

Langholm Academy



National 5 Biology

Unit 2: Multicellular Organisms Homework Booklet

Name: _____ Class: _____

<i>Homework title</i>	<i>Due date</i>	<i>On time/Complete?</i>	<i>Mark</i>
Producing New Cells			/18
Communication and Control			/26
Reproduction			/20
Variation and Inheritance			/45
Plant Transport			/12
Animal Transport			/50
Absorption			/30

Producing New Cells

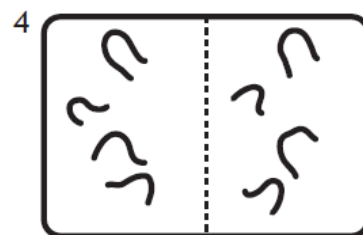
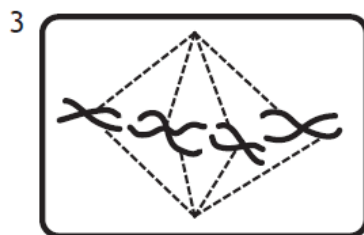
1. Specialisation of cells in animals leads to the formation of

- A tissues and organs
- B meristems and organs
- C stem cells and tissues
- D stem cells and meristems.

2. Which of the following does **not** involve mitosis?

- A Synthesis of proteins
- B Growth of tissue
- C Maintenance of the diploid chromosome complement
- D Repair of tissue

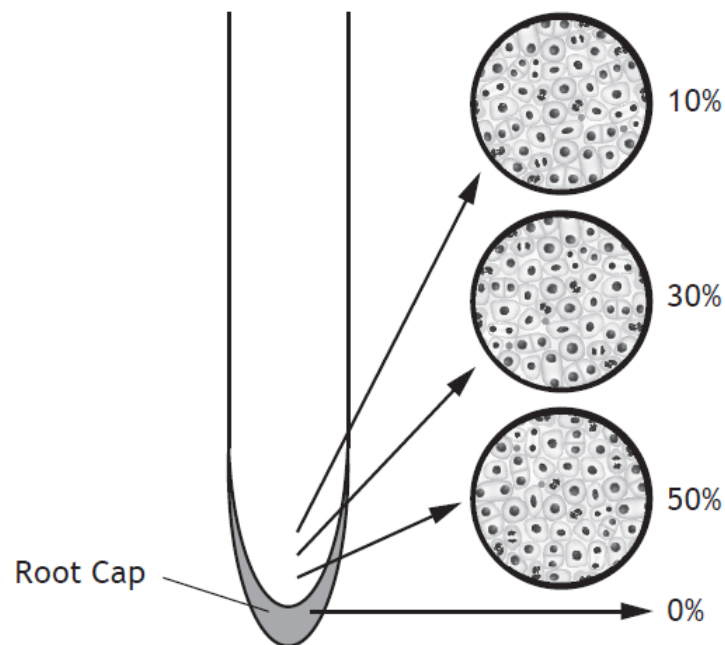
3. The following diagrams show a cell at four different stages of mitosis.



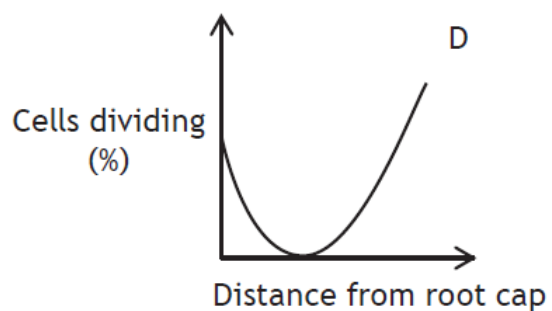
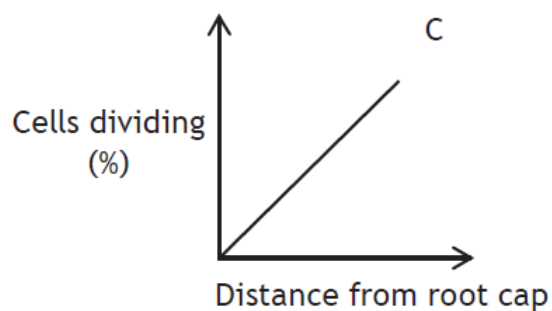
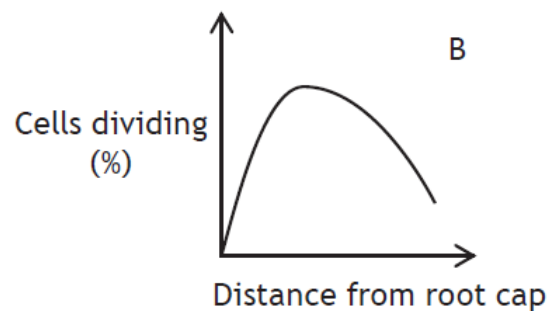
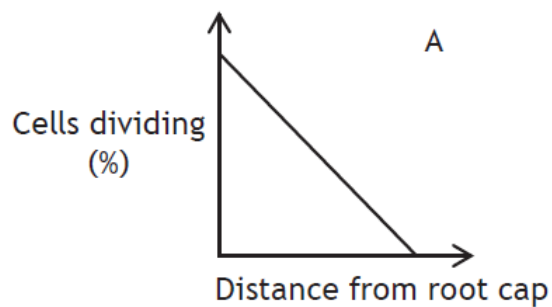
The correct order of the stages of mitosis is

- A 1,3,2,4
- B 2,3,4,1
- C 3,2,1,4
- D 4,1,2,3.

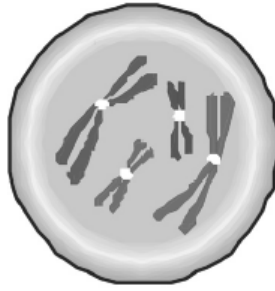
4. The diagram below shows the percentage of cells dividing in four areas of a root.



Which graph represents the number of cells dividing in this root?



5. (a) The diagram below represents a cell in an early stage of mitosis.



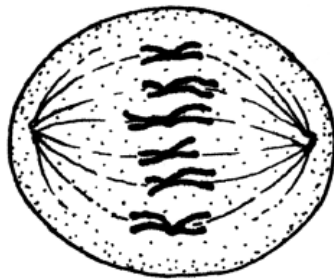
- (i) State the number of chromosomes present in this cell.

1

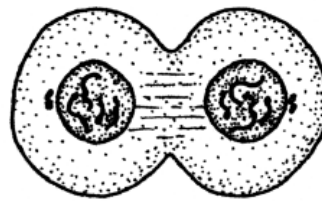
- (ii) State how many chromosomes will be present in each of the two cells produced by the process.

1

6. (a) The following diagrams show two stages in cell division.



Stage X



Stage Y

Draw **one** line from each of the stages named below to its correct description.

<i>Stage</i>	<i>Description of stage</i>
Stage X	Chromosomes become visible in the nucleus
	Chromosomes line up at the equator
Stage Y	Nuclear membrane breaks down
	Cytoplasm divides

2

- (b) Underline one option in each of the brackets to make the following sentences correct.

Cell division is controlled by the $\left\{ \begin{array}{l} \text{membrane} \\ \text{nucleus} \\ \text{cytoplasm} \end{array} \right\}$.

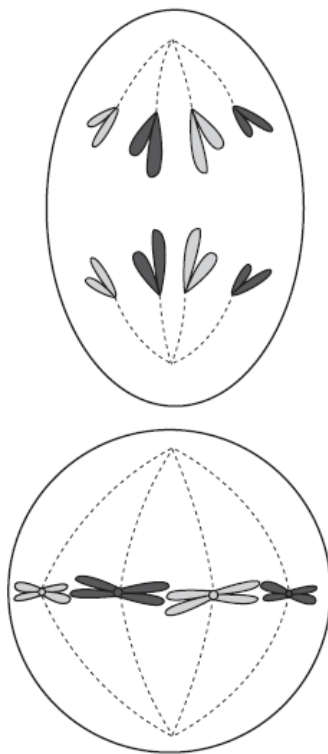
The number of chromosomes in the daughter cells is

$\left\{ \begin{array}{l} \text{greater than} \\ \text{less than} \\ \text{the same as} \end{array} \right\}$ the original cell.

2

7. (a) The diagrams below show two stages of mitosis in cells.

Draw **one** straight line from each diagram to its correct description.



chromosomes shorten and thicken

chromosomes line up at the centre of the cell

chromatids are pulled to opposite ends of the cell

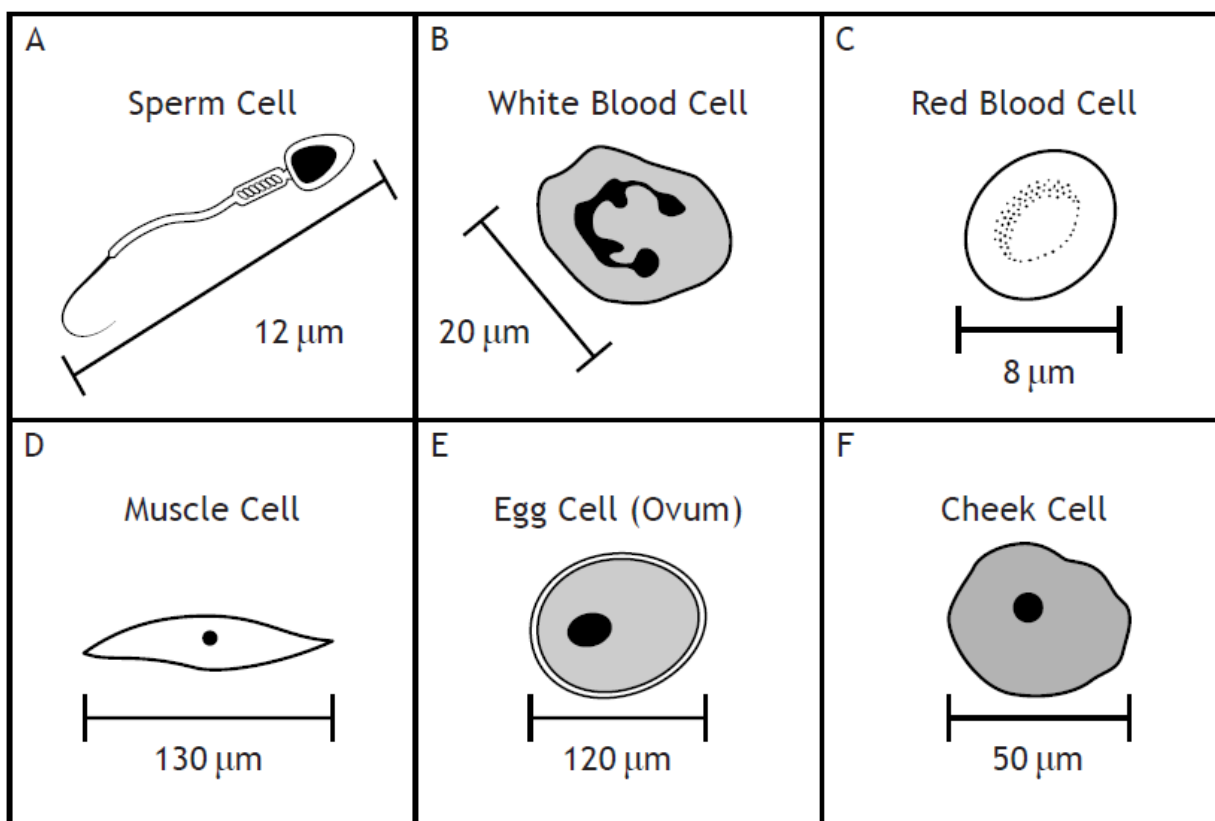
nuclear membrane reforms

2

- (b) How does mitosis ensure that the daughter cells will be able to function properly?

1

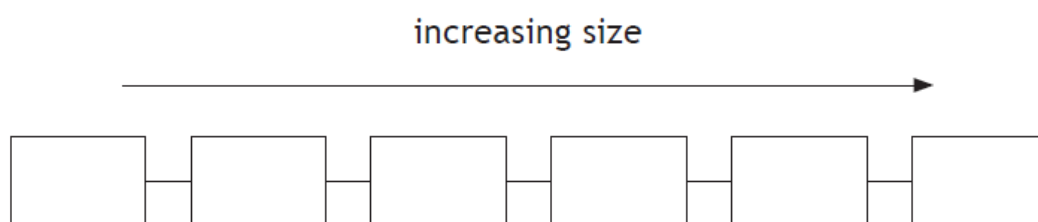
8. The diagrams below show examples of some types of specialised cells from the human body.



The cells are not drawn to the same scale.
(μm = micrometre)

- (a) Put letters in the boxes below to arrange the cells in order of size.

1



- (b) Choose one of the following cell types by circling it.

sperm cell

egg cell

red blood cell

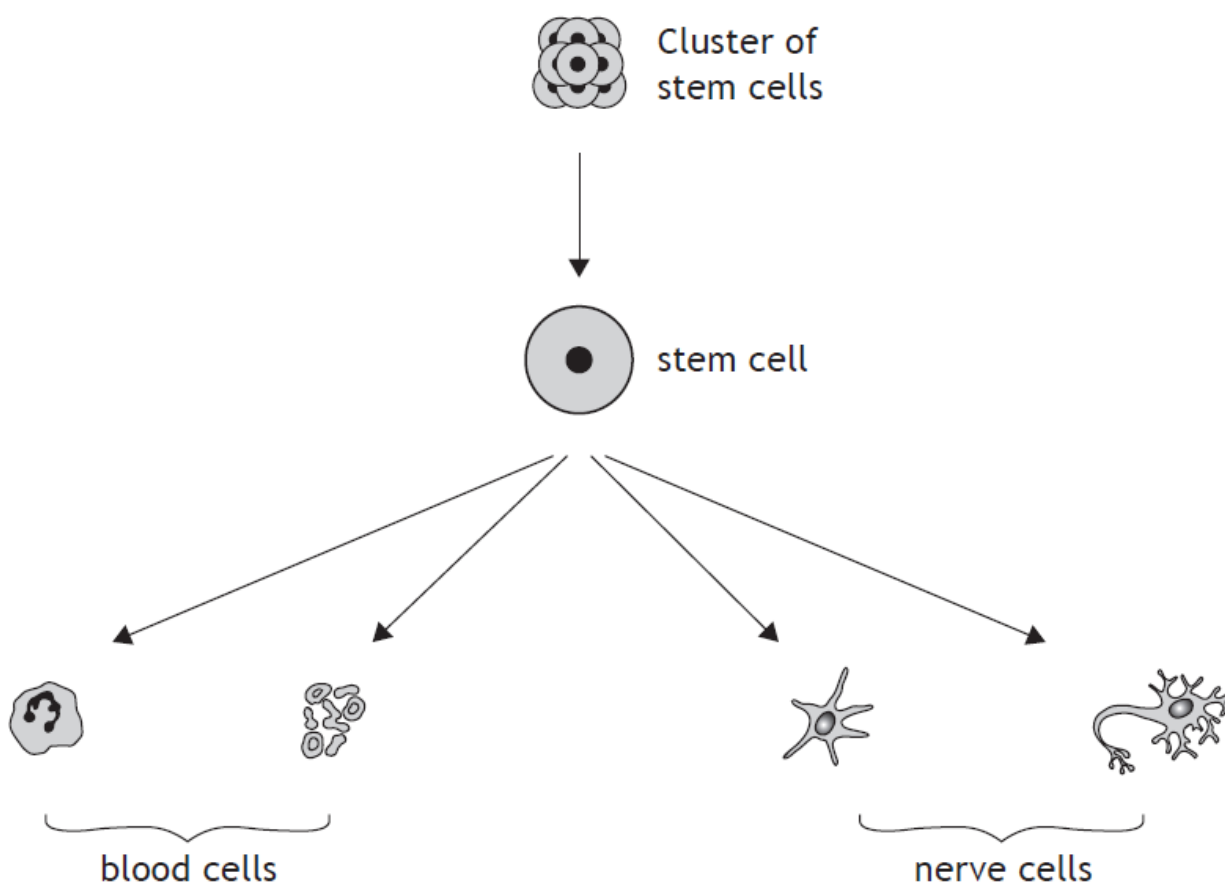
Describe the function of the chosen cell and explain how its specialisation allows it to carry out that function.

2

Function _____

Explanation _____

9. The diagram below shows some stages in the development of blood cells and nerve cells.



Describe the feature of stem cells which gives them the potential to develop into many different types of cells, such as blood and nerve cells.

1

- (d) Which of the following statements refer to processes involving stem cells?

Tick (✓) the correct box(es).

1

Growth of new skin

☐

Transmission of nerve impulses

☐

Muscle contraction

☐

Repair of broken bones

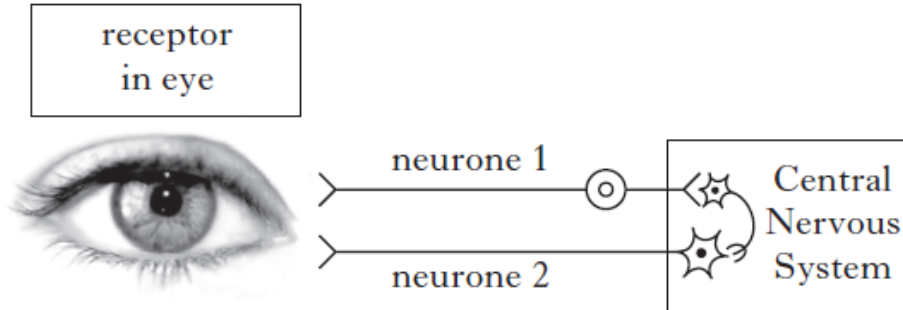
☐

Production of insulin

☐

Communication and Control

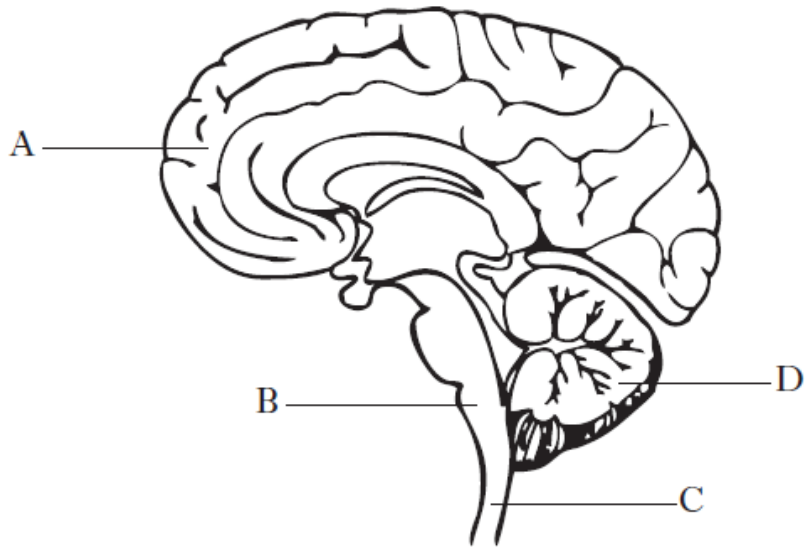
1. The diagram below shows neurones connecting the eye with the central nervous system.



Which line in the table below identifies correctly the types of neurones and the direction of impulses which travel along them?

	<i>Neurone 1</i>	<i>Neurone 2</i>
A	Motor →	Sensory ←
B	Sensory →	Motor ←
C	Motor ←	Sensory ←
D	Sensory ←	Motor →

2. The following diagram shows a human brain.

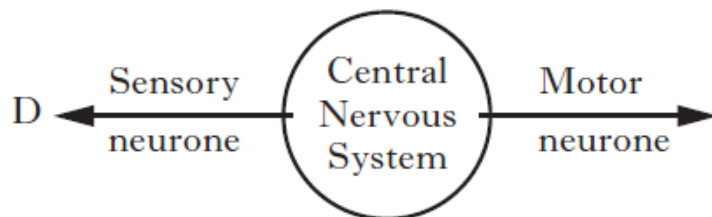
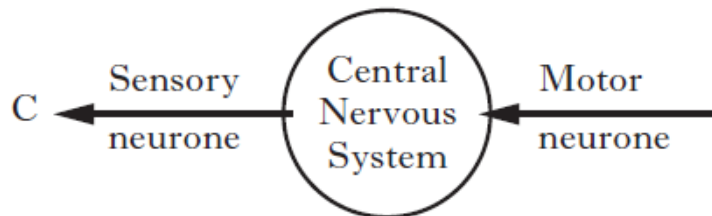
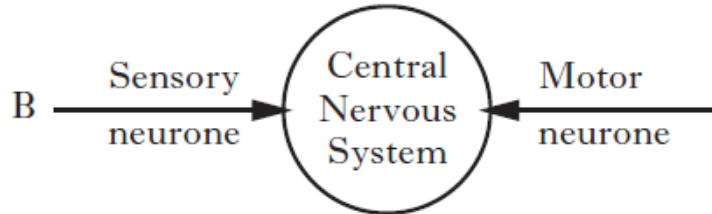
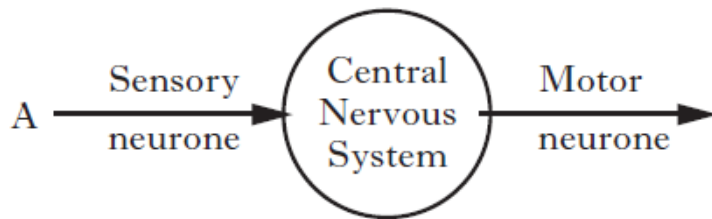


Which letter indicates the site of memory and conscious responses?

3. Which part of the brain controls breathing and heart rate?

- A Cerebellum
- B Cerebrum
- C Hypothalamus
- D Medulla

4. Which of the diagrams below correctly identifies neurones and the direction of travel of nerve impulses?



5. The table below shows the blood glucose levels of two people after eating the same meal.

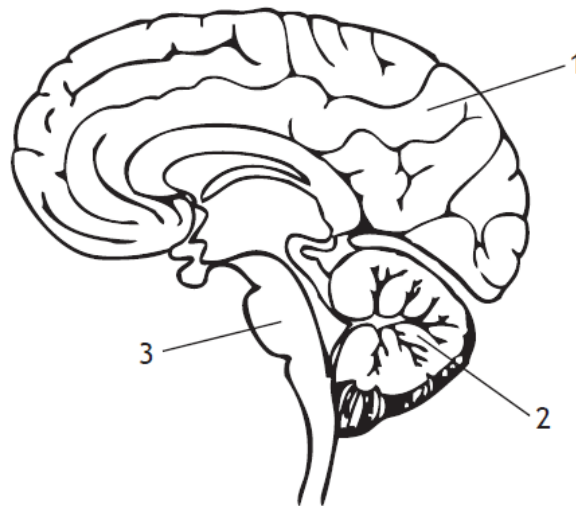
The normal range of blood glucose levels is 82–110 mg/dL.

<i>Time after eating meal (min)</i>	<i>Blood glucose levels (mg/dL)</i>	
	<i>Person A</i>	<i>Person B</i>
30	120	140
60	140	170
90	110	190
120	90	180
150	85	170
180	90	160

Using the information given, which of the following statements is correct?

- A Person A always stayed within the normal range.
- B Person B was outwith the normal range 180 minutes after eating.
- C Person B had a level twice as high as that of person A 180 minutes after eating.
- D Person A and person B both had their highest levels 90 minutes after eating.

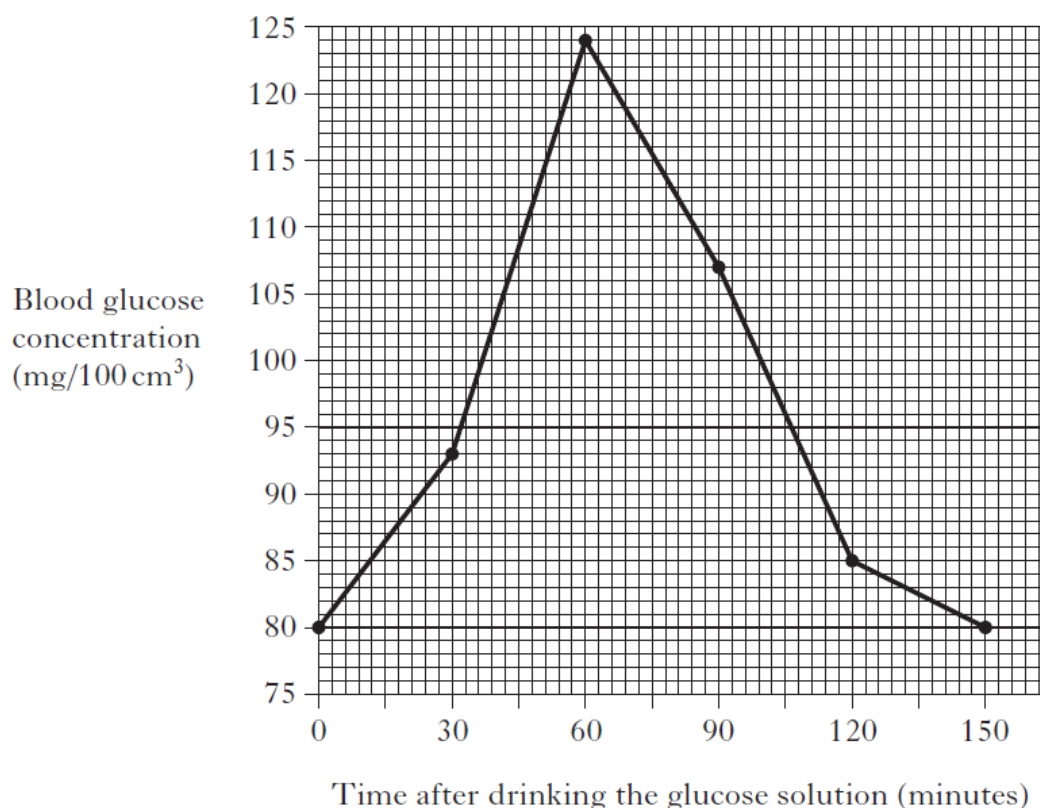
6. The diagram below represents the human brain.



Which line in the table below identifies structures 1, 2 and 3 of the human brain?

	<i>Structure 1</i>	<i>Structure 2</i>	<i>Structure 3</i>
A	medulla	cerebrum	cerebellum
B	cerebrum	medulla	cerebellum
C	cerebellum	cerebrum	medulla
D	cerebrum	cerebellum	medulla

7. A person's blood glucose concentration was measured. The person then drank a glass of 25% glucose solution. The blood glucose concentration was measured over the next 150 minutes. The graph below shows the results.



- (a) Use data from the graph to describe the changes in blood glucose concentration over this 150 minute period.

2

- (b) Calculate the percentage increase in blood glucose concentration from 0 to 60 minutes.

Space for calculation

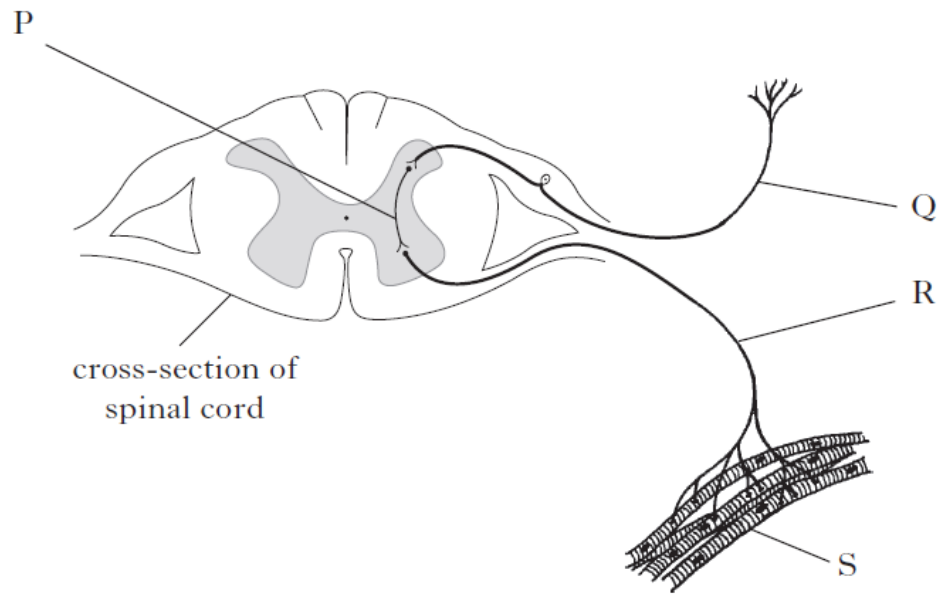
_____ % 1

- (c) It was predicted that drinking a glass of 10% glucose solution would give a lower blood glucose concentration after 60 minutes. When this test was carried out, the result was the same as shown on the graph.

Give **one** possible source of error that caused this result.

1

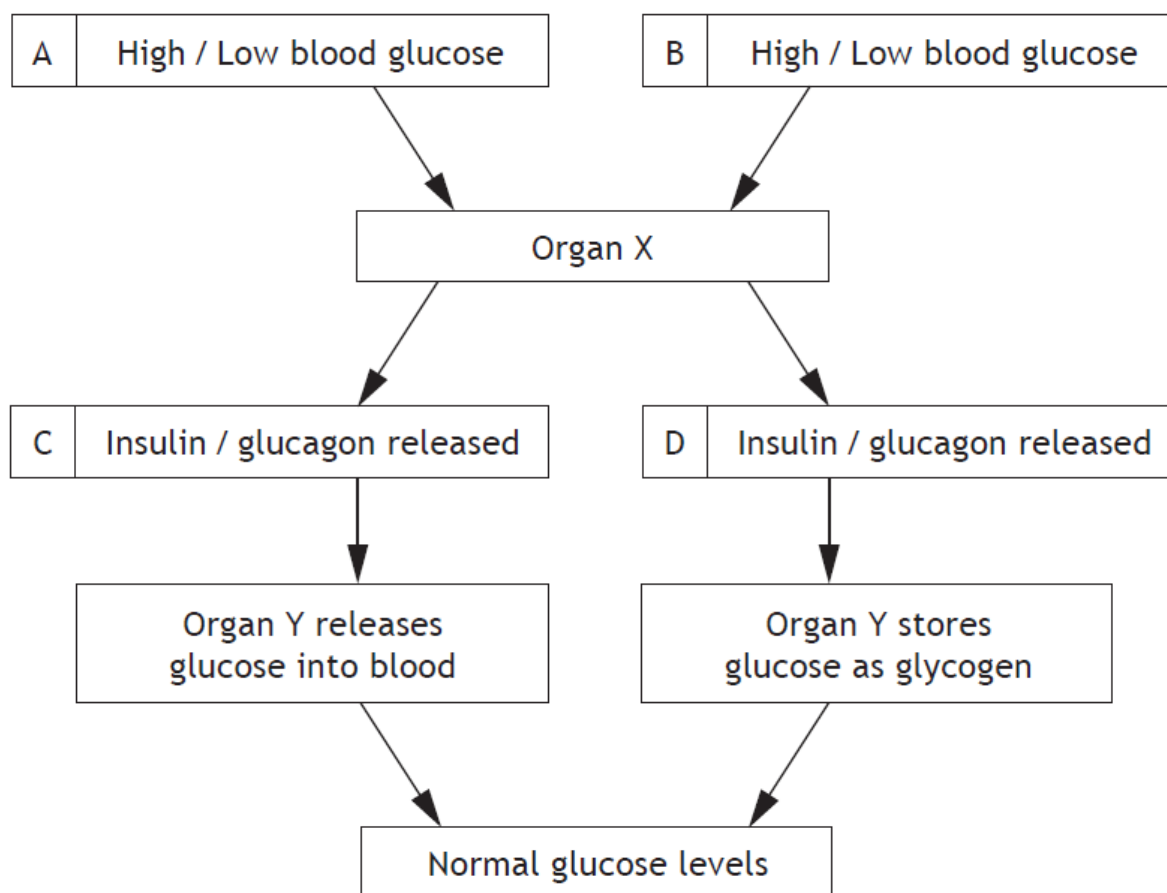
8. (a) The diagram below shows the structures found in a reflex arc.



Complete the table below to identify the structures and their functions.

<i>Structure</i>	<i>Letter</i>	<i>Function</i>
Sensory neurone		Carries impulses from the receptor to the spinal cord
	P	Passes impulses from the sensory neurone to the motor neurone
Effector		

9. (a) The regulation of glucose in the blood is represented in the diagram below.



- (i) The diagram above has two options in each of the four boxes A, B, C, D.

Circle the correct option in each box.

2

- (ii) Identify organs X and Y.

2

Organ X _____

Organ Y _____

- (b) Insulin and glucagon are hormones.

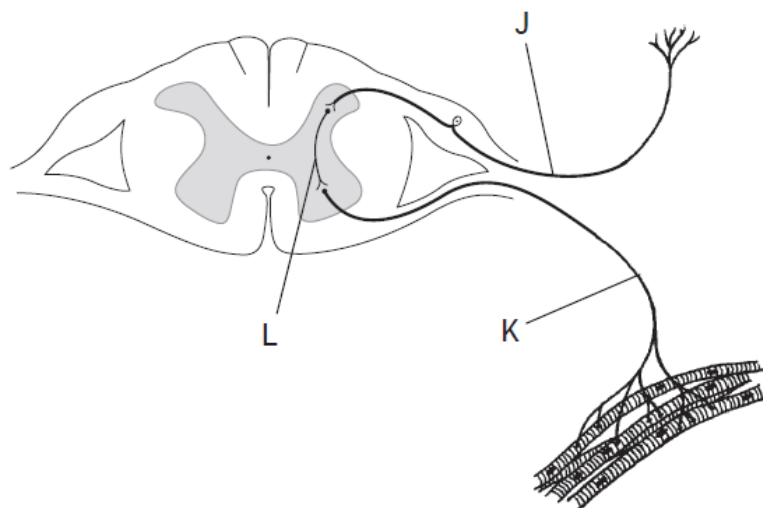
Describe two features of hormones.

2

1 _____

2 _____

10. The diagram below shows the neurons involved in a reflex action. Neurons J, K and L form a reflex arc.



- (a) Describe how information is passed along a neuron. 1

- (b) Select **one** of the neurons shown in the diagram and tick (✓) the appropriate box below.

Name that type of neuron and describe its particular function. 2

J ☐

K ☐

L ☐

Name _____

Function _____

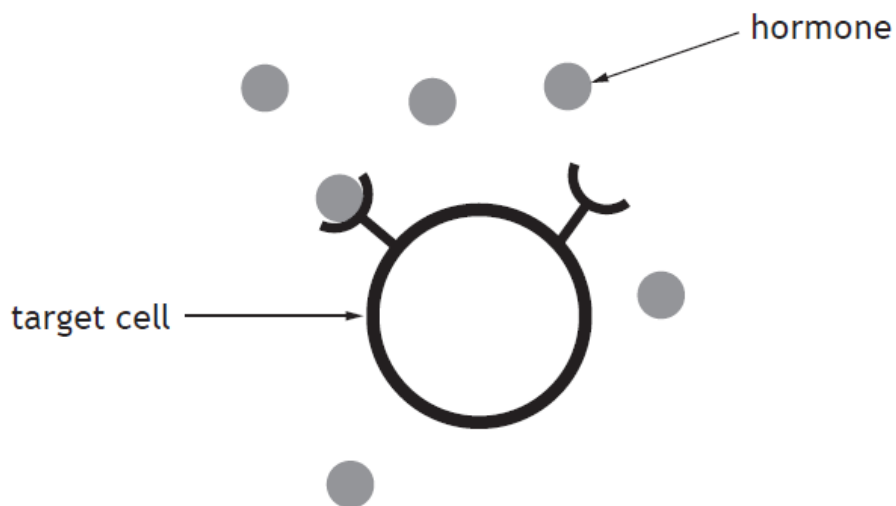
- (c) During a reflex action, the speed at which the information flows was measured to be 90 metres per second.

Calculate how long it would take for the information to complete a reflex arc which was 0.9 m in length. 1

Space for calculation

_____ seconds

11. (a) The diagram below represents a hormone binding to a cell within its target tissue.



Explain why only the target cells are affected by this hormone.

1

- (b) Name the type of gland that releases hormones into the bloodstream.

1

- (c) Blood glucose levels are controlled by two hormones.

Underline one option in the bracket to make the following sentence correct.

1

A decrease in blood glucose levels is detected by the pancreas

and this causes an increase in the release of

{	glycogen	}
	insulin	
	glucagon	

into the blood stream.

Reproduction

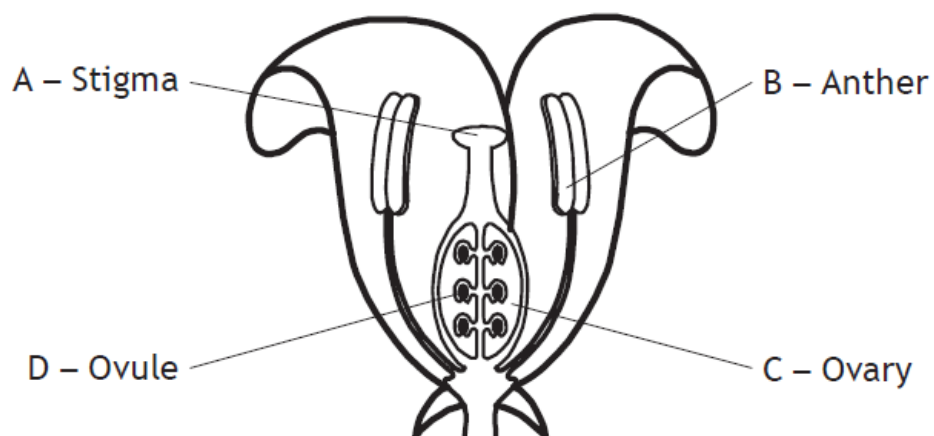
1. The table below shows the results of an investigation into the effect of temperature on egg laying in adult red spider mites.

<i>Feature</i>	<i>Temperature (°C)</i>		
	20 °C	25 °C	30 °C
Average length of egg laying period (days)	24	18	12
Average number of eggs laid per female during egg laying period	72	72	72

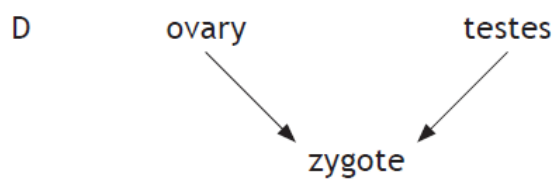
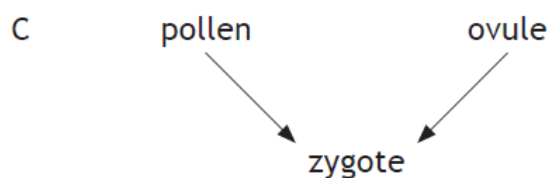
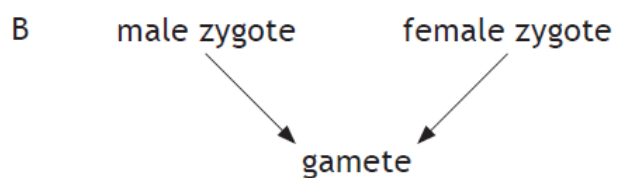
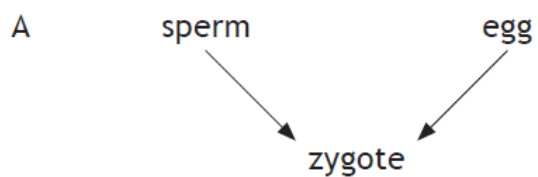
As the temperature increases, the average number of eggs laid per female per day

- A increases
 - B decreases
 - C stays the same
 - D halves.
2. The fusion of the nuclei of two gametes is called
- A fertilisation
 - B meiosis
 - C random assortment
 - D zygote.

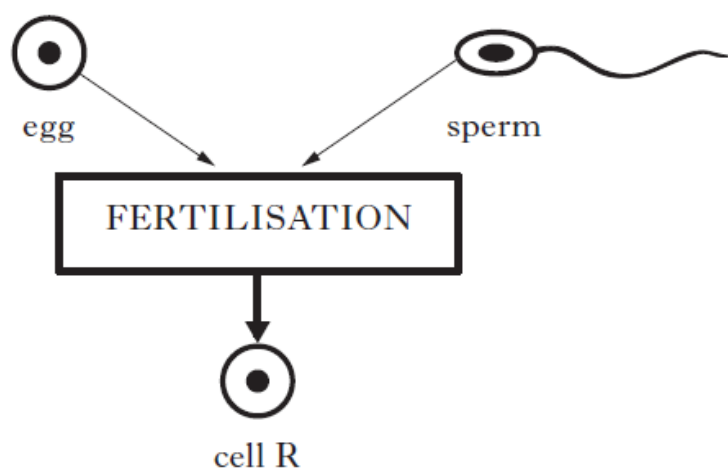
3. The diagram below shows the structure of a flower.
Where are the male gametes produced?



4. Which of the following diagrams represents the process of fertilisation in plants?



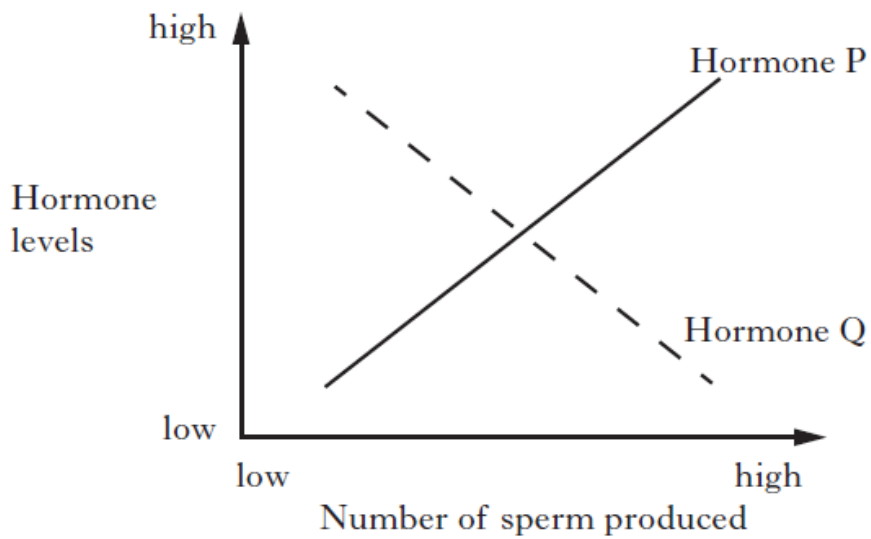
5. The diagram below shows the process of fertilisation.



Cell R is

- A a zygote
- B a gamete
- C an ovule
- D an embryo.

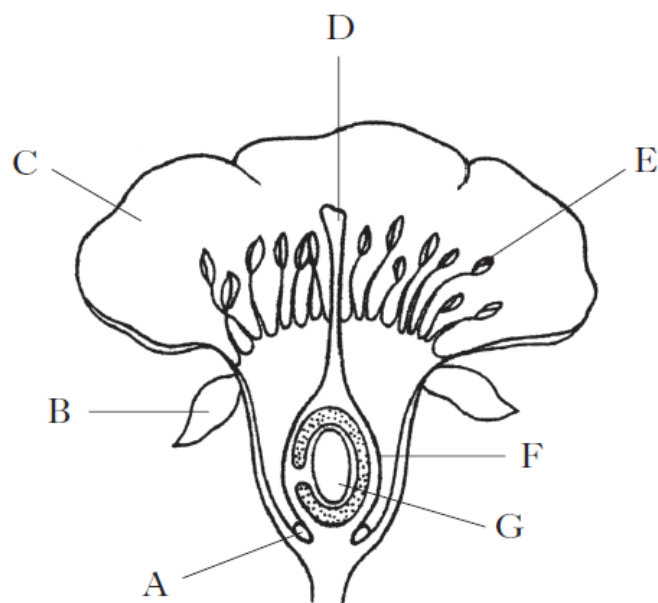
6. The effects of 2 hormones, P and Q, on human sperm production are shown in the graph below.



A possible conclusion from the graph is that when the level of

- A hormone P is high and hormone Q is high, sperm production is low
- B hormone P is low and hormone Q is low, sperm production is low
- C hormone P is low and hormone Q is high, sperm production is high
- D hormone P is high and hormone Q is low, sperm production is high.

7. The diagram below shows a section through a flower.



(a) Complete the following table using information from the diagram.

<i>Letter</i>	<i>Name of structure</i>	<i>Function</i>
	anther	
B	sepal	
		collects pollen
G		site of fertilisation

3

(b) Complete the following table about the sex cells of mammals.

<i>Sex</i>	<i>Name of sex cell</i>	<i>Where produced</i>	<i>Relative size (large or small)</i>	<i>Contains food store</i>	<i>Able to swim</i>
Male		Testes		No	
Female	Egg/Ova				

3

8. Gametes are made by plants and animals so that they can reproduce.

(a) The columns below show sites of production, types of gamete and chromosome complements.

Draw lines to connect each **human** gamete with its site of production and its chromosome complement.

Site of production

Type of gamete

anther

egg

ovary

ovule

testis

pollen

sperm

2

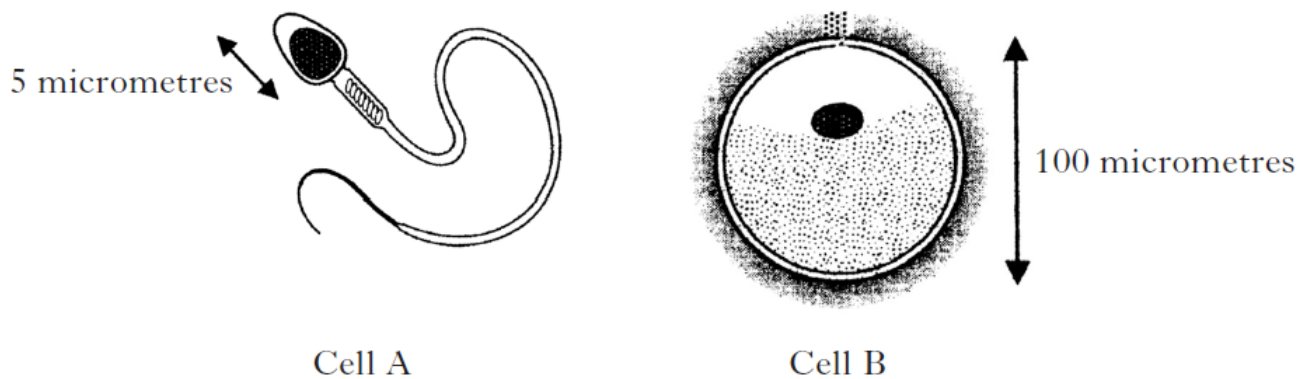
(b) (i) Name the process by which a zygote is formed.

_____ 1

(ii) State which parts of the gametes must fuse to produce the zygote.

_____ 1

9. (a) The following diagrams represent human sex cells.



- (i) Name cells A and B.

Cell A _____ Cell B _____ 1

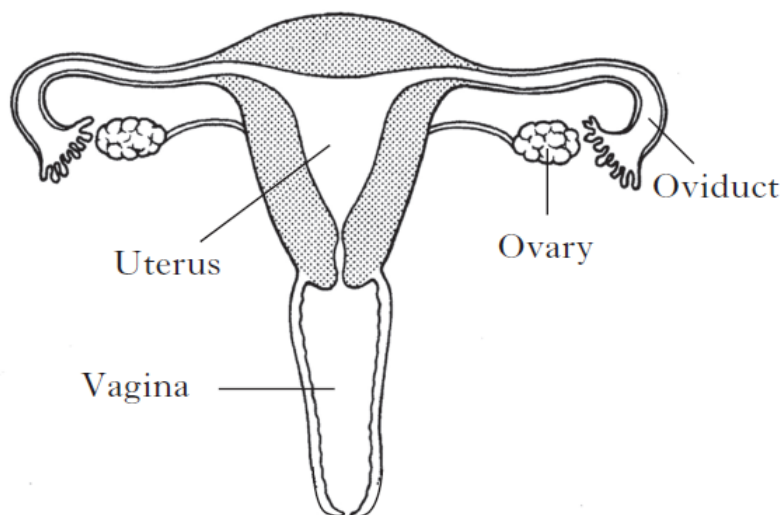
- (ii) Give **one** feature of cell A which makes it different from cell B.

_____ 1

- (iii) Name the organ which produces cell A.

_____ 1

- (b) The diagram below represents the female reproductive system.



In which of the named structures would the following take place?

- (i) Fertilisation

_____ 1

Variation and Inheritance

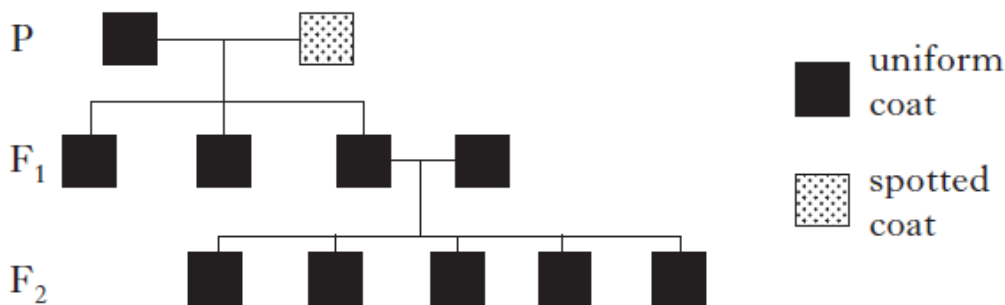
1. *Distichiasis* is a dominant characteristic in humans which causes the person to have two rows of eyelashes.

A woman who is homozygous for the condition and a man who is unaffected have children.

What proportion of their children would be expected to have *Distichiasis*?

- A 0%
- B 25%
- C 50%
- D 100%

2. In dogs, uniform coat colour is dominant to spotted coat.



From the family tree above, in which generation(s) are all the dogs heterozygous for coat colour?

- A P only
- B F₁ only
- C F₂ only
- D P and F₁

3. An organism has two different alleles of a gene.

This genotype is

- A dominant
B homozygous
C recessive
D heterozygous.
4. Variation in a characteristic can either be discrete or continuous. The range of heights and weights for a group of students were measured and recorded. Ear lobe types were also examined and categorised into groups.

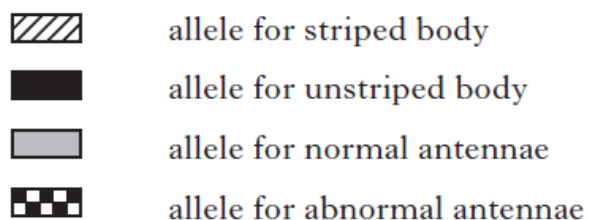
Which line in the table below identifies the type of variation shown by each of these human characteristics?

	<i>Height</i>	<i>Weight</i>	<i>Ear lobe types</i>
A	continuous	continuous	discrete
B	discrete	continuous	continuous
C	discrete	discrete	continuous
D	continuous	discrete	discrete

5. The diagrams below show the same sections of matching chromosomes found in four flies, A, B, C and D.

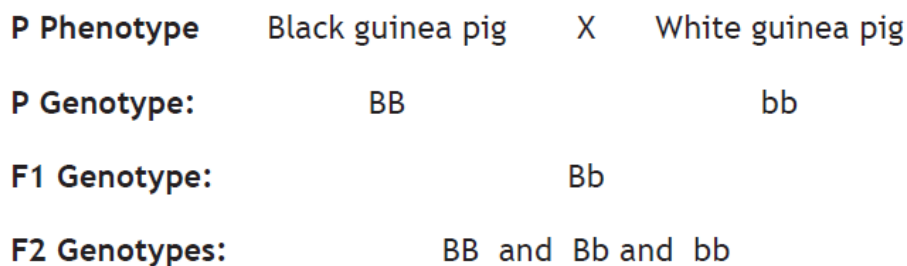


The alleles shown on the chromosomes can be identified using the following key.



Which fly is homozygous for body pattern and heterozygous for antennae type?

6. The following diagram shows the inheritance of coat colour in guinea pigs.



Which of the following generations contain heterozygous individuals?

- A P and F1
- B P and F2
- C F1 and F2
- D P, F1 and F2

7. Sorghum is an important food crop in some parts of the world.
The colour of the seed husk (coat) is controlled by a single gene.
Purple husk colour (H) is dominant to tan husk colour (h).



- (a) A true breeding purple husk plant is crossed with a true breeding tan husk plant.

- (i) What other term is used in genetics to indicate true breeding?

Circle the correct term below.

heterozygous polygenic homozygous recessive

1

- (ii) Complete the genotypes of the parental (P) generation below:

P purple X tan

P genotypes _____ _____

1

- (iii) State the phenotype(s) of the F_1 plants.

F_1 phenotype(s) _____

1

- (b) An individual from the F_1 generation is crossed with a true breeding tan husk plant.

- (i) Complete the Punnett square to show the expected results of this cross.

		Genotypes of gametes from F_1 plant	
Genotype of gametes from tan husk plant			

2

- (ii) State the expected phenotype ratio for the offspring of this cross.

_____ : _____
purple tan

1

8. Coat colour in Labrador dogs is an inherited characteristic. Black coat (**B**) colour is dominant to chocolate coat colour (**b**).



- (a) A homozygous black Labrador was crossed with a Labrador with a chocolate coloured coat.

Complete the diagram below to show the genotypes of each of the parents and the F_1 phenotype.

2

Parents: black coat X chocolate coat

Genotypes:

F_1 genotype:

All Bb

F_1 phenotype:

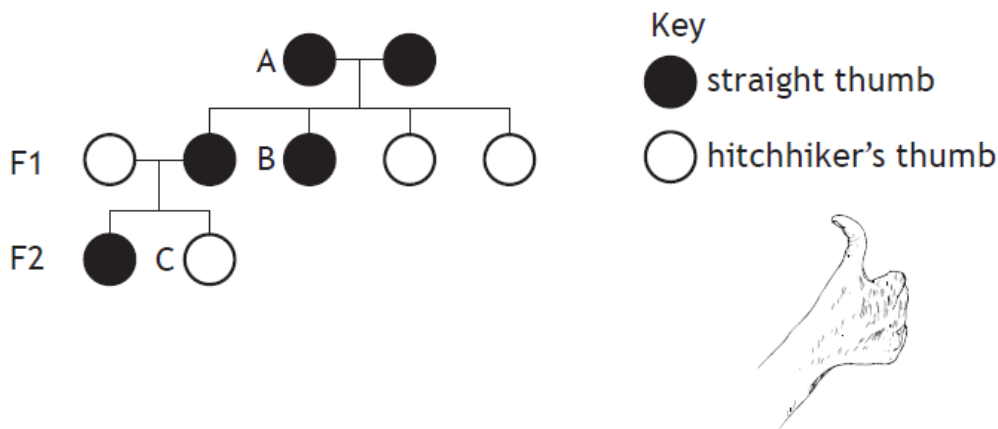
- (b) (i) Explain what is meant by polygenic inheritance.

1

- (ii) State the type of variation shown by polygenic inheritance.

1

9. The following diagram represents part of a family tree showing the inheritance of hitchhiker's thumb, where the thumb can bend back as shown below.



- (a) Complete the table below for individuals A and C.

2

Individual	Possible Genotype(s)	Phenotype
A		straight thumb
B	TT or Tt	straight thumb
C	tt	

- (b) In a survey of 90 students it was found that 25 of them had hitchhiker's thumb.

- (i) Calculate the number of students with straight thumb to hitchhiker's thumb as a simple, whole number ratio.

1

Space for calculation

_____ : _____

straight thumb hitchhiker's thumb

- (ii) The predicted ratio was 3 straight thumb : 1 hitchhiker's thumb. Explain why the predicted ratio was different to the actual ratio.

1

10. (a) The diagram below shows the two ways in which hands can be clasped together.



Left thumb on top



Right thumb on top

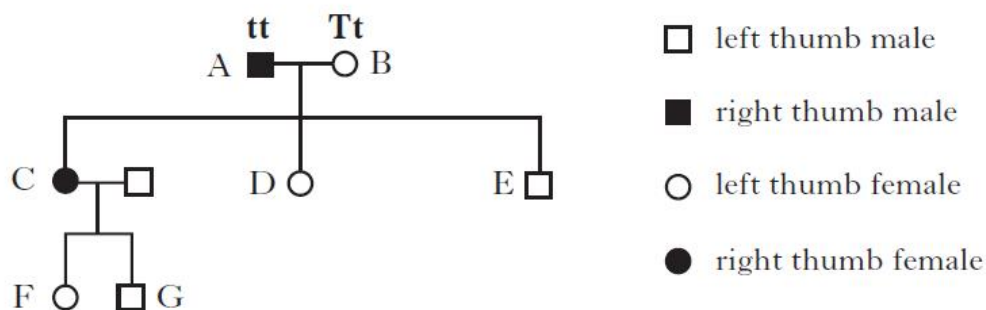
- (i) This behaviour is thought to be influenced by a single gene with two forms. What term refers to the two forms of a single gene?

1

- (ii) The diagram below shows whether members of a family clasp their hands with the right or left thumb on top.

T represents the left thumb form of the gene.

t represents the right thumb form of the gene.



What information from parent B proves that the left thumb on top is the dominant form of the gene?

1

- (iii) Use the information in the diagram to complete the following table.

<i>Person</i>	<i>Genotype</i>
C	
E	
F	

2

- (iv) If person D has a child with a man with the same genotype, what is the chance of their first child clasping their hands with the left thumb on top?

Space for working

1

- (v) When 1000 people were surveyed, 625 people were found to clasp their hands with the left thumb on top.

What is the simple whole number ratio of left to right thumb people?

Space for calculation

:

left thumb : right thumb

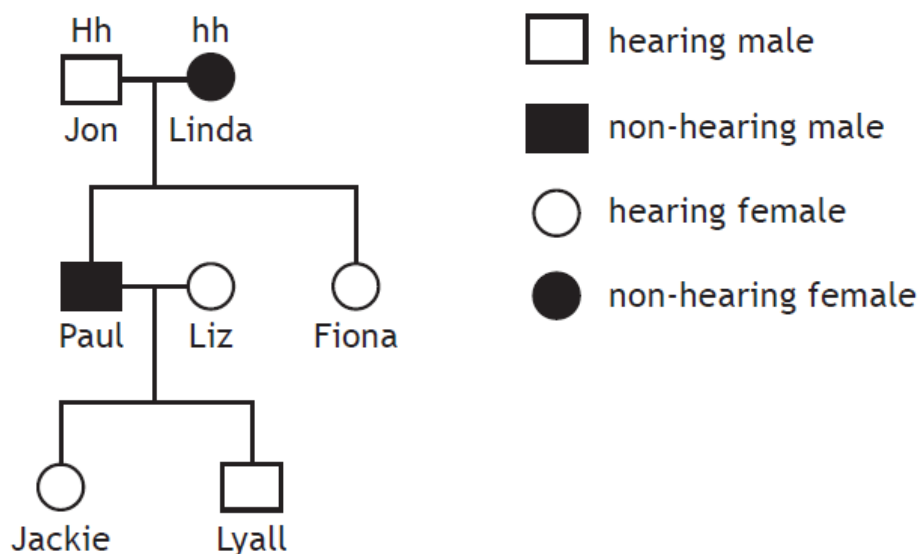
1

11. (a) One type of deafness in humans is caused by a single gene.

The diagram below shows the pattern of inheritance in one family.

H represents the hearing form of the gene.

h represents the non-hearing form of the gene.



- (i) Using Jon as an example, explain how it is known that the hearing form of the gene is dominant.

1

- (ii) Use information in the family tree to complete the following table to show the genotype and phenotype of each individual.

2

<i>Individual</i>	<i>Genotype</i>	<i>Phenotype</i>
Paul		
Lyall		

- (iii) Fiona has a child with a man who has the same genotype as her. State the chance of their child being able to hear.

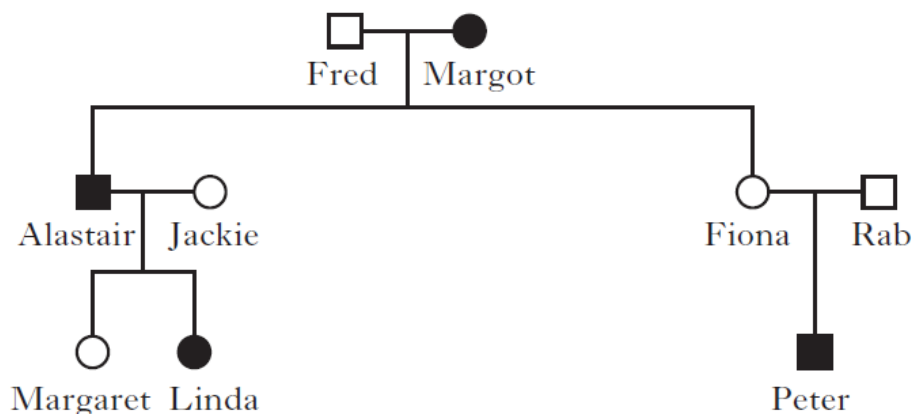
1

Space for calculation

12. (a) The shape of the human ear lobe is controlled by two different alleles of the same gene.

The family tree below shows the inheritance of ear lobe type.

- ☐ male with attached ear lobes ☐ female with attached ear lobes
☒ male with free ear lobes ☒ female with free ear lobes



- (i) Name the **two** phenotypes of this characteristic, shown in the family tree.

1 _____

2 _____

1

- (ii) From the information, identify:

1 A male with attached ear lobes _____

2 A female with free ear lobes _____

1

- (iii) From the information, state which form of ear lobe shape is dominant.

1

- (iv) What symbol is used to identify the generation of each of the following individuals?

Fiona _____

Linda _____

1

- (v) What type of variation is shown by this genetic characteristic?

1

- (b) What term refers to the genetic information for a characteristic, in terms of the alleles present in an individual?

1

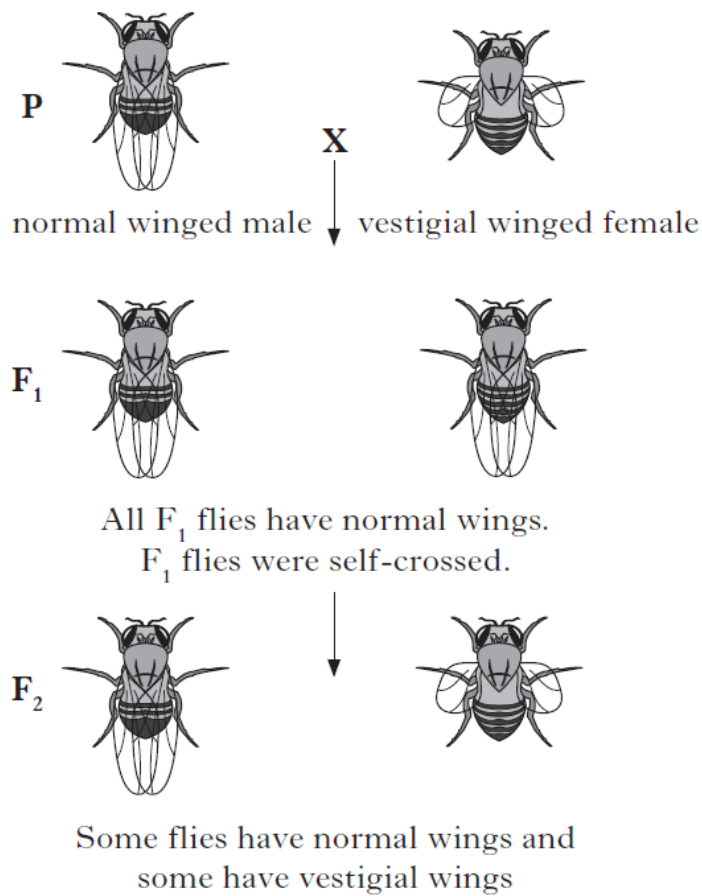
- (c) (i) Sex cells contain only one set of chromosomes compared to the two sets present in body cells.

What term is used to refer to all types of sex cells?

1

13. (a) Fruit flies show variation in wing structure which can be inherited.

Flies were crossed as shown below.



- (i) Using “N” for the normal form and “n” for the vestigial form, give the genotypes of each of the following:

1 Parent with normal wings _____

2 A fly from the F₁ generation _____

3 An F₂ fly with vestigial wings _____

2

- (ii) Which of the following flies could be described as true-breeding?

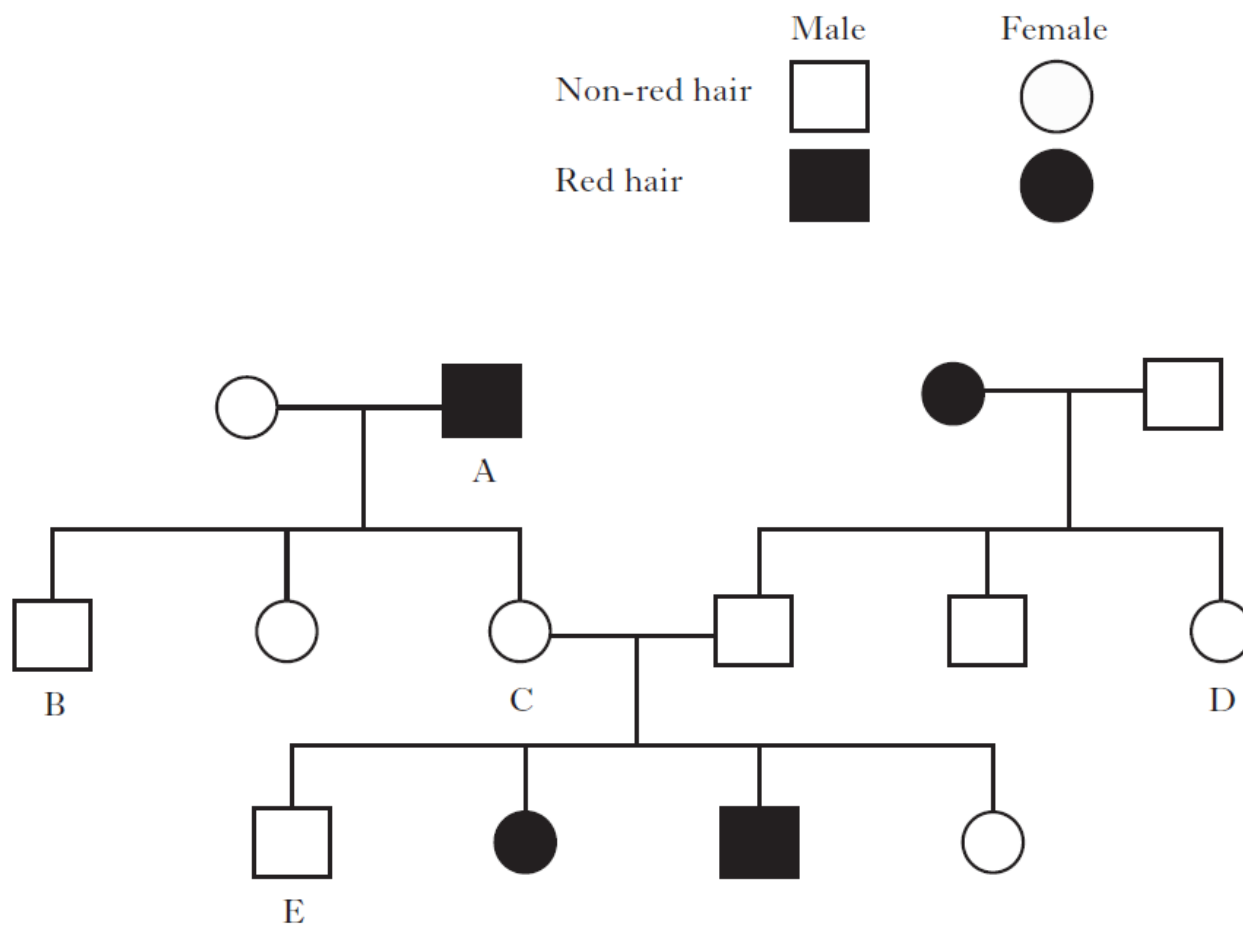
Tick (✓) the correct boxes.

- ☐ Parent with normal wings
- ☐ Parent with vestigial wings
- ☐ F₁ flies
- ☐ F₂ flies with normal wings

1

14. In humans, red hair is determined by the recessive allele (h) and non-red hair by the dominant allele (H).

The following family tree shows the inheritance of hair colour.



(a) Use the family tree to complete the following table.

<i>Individual</i>	<i>Genotype</i>	<i>Phenotype</i>
A		red hair
C		
E	HH	

(b) Individuals B and D have a child together.

- (i) Complete the Punnett square below to show the genotypes of their gametes and the possible genotypes of their child.

		Genotype of gametes from B	
Genotype of gametes from D			

2

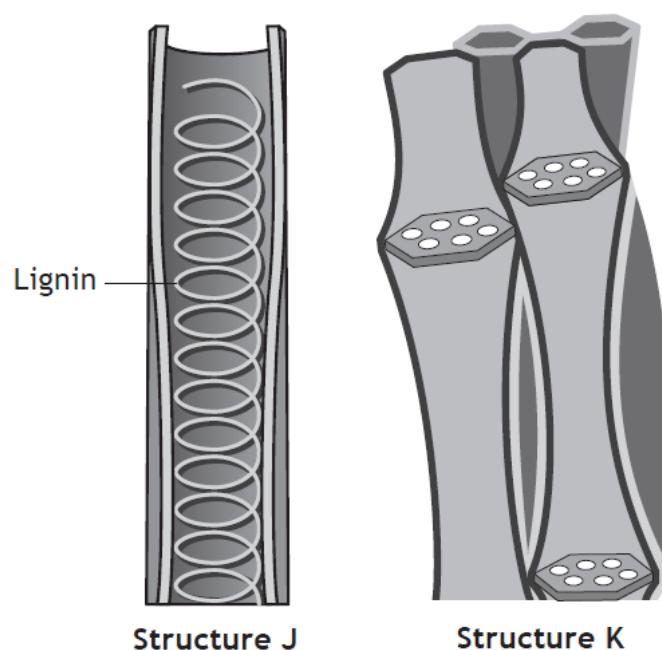
- (ii) Calculate the percentage chance of their child having red hair.

Space for calculation

_____ % 1

Plant Transport

1. The diagram below shows some of the structures involved in transport in plants.



Which line in the table below correctly identifies structures J and K and the substance transported by them?

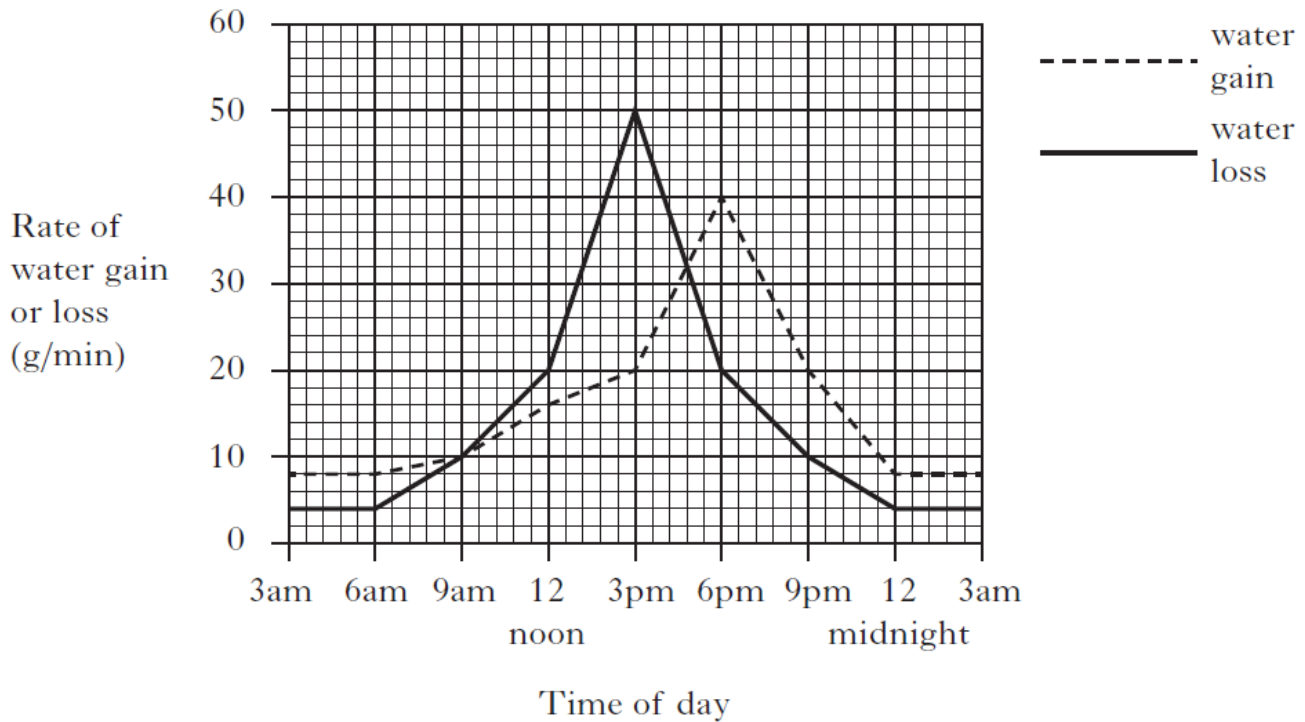
	Structure J		Structure K	
	Name	Substance transported	Name	Substance transported
A	Xylem	Water	Phloem	Sugar
B	Xylem	Sugar	Phloem	Water
C	Phloem	Water	Xylem	Sugar
D	Phloem	Sugar	Xylem	Water

2. Transpiration occurs from the leaves of a plant.

Which environmental conditions would produce the greatest transpiration rate?

- A Warm and still air
- B Cold and still air
- C Warm and windy
- D Cold and windy

3. (a) The following graph shows the rate of water gain and water loss by a plant during a 24 hour period in summer.



- (i) How long after the time of maximum water loss did the plant show its maximum water gain?

Space for calculation

_____ hours

1

- (ii) At what time in the morning did the rate of water gain exactly balance the rate of water loss?

1

- (b) Plants gain water through their roots and lose it from their leaves.

- (i) Name the plant tissue which transports water from the roots to the leaves.

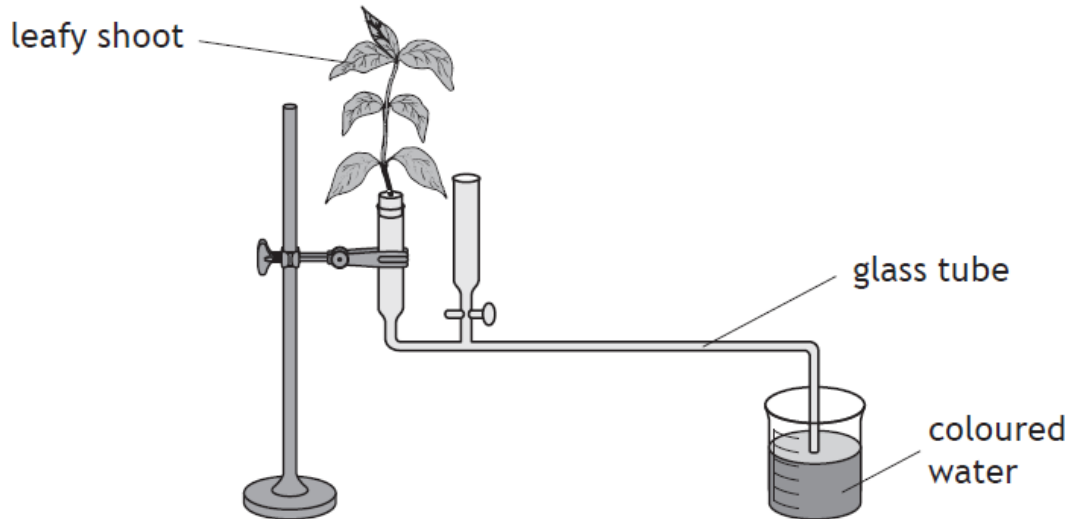
1

- (ii) Name the pores in plant leaves through which water vapour is lost.

1

4. (a) The rate of transpiration in plants can be measured using the apparatus shown below.

As the plant transpires, coloured water is drawn up the glass tube and its volume measured, over a set period of time, to give the rate of transpiration.



Changes in the surrounding environment can have an effect on the rate of transpiration.

- (i) Select **one** of the environmental changes listed below by circling it.

increase in humidity	increase in temperature	increase in wind speed
----------------------	-------------------------	------------------------

State the effect of this change on the rate of transpiration.

1

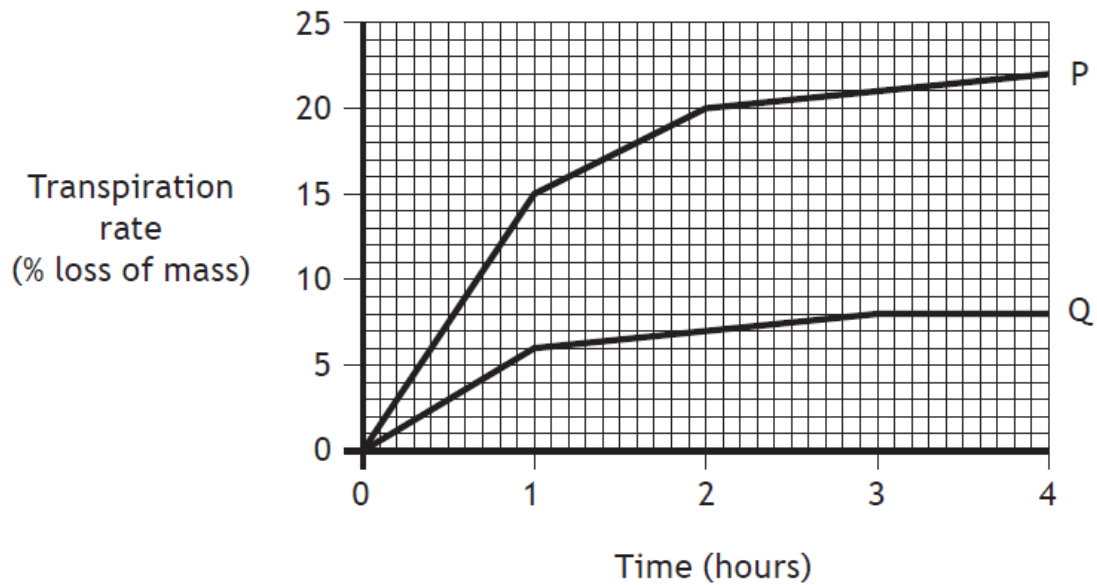
- (ii) Choose any of the environmental changes listed above and describe an addition to the apparatus shown, which would allow an investigation into its effect.

1

Environmental change _____

Description of addition _____

(b) The graph below shows transpiration rates of two plants, P and Q.



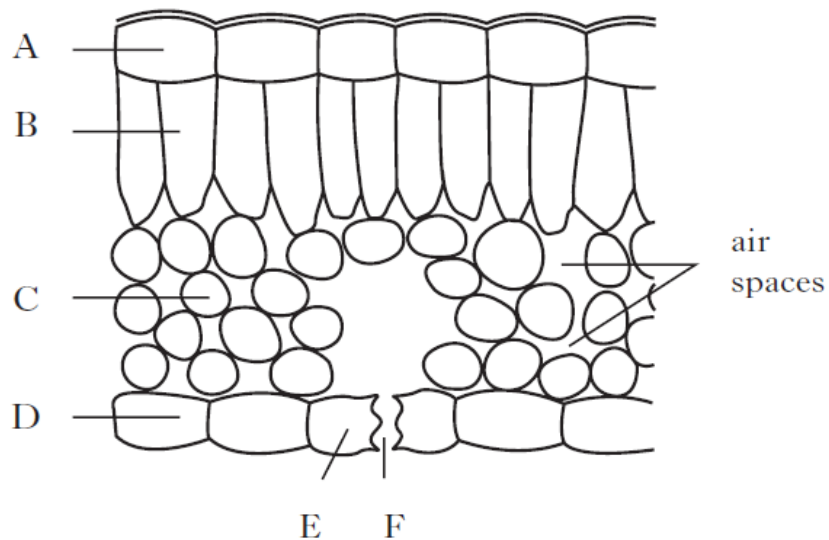
- (i) With reference to the number of stomata, suggest a reason for the different transpiration rates of plants P and Q.

1

- (ii) Name the type of cells which control the opening and closing of stomata.

1

5. (a) The diagram below represents part of a cross section through a leaf.



Identify **one** example of each of the cells described below by using letters from the diagram to complete the boxes.

Each letter may be used **once, more than once** or **not at all**.

Transparent cells

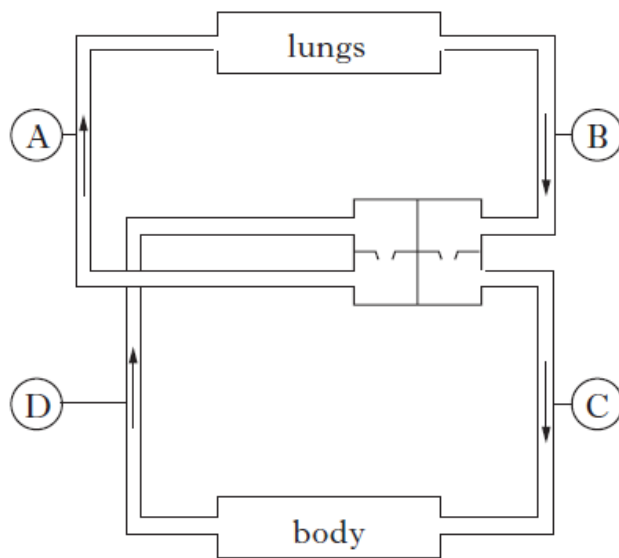
Cells which carry out photosynthesis

Mesophyll cells

Guard cells

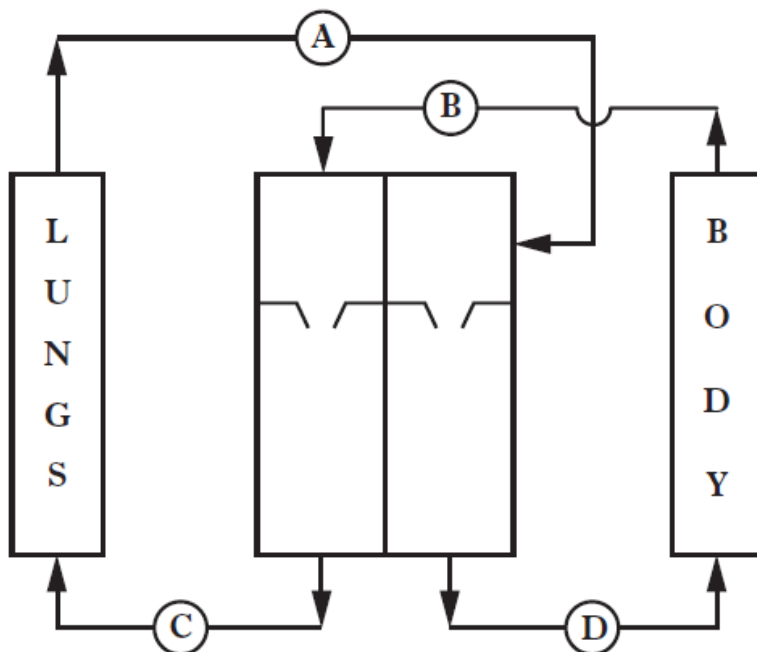
Animal Transport

1. The diagram below shows the heart and circulation.



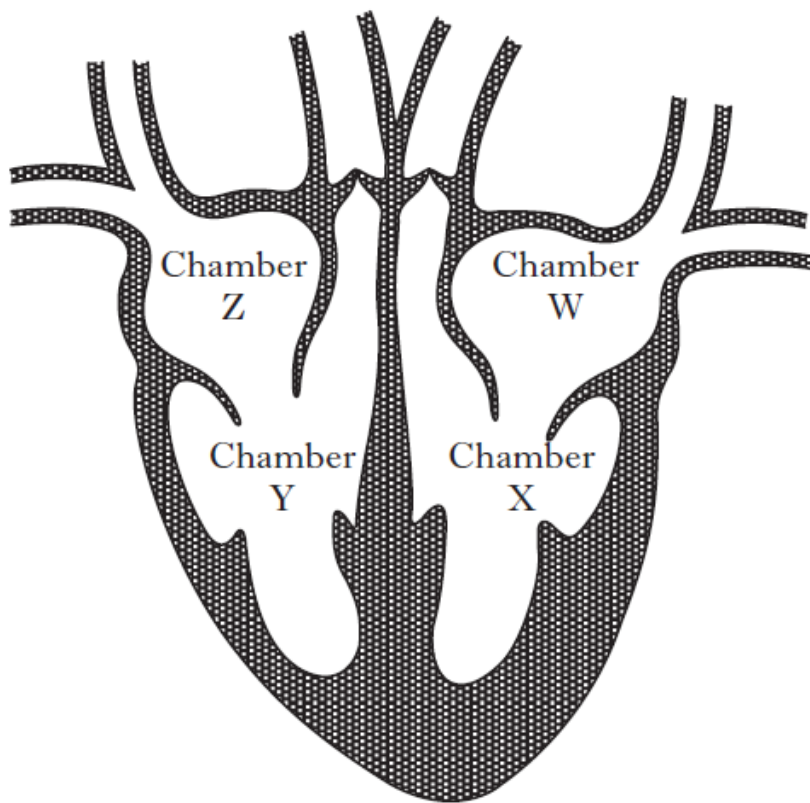
Which labelled structure is the pulmonary artery?

2. The diagram below represents the heart and circulation.



Which labelled structure is the aorta?

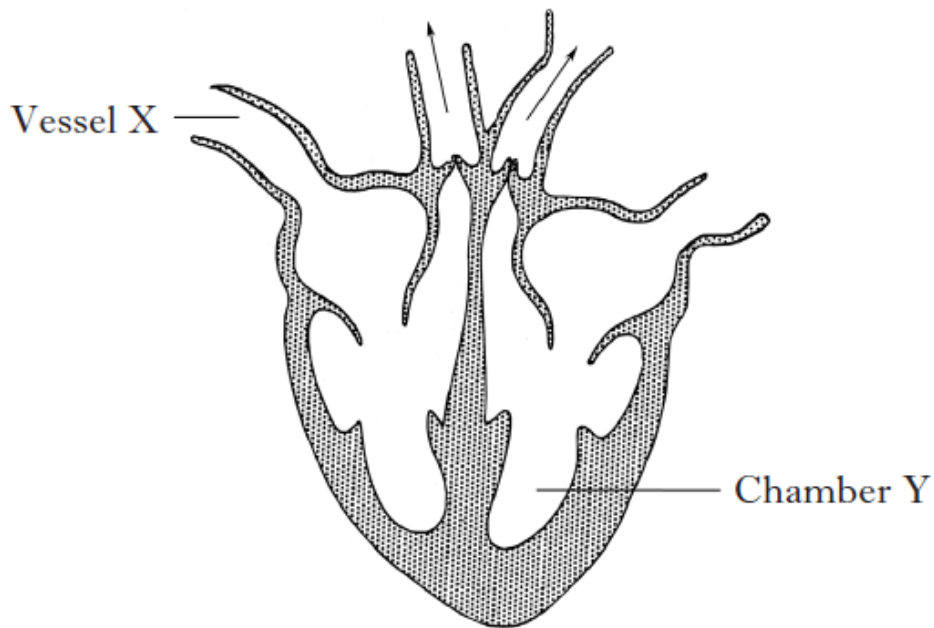
3. The diagram below shows a section through a mammalian heart.



When closed, the tricuspid valve

- A prevents blood flowing from chamber X to chamber W
- B allows blood to flow from chamber X to chamber W
- C allows blood to flow from chamber Y to chamber Z
- D prevents blood flowing from chamber Y to chamber Z.

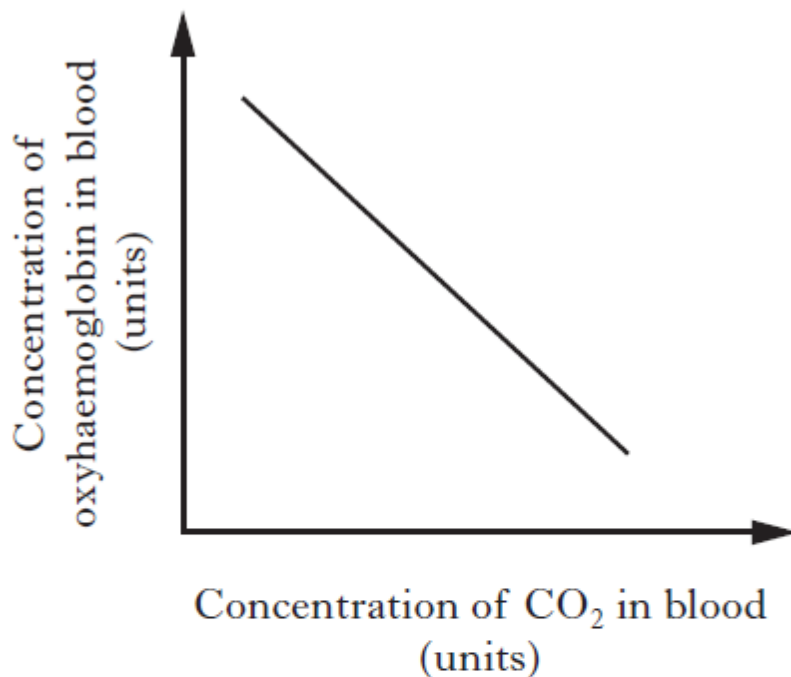
4. The diagram below shows a cross section of a human heart.



Which line in the table identifies the parts of the heart correctly?

	<i>Vessel X</i>	<i>Chamber Y</i>
A	aorta	left ventricle
B	vena cava	left ventricle
C	vena cava	right ventricle
D	aorta	right ventricle

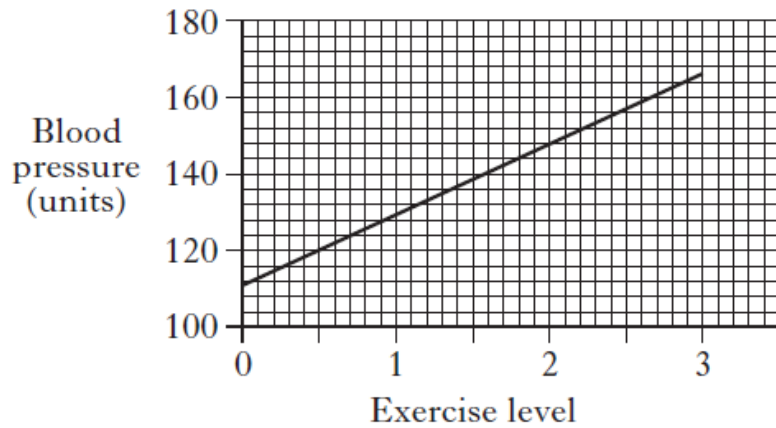
5. The graph below shows the relationship between the concentration of carbon dioxide and oxyhaemoglobin in the blood.



Which of the following statements describes this relationship?

- A As the carbon dioxide concentration decreases the concentration of oxyhaemoglobin decreases.
- B As the carbon dioxide concentration increases the concentration of oxyhaemoglobin decreases.
- C As the carbon dioxide concentration increases the concentration of oxyhaemoglobin increases.
- D Increasing carbon dioxide concentration has no effect upon the concentration of oxyhaemoglobin.

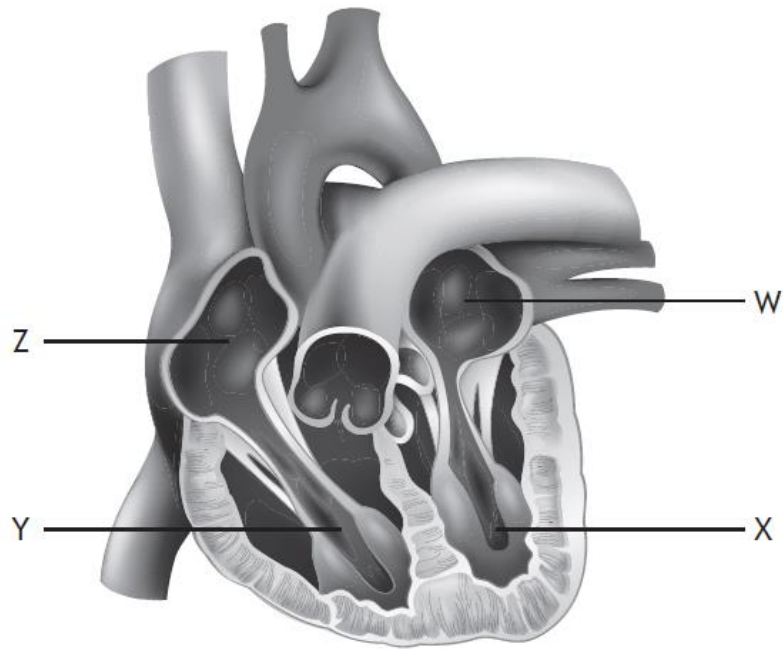
6. The graph below shows the results of an investigation on the effect of exercise on blood pressure.



What was the difference between the blood pressure at exercise level 0 and exercise level 3?

- A 13 units
- B 27 units
- C 54 units
- D 66 units

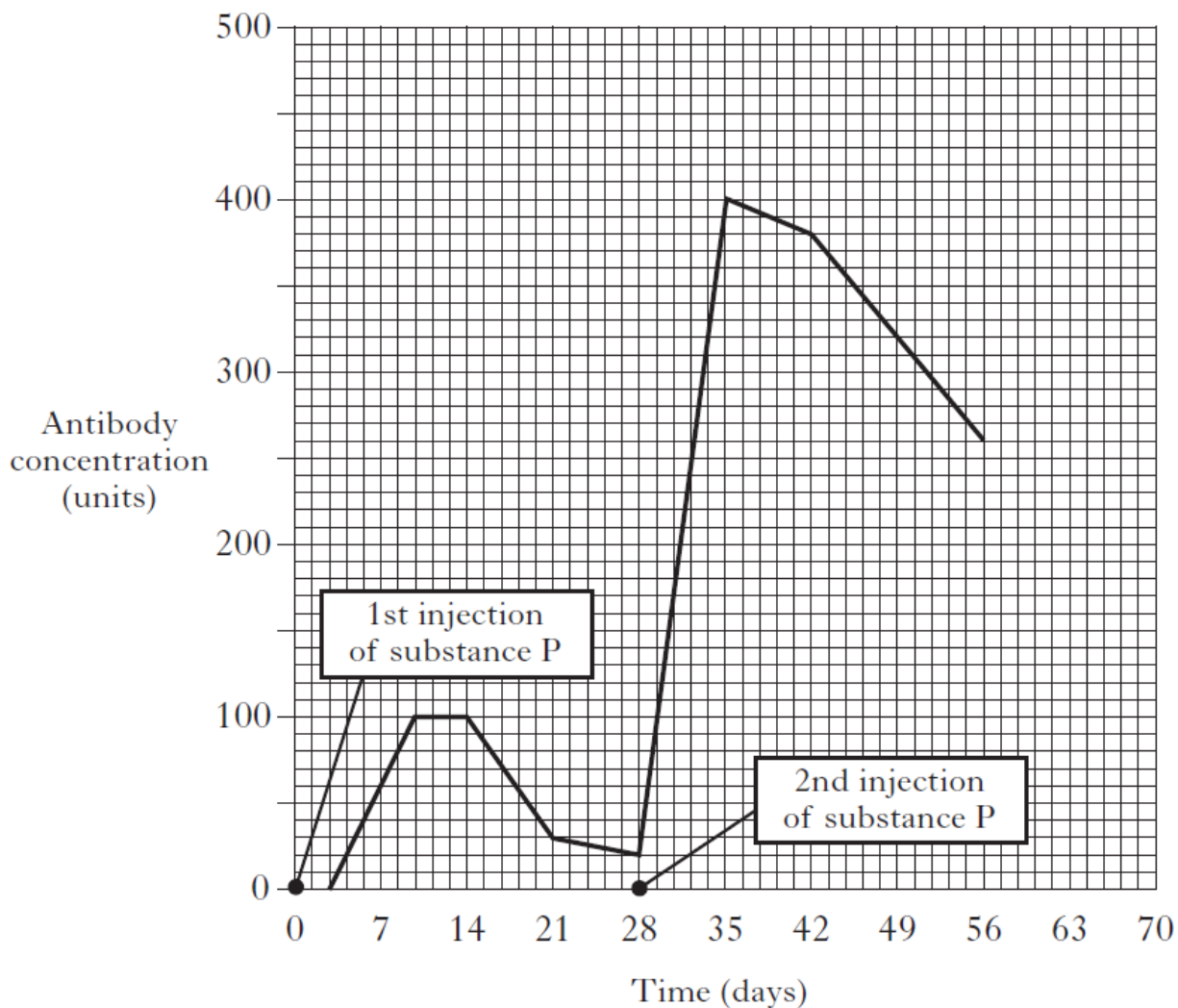
7. The diagram below shows the heart and associated blood vessels.



Which of the following statements is correct?

- A W is the left atrium which receives blood from the body.
- B X is the left ventricle which pumps blood to the body.
- C Y is the right atrium which receives blood from the lungs.
- D Z is the right ventricle which pumps blood to the lungs.

8. Antibodies are produced as a defence against disease-causing organisms. In an experiment, a volunteer was injected with substance P at the start (day 0) and again on day 28. The substance caused the production of antibodies. The graph below shows antibody concentration in the blood in response to the two injections.



- (a) (i) The antibody concentration was higher in response to the second injection. **From the graph**, state **one** other difference in response to the second injection.

1

- (ii) Predict the antibody concentration on day 70.

_____ units

1

- (iii) The results obtained gave a valid comparison of the response to the two injections of substance P. State **one** variable that must have been kept constant in the experiment.

1

(b) Name the type of white blood cell that produces antibodies.

1

(c) Explain what is meant by the term “antibody specificity”.

1

(d) A second method of defence by blood cells is phagocytosis. Describe the process of phagocytosis.

1

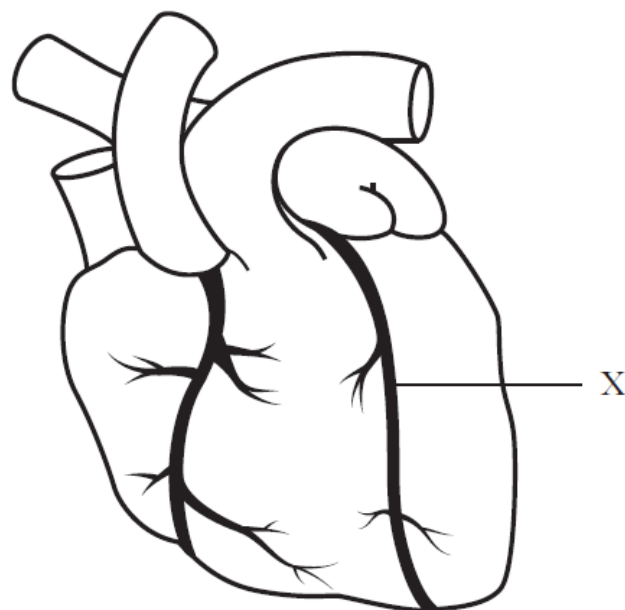
9a. The table below shows features of arteries and capillaries.

Complete the table by entering the words **yes** or **no** in each blank space.

<i>Type of blood vessel</i>	<i>Thick muscular walls present</i>	<i>Valves present</i>
artery		no
capillary	no	

1

- b. The diagram below represents a surface view of the human heart.



Describe the effect of a blockage in blood vessel X.

1

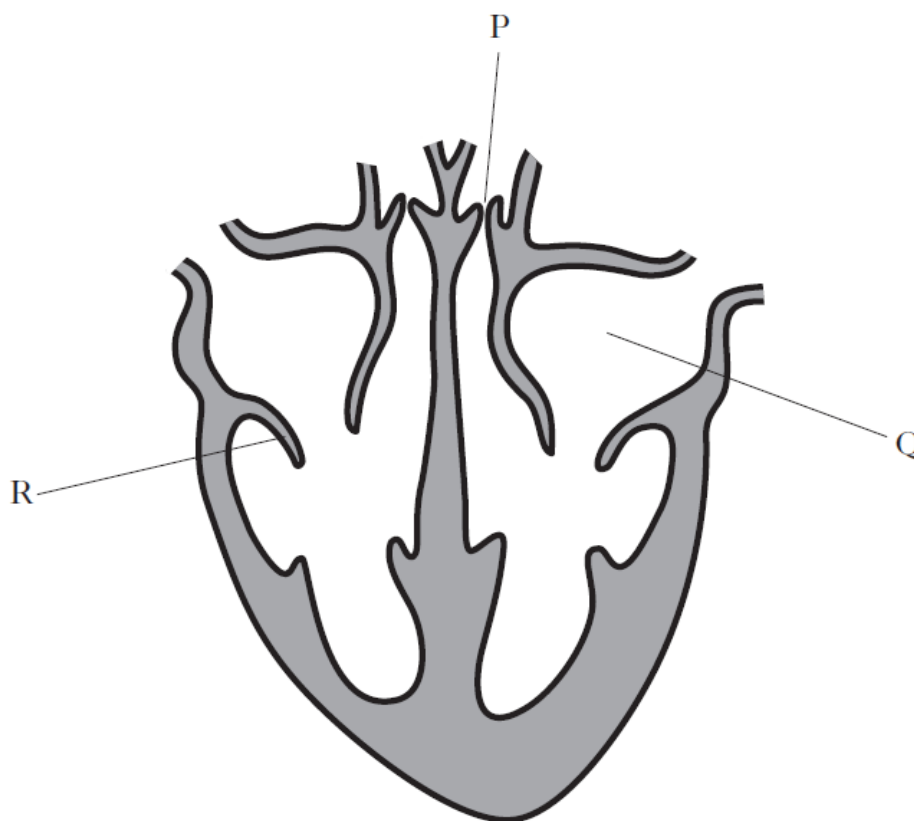
- (d) At rest the heart muscle receives blood at a rate of 300 cm^3 per minute. Immediately after exercise the heart muscle receives 1050 cm^3 per minute.

Calculate how many times greater the blood supply to the heart muscle is after exercise than at rest.

Space for calculation

_____ times greater 1

10. The following diagram shows the human heart.



(a) (i) Name chamber Q and valve R.

Q _____

1

R _____

1

(ii) Describe the function of valve P.

2

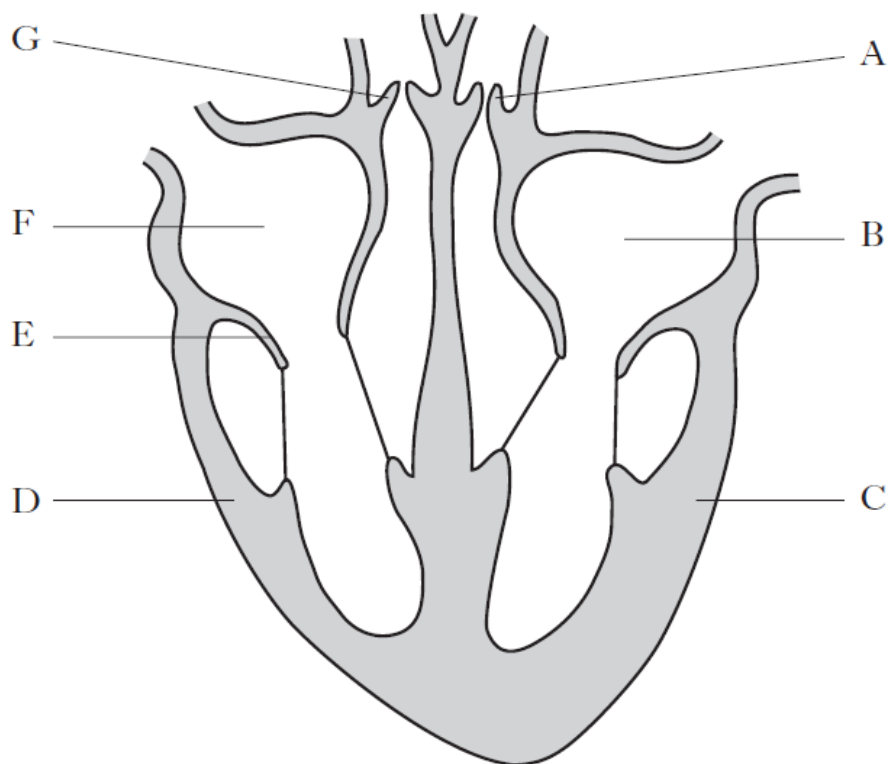
(iii) **Add** an arrow **to the diagram** showing where blood enters the heart from the lungs.

1

(b) Name the blood vessel that carries blood to the lungs.

1

11. (a) The following diagram shows the structure of the heart.



From the diagram select the letters which match the statements below.

- (i) Produces maximum pressure to push blood round the body.

Letter _____

1

- (ii) Prevents backflow of blood into the right ventricle.

Letter _____

1

- (iii) Receives oxygenated blood from the lungs.

Letter _____

1

- (b) Name the blood vessel which supplies blood to the heart muscle.

1

(c) The table below gives information about structures in the blood.

<i>Name of structure</i>	<i>Number in 1 cm³ of blood (millions)</i>	<i>Diameter (mm)</i>	<i>Features</i>
Red blood cells	56 000	0.008	Made in bone marrow. Body produces 280 million each hour. Carry oxygen.
White blood cells	80	0.02	Made in bone marrow and lymph nodes. Fight infection by engulfing bacteria or by producing antibodies.
Platelets	4 000	0.003	Made in bone marrow. Contain proteins which form blood clots.

Use this information to answer the following questions.

- (i) State **one** way that blood cells fight infection.

1

- (ii) Name the substance which forms blood clots.

1

- (iii) Complete the simple whole number ratio below to show the relative numbers of each structure in 1 cm³ of blood.

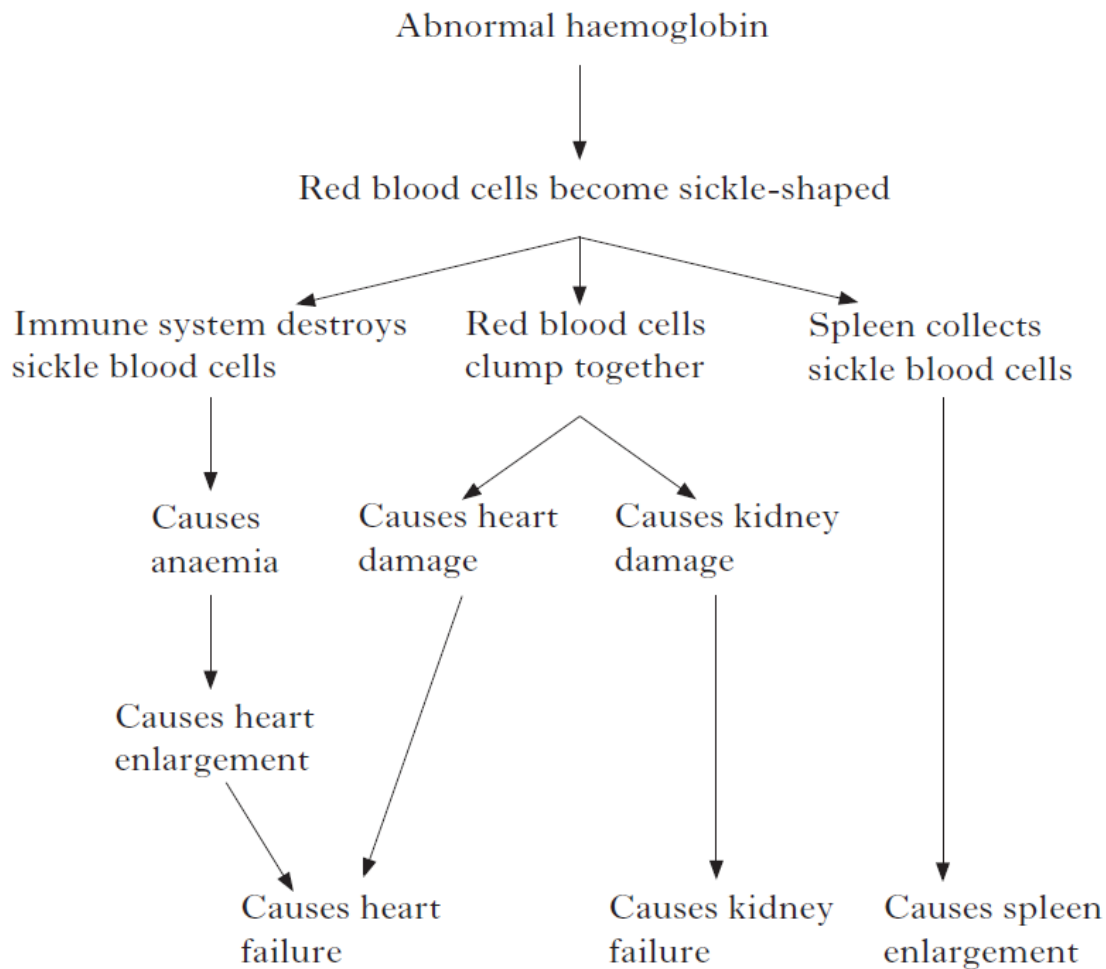
Space for calculation

1 : :
 _____ : _____ : _____
 white blood cells : platelets : red blood cells

1

14. An inherited characteristic can give rise to abnormal haemoglobin in the blood.

The flow chart shows some of the consequences of this.



- (a) What is the first effect on red blood cells if the body makes abnormal haemoglobin?

_____ 1

- (b) Which system of the body destroys sickle blood cells?

_____ 1

- (c) Name **two** organs which become enlarged because of sickle blood cells.

_____ and _____ 1

15. The table below gives information about features of three different types of blood vessel.

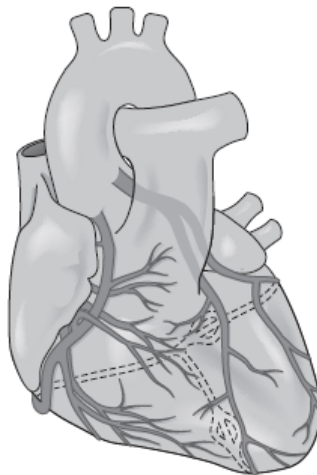
- (a) (i) Complete the table by writing the name of the missing types of blood vessels in the empty boxes. 2

<i>Type of blood vessel</i>	<i>Diameter of central channel (mm)</i>	<i>Thickness of vessel wall (mm)</i>
	30.0	1.5
Capillary	0.006	0.001
	25.0	2.0

- (ii) Of all the blood vessels, capillaries are best adapted for gas exchange.

Using the information in the table, give a reason for this. 1

- (b) The heart is a muscle which pumps blood around the body and requires its own blood supply.



Name the blood vessel which supplies the heart muscle with blood. 1

16. 6. (a) Complete the following table to show the three types of blood vessels and their functions.

<i>Blood vessel</i>	<i>Function</i>
vein	
artery	
	allows exchange of materials with tissues

2

- (b) What is the main function of red blood cells?

1

- (c) The concentration of substances found in blood plasma is shown in the table below.

<i>Substance</i>	<i>Concentration</i> (g per 100 ml)
sugars	0.1
salts	0.8
proteins	6.4
fats	0.6
wastes	0.1

- (i) Express the concentration of salts to proteins as a simple whole number ratio.

Space for calculation

_____ : _____
salts proteins

1

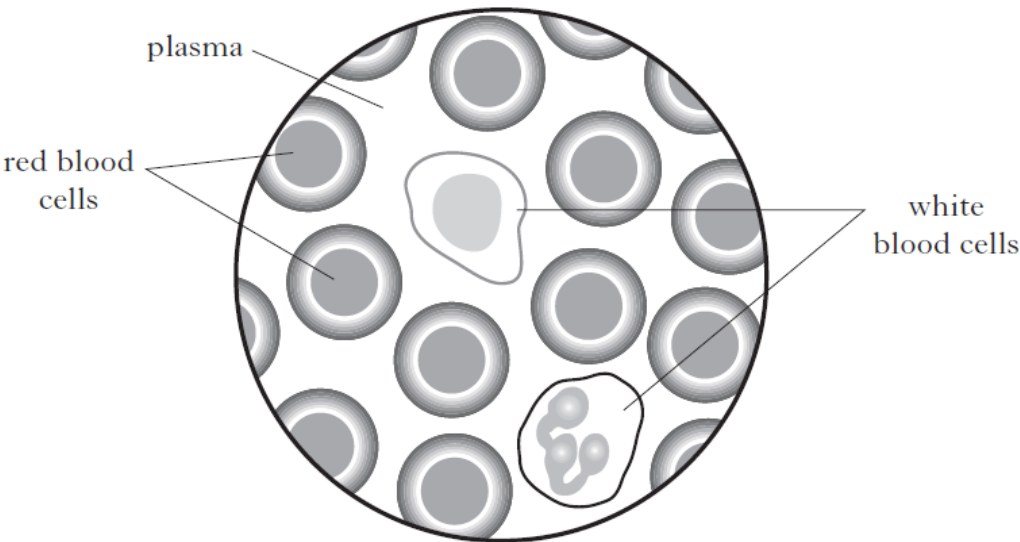
- (ii) A man has 3 litres of blood plasma (1 litre = 1000 ml).
Calculate the total mass of proteins present in his blood.

Space for calculation

_____ g

1

17. (a) Blood contains plasma and cells which are used for transport and in defence.



(i) Name the type of white blood cell that can produce antibodies.

1

(ii) Carbon dioxide is carried in blood plasma. Name the other part of the blood that also carries carbon dioxide.

1

(iii) Name the chemical formed in red blood cells at high oxygen levels in the lungs.

1

(b) The table below shows how altitude affects the percentage oxygen carried in blood.

<i>Altitude (metres)</i>	<i>Percentage oxygen carried in blood (%)</i>
(sea level) 0	97
2800	91
3700	85
4700	80

Use the data in the table to explain why a runner who lives at an altitude of 2800 metres would fatigue more quickly if racing in an event at 4700 metres.

2

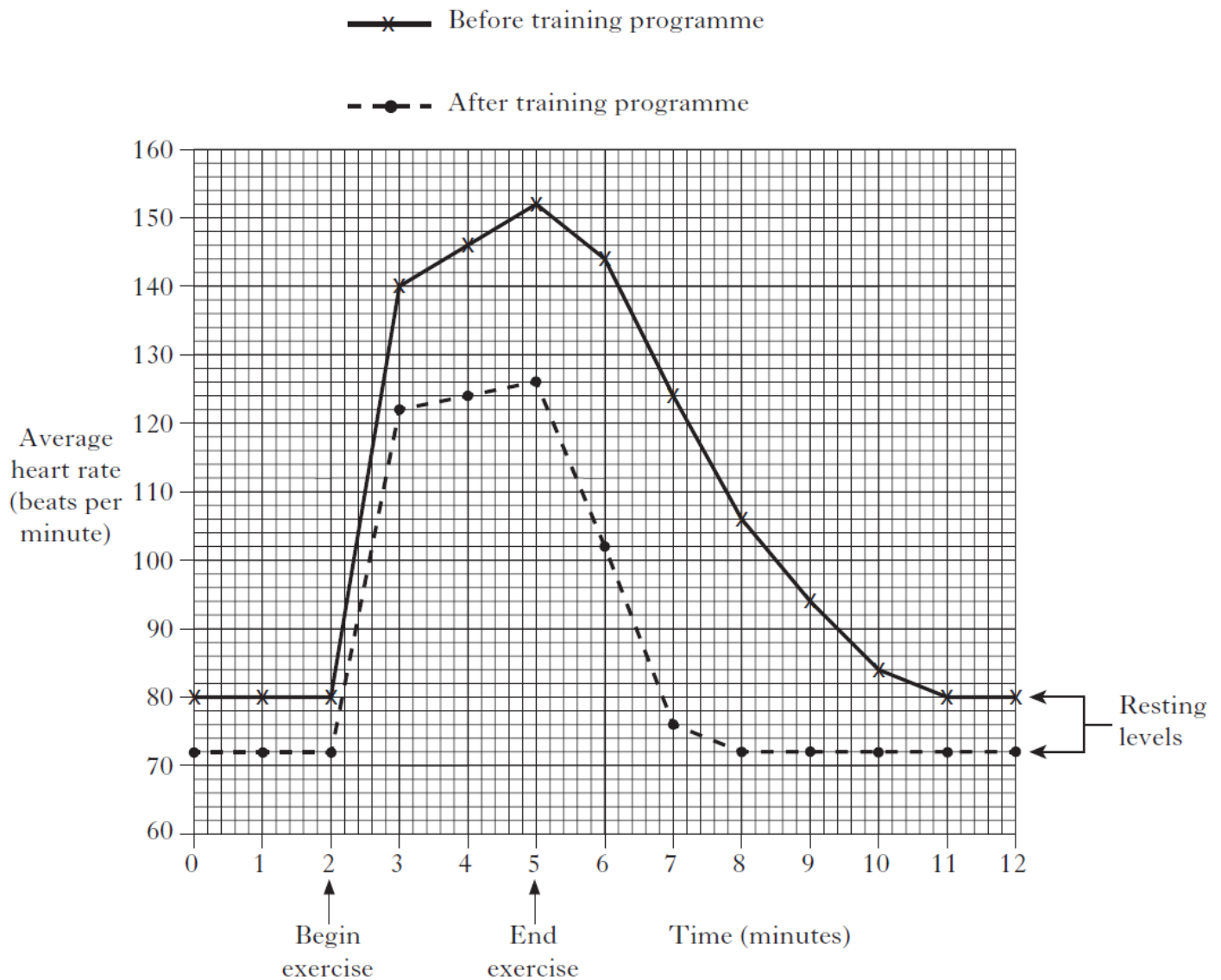
18.

An investigation was carried out to study the effect of physical training on recovery time.

The investigation was carried out as described below.

- Twenty students did an exercise test.
- Their heart rates were recorded before, during and after the exercise test.
- The students then did a training programme for 8 weeks.
- At the end of the training programme, the twenty students repeated the exercise test.
- Average heart rates were calculated.

The graph below shows the results of this investigation.



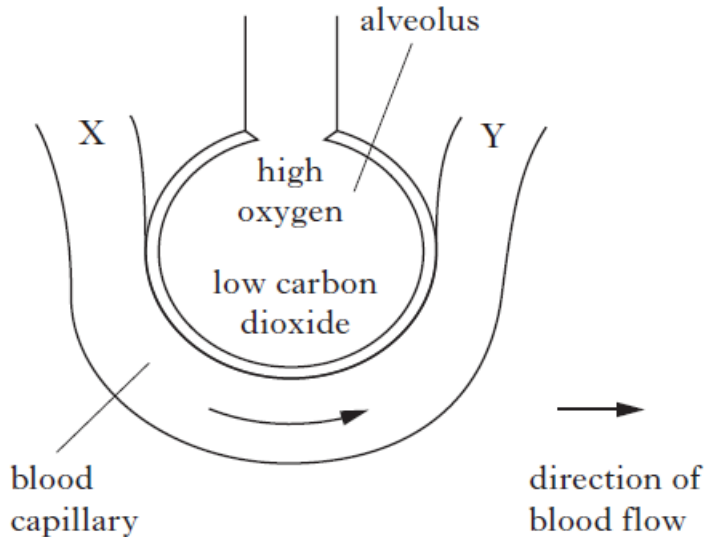
Recovery time is the length of time taken for heart rate to return to resting level after exercise.

(a) How long was the recovery time before the training programme?

_____ minutes

Absorption of Materials

1. The diagram below shows an alveolus and an associated blood capillary.

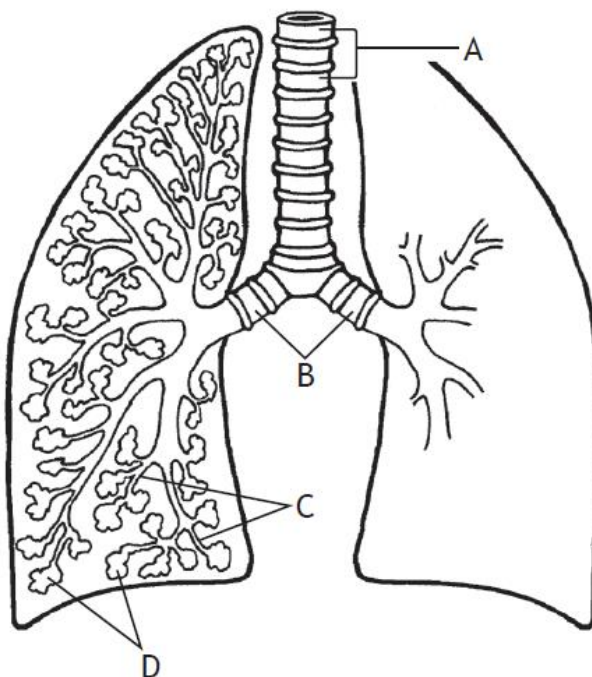


As blood flows from X to Y gases are exchanged with the alveolus.

Which line in the table below identifies the concentrations of gases at X and Y?

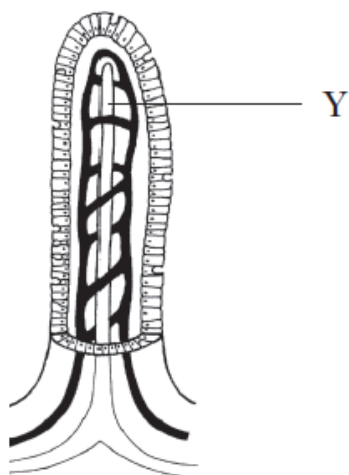
	<i>Concentration at X</i>	<i>Concentration at Y</i>
A	high oxygen	high carbon dioxide
B	low oxygen	high carbon dioxide
C	low oxygen	low carbon dioxide
D	high oxygen	low carbon dioxide

2. The diagram below shows part of the human respiratory system.



Which letter identifies the alveoli?

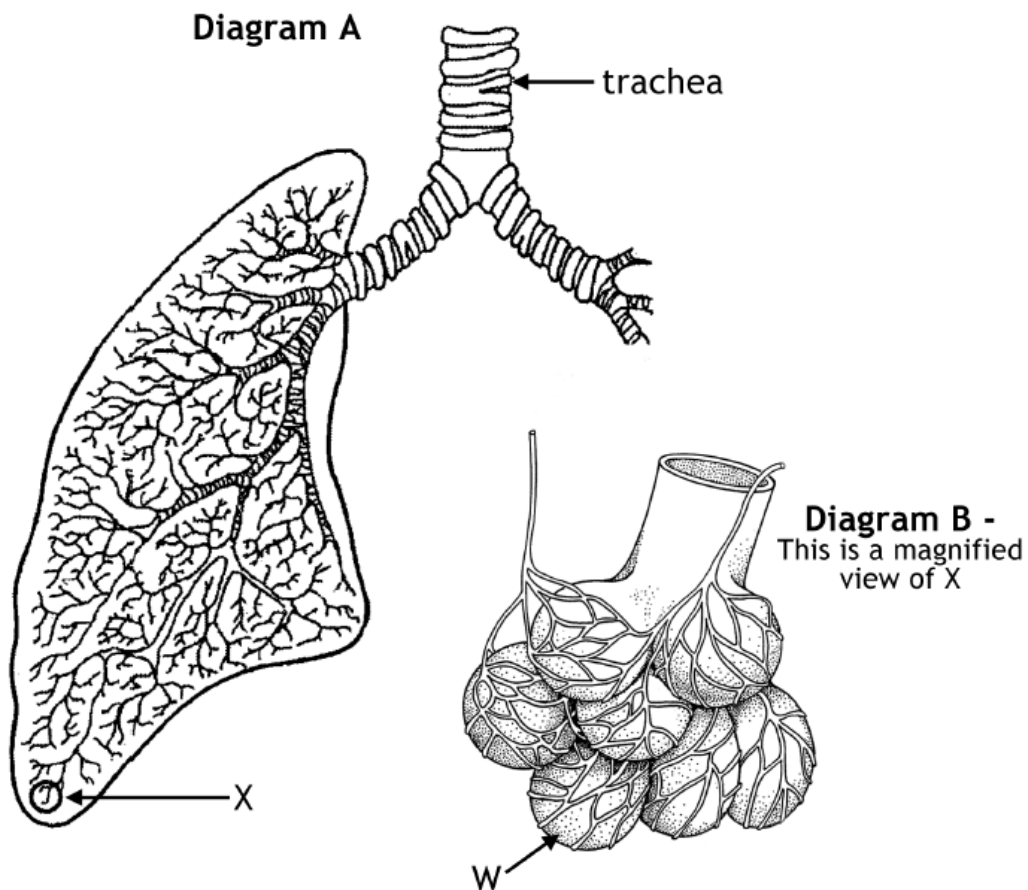
3. The diagram below shows the structure of a villus.



Which food molecules are absorbed by structure Y?

- A Amino acids
- B Fatty acids
- C Glucose
- D Glycogen

4. The diagrams below represent part of the human breathing system.



- (a) (i) Name the structure labelled W.

1

- (ii) Describe **two** features of these structures which improve the efficiency of gas exchange.

2

1 _____

2 _____

- (b) (i) Name the process by which oxygen moves from the lungs into the blood.

1

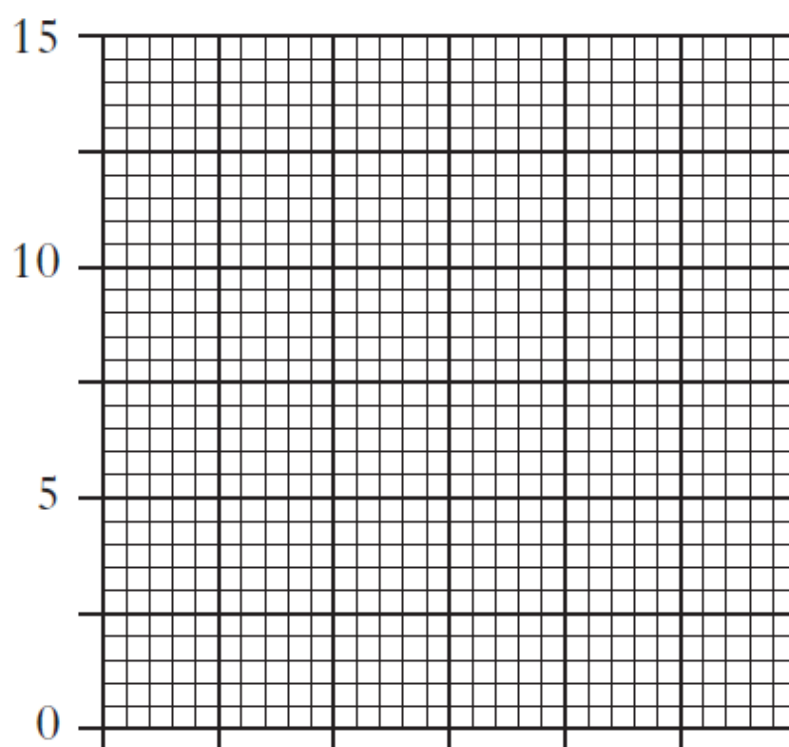
- (ii) Describe what happens to oxygen after it enters a red blood cell.

2

5. The table below shows the annual death rates from lung cancer of ex-smokers who had smoked for more than five years and then stopped smoking.

<i>Time since ex-smokers stopped smoking (years)</i>	<i>Annual deaths per 10 000 of population</i>
0	14
2	7
4	5
6	3
8	2
10	2
12	2

(a) Draw a line graph of these results on the grid below.



Time since ex-smokers stopped smoking
(years)

- (b) Underline one option in each bracket to complete the following sentences based on the data in the table.

The annual death rate from lung cancer for people who stop smoking

$\left\{ \begin{array}{l} \text{rises} \\ \text{stays the same} \\ \text{falls} \end{array} \right\}$. The greatest change is $\left\{ \begin{array}{l} 0 - 2 \\ 2 - 4 \\ 4 - 6 \end{array} \right\}$ years after

stopping. Within 8 years from stopping, their risk of death from lung

cancer is $\left\{ \begin{array}{l} 2 \\ 7 \\ 12 \end{array} \right\}$ times less than that of people who have just stopped

smoking.

2

- (c) The annual death rate from lung cancer for non-smokers is 1 per 10 000. What evidence in the table suggests that some of the damage caused by smoking for more than five years is permanent?

1

6. Two athletes, R and S, carried out a six month training programme in preparation for the 2014 Commonwealth Games in Scotland.

The fitness of the two athletes was tested on the first day of each month by measuring their rate of oxygen absorption.

An increase in fitness is shown by an increase in the rate of oxygen absorption.

The rate of oxygen absorption was measured for each athlete during exercise as shown in the picture below.



The following table shows the results of these fitness tests.

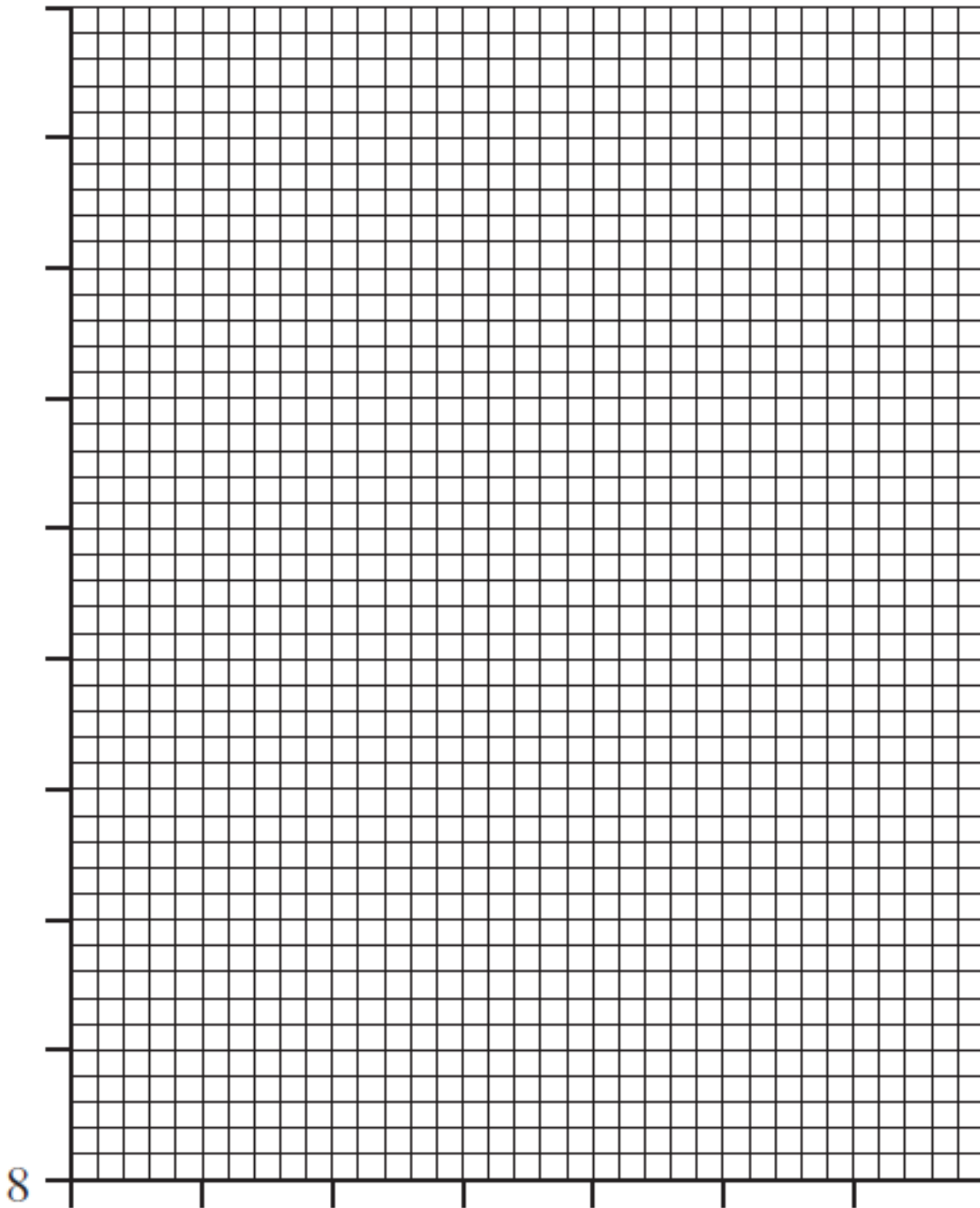
<i>Month of training programme</i>	<i>Rate of oxygen absorption (cm³ per kg per min)</i>	
	<i>Athlete R</i>	<i>Athlete S</i>
1	39.0	59.0
2	45.0	62.5
3	50.0	67.5
4	53.0	70.7
5	53.0	70.8
6	53.0	70.8

- (a) State which athlete has benefitted most from the training programme. Justify your answer.

Athlete _____

Justification _____

(b) Construct a **line graph** to show the results for **athlete R**.



- (c) Calculate the volume of oxygen absorbed per minute by **athlete R** when tested in month 6.

Athlete R had a mass of 60 kg.

Space for calculation

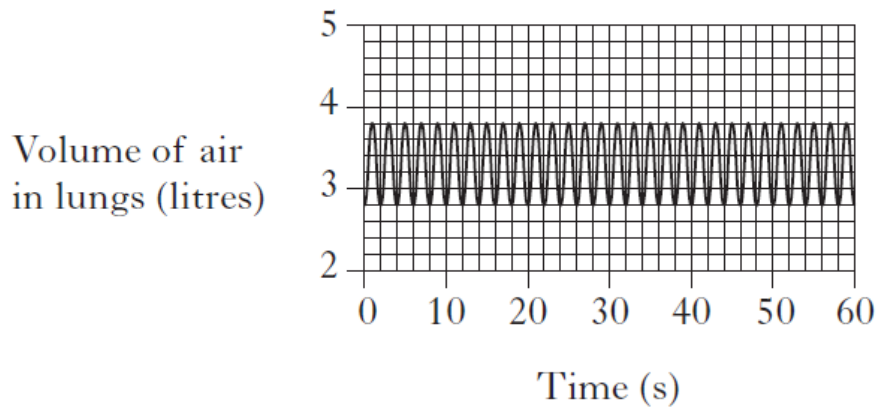
_____ cm³ per minute

1

- (d) From the results, it was concluded that fitness levels improve in the first months of training and then remain constant. Suggest **one** way in which the reliability of this conclusion could be improved.

1

7. The graph below shows the volume of air in the lungs of a person while breathing.



- (i) What volume of air is inhaled in one breath?

Space for calculation

_____ litres

1

- (ii) What is the person's breathing rate?

Space for calculation

_____ breaths per minute

1

8. Read the following passage carefully and answer the following questions.

Adapted from “*The latest superfood revealed: electric potatoes*”

The Herald, 23 August 2010.

Potatoes could become one of nature’s superfoods. Scientists have tested the effects of mechanical stress on the potato, one of the world’s most widely consumed plant foods.

Scientists know that bruising and exposure to periods of drought stimulate the production of useful compounds such as antioxidants and polyphenols in fresh fruit and vegetables. These antioxidants help the plants to survive droughts, disease and attack by pests by mopping up molecules which can damage cells. Scientists have also shown that zapping potatoes with ultrasound or electricity causes them to double their production of antioxidants, including vitamin C.

When consumed, antioxidants have been shown to combat heart disease, protect arteries and reduce the risk of diabetes and neurological diseases. Antioxidants also prevent damage to DNA which leads to cells becoming cancerous.

- (a) (i) Name **two** natural causes of increased antioxidant levels in fruit and vegetables.

1 _____

2 _____

1

- (ii) Give **two** treatments carried out by scientists to increase the production of antioxidants in potatoes.

1 _____

2 _____

1

- (iii) State **one** benefit of antioxidants for plants.

1

- (iv) Name **one** antioxidant found in potatoes.

1

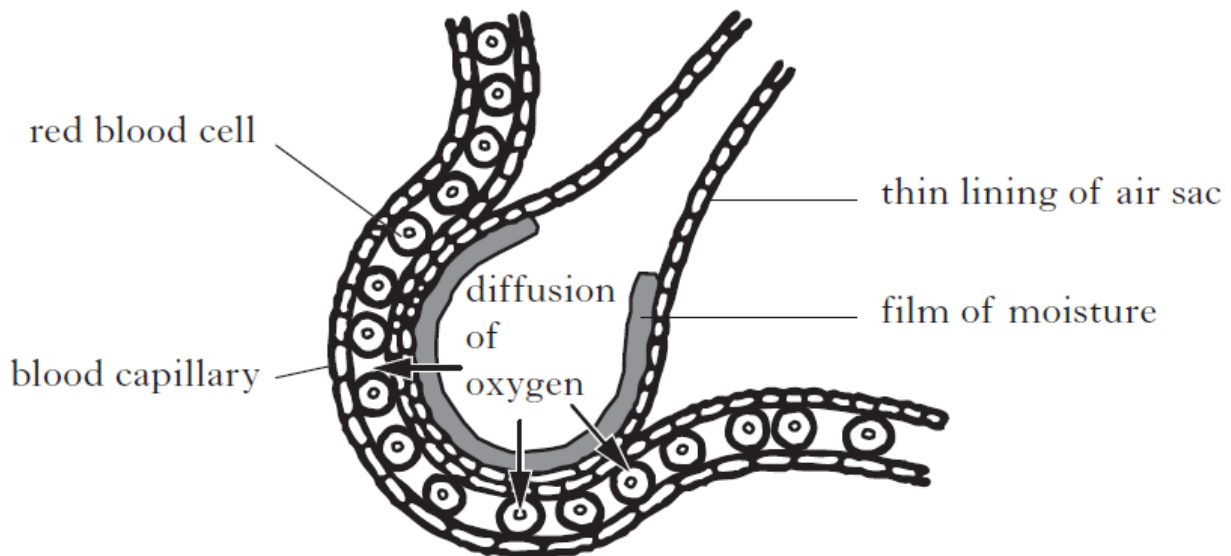
(b) (i) Explain how antioxidants reduce the risk of cancer.

1

(ii) Give **one** other benefit of antioxidants in our diet.

1

9. The diagram below represents an air sac in a human lung.



- (i) Explain why each of the following features, shown in the diagram, are needed for the efficient diffusion of oxygen.

1 Film of moisture _____

1

2 Thin lining of air sac _____

1