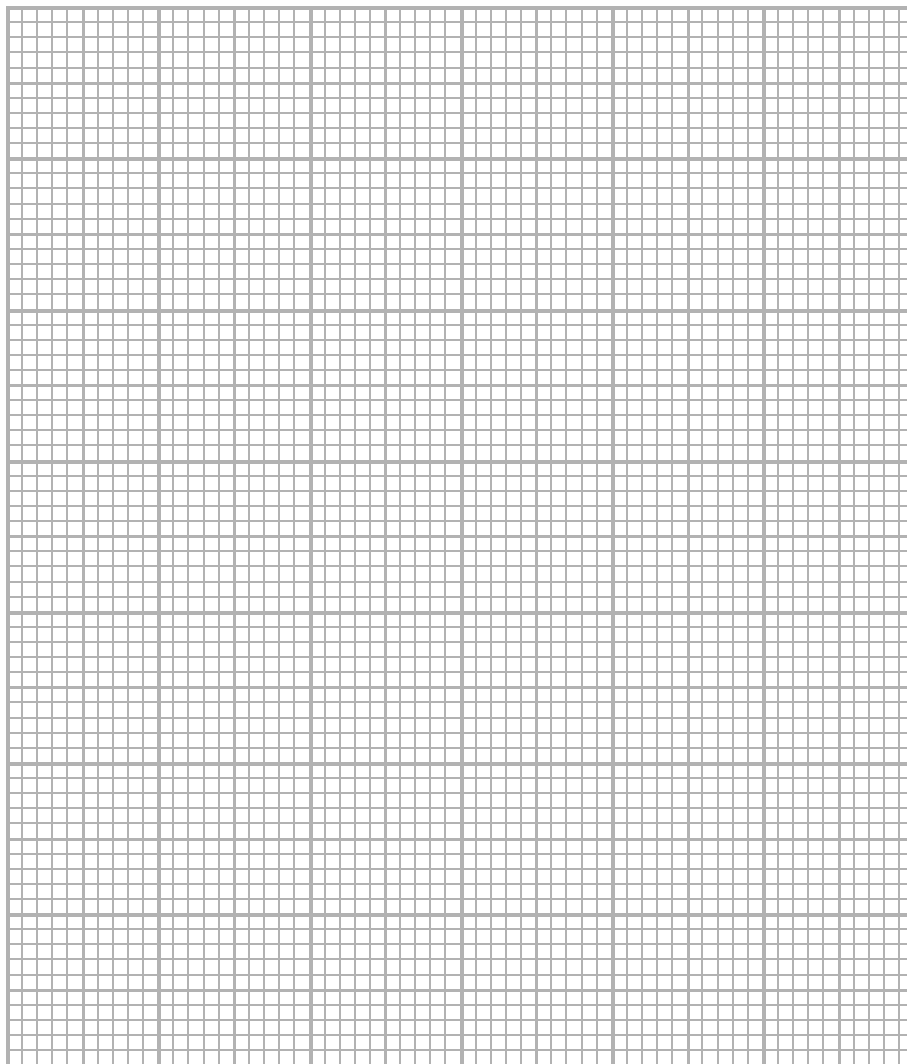
(1)



(b) The table shows the speed of a nerve impulse along neurones with different diameters, measured in micrometres (μm).

| Diameter of neurone in μm | Speed of impulse in m per second |
|--------------------------------------|----------------------------------|
| 2 | 12 |
| 4 | 28 |
| 6 | 40 |
| 8 | 46 |
| 10 | 60 |
| 12 | 68 |

(i) Plot a line graph of the data in the table on the grid below.



(2)



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(ii) Describe the relationship between the diameter of a neurone and the speed of an impulse along the neurone.

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(1)

(iii) Suggest how fast an impulse would travel along a neurone with a diameter of 5 μm .

..... m per second

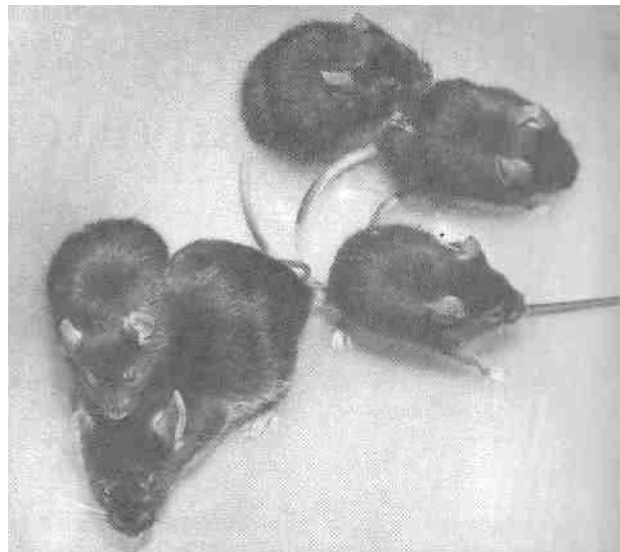
(1)

Q9

(Total 8 marks)



10. The photograph shows a mouse of normal size together with some dwarf mice.



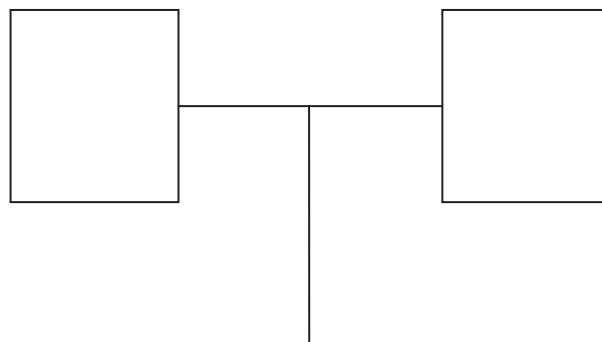
A gene controls whether a mouse is normal in size or dwarf. This gene has two alleles. The allele **D** is dominant to the allele **d**. Mice with a dominant allele develop a normal pituitary gland. This produces a growth hormone and these mice grow to normal size. Mice that lack the dominant allele develop a pituitary gland that fails to secrete growth hormone. These mice do not grow to normal size and are dwarf.

Dwarf mice are sterile and can only be produced by mating normal mice.

(a) (i) A cross between two normal mice produced some dwarf mice. Complete the diagram below to give the genotypes of the parents and the possible offspring from this cross.

genotype of male parent

genotype of female parent



possible genotypes of offspring

(2)



(ii) What is the phenotype ratio of the possible offspring?

..... (1)

(iii) What is the probability of two homozygous parents producing a dwarf mouse? Give a reason for your answer.

.....

 (2)

(b) Suggest why dwarf mice use up more oxygen per g body mass than normal mice.

.....

 (2)

(c) Hormones are produced in glands called endocrine glands. These glands secrete their hormones into the bloodstream. The bloodstream transports the hormone to a target organ in the body where the hormone produces an effect.

Use this information to help you complete the table below.

| Hormone | Endocrine gland | Target organ | Effect |
|------------|-----------------|--------------|----------------|
| adrenaline | adrenal | heart | |
| oestrogen | | | repairs lining |

(3)

(Total 10 marks)

Q10

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12. The table lists some processes. Complete the table by giving a brief description of what is involved for each process.

| Process | Description |
|---------------|-------------|
| decomposition | |
| transpiration | |
| nitrification | |
| vasodilation | |

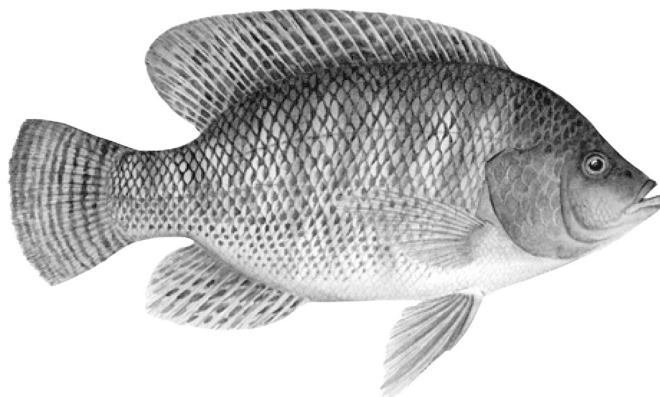
Q12

(Total 8 marks)



13. Fish farms produce large numbers of fish as food for humans. The fish are kept in ponds and fed a diet that includes lipids and vitamin D.

The picture shows one type of fish that is farmed.



(a) (i) Suggest why fish need lipids.

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(1)

(ii) Suggest why fish need vitamin D.

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(1)

(b) For every 100 units of energy ingested by each fish, 23 units are assimilated into biomass. Give **two** reasons to explain what might have happened to the other 77 units of energy.

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(2)



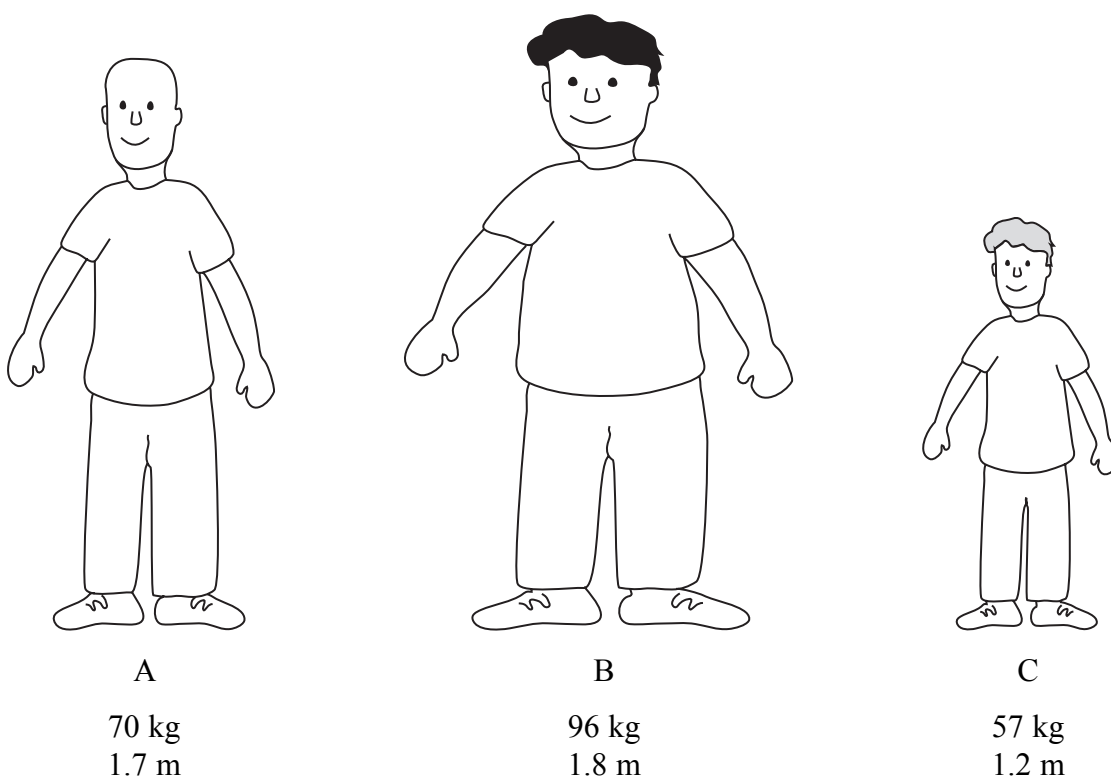
14. Obesity (being extremely overweight) is an increasing problem in the Western world. You can calculate whether or not you are obese by using a formula called the BMI (body mass index). The formula is shown below.

$$\text{BMI} = \frac{\text{body mass in kg}}{(\text{height in m})^2}$$

The table shows how BMI values are used to describe the weight of people.

| BMI value | Description of weight |
|----------------|-----------------------|
| less than 18.5 | underweight |
| 18.5 to 24.9 | normal weight |
| 25.0 to 29.9 | overweight |
| 30.0 or above | obese |

The diagram gives information about the mass and height of three people, A, B and C.



(a) Use the BMI formula to complete the table below. Show your working.

| Person | BMI value | Description of weight |
|--------|-----------|-----------------------|
| A | 24.2 | normal weight |
| B | | |
| C | | |

(2)

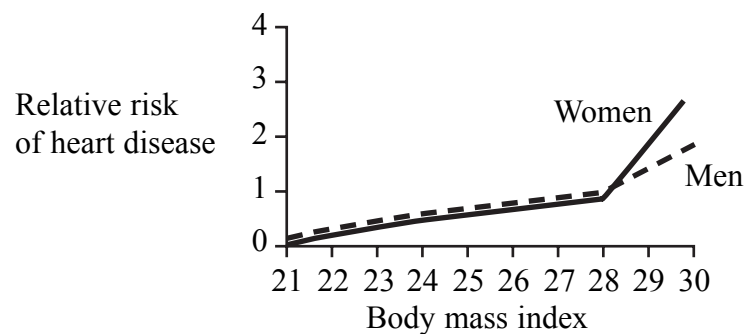
(b) Exercise increases muscle tissue and reduces body fat. Muscle is more dense than fat. Suggest how this might affect the BMI of an athlete compared to a non athlete of the same size.

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(1)



(c) The graph shows the relationship between BMI and the risk of heart disease in men and in women.



(i) Give **two** conclusions that can be drawn from the information in the graph.

1

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(2)

(ii) When a person has heart disease, the blood vessels supplying the heart muscle become narrow and may get totally blocked. Suggest how this might happen and describe how it would change the respiration of heart muscle cells, leading to their death.

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(5)

(Total 10 marks)

Q14

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N 3 1 3 7 6 A 0 2 3 2 8

15. Ultrafiltration and selective reabsorption are processes that take place in the kidneys.

(a) Give **three** ways in which ultrafiltration differs from selective reabsorption.

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(3)

(b) Kidneys can produce urine that varies in volume and concentration depending on certain events.

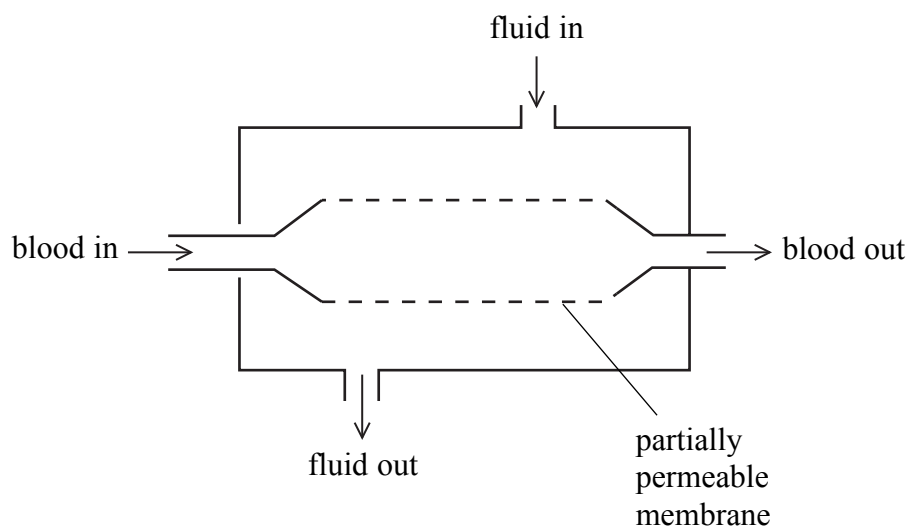
(i) Complete the table by writing the correct word in each box to show the description of urine after each event. Some boxes have been completed for you.

| Event | Volume of urine (large or small) | Concentration of urine (dilute or concentrated) |
|------------------------------|-------------------------------------|--|
| after doing lots of exercise | | concentrated |
| after eating lots of protein | small | |
| after drinking lots of water | | |
| after eating salty crisps | | |

(4)



(c) If kidneys stop working, a kidney machine can be used to remove waste substances from the blood. The diagram shows a section of the machine.



A tube is connected from a vein in the arm to the kidney machine. Blood flows through the kidney machine before returning to the same vein in the arm. A fluid also passes through the machine removing the waste substances from the blood.

(i) Suggest **two** reasons why the tube is connected to a vein rather than an artery.

- 1
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 - 2
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- (2)**

(ii) The kidney machine can remove excess salts (mineral ions) from the blood. Explain how these pass from the blood into the fluid.

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- (2)**



(iii) Name **two** waste substances, other than salts, that the kidney machine can remove from the blood.

1

2

(2)

(Total 17 marks)

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Q15

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