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Answer ALL questions in the spaces provided.

1. Read through the following passage about blood cells, and then complete the passage by writing the most appropriate word or words on the dotted lines.

White blood cells (leucocytes) can be classified into two groups, granulocytes and agranulocytes.

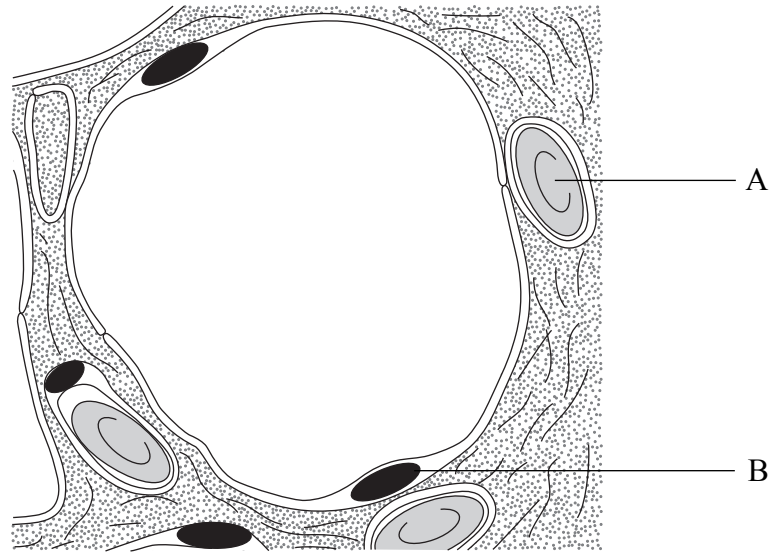
Agranulocytes include lymphocytes and Lymphocytes secrete in the presence of antigens. Granulocytes include neutrophils and Neutrophils can be recognised in a stained film of blood, using a microscope, as they have an irregularly-shaped, which typically has up to five lobes.

(Total 4 marks)

Q1



2. The diagram below shows a section through an alveolus and the surrounding tissue.



Magnification $\times 2000$

(a) Name the cells labelled A and B.

A

B

(2)



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(b) Describe and explain how alveoli are adapted for the function of gas exchange.

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(4)

(c) The pulmonary ventilation rate is found by multiplying the tidal volume by the number of breaths taken per minute.

Calculate the pulmonary ventilation rate for a person breathing a tidal volume of 0.45 dm^3 , 18 times per minute.

Answer dm^3 .
(1)

(Total 7 marks)

Q2



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3. (a) The table below refers to the digestion of carbohydrates. Complete the table by writing the most appropriate word or words in the empty boxes.

Carbohydrate	Enzyme	Products
Starch		Maltose
Lactose	Lactase	
		Glucose and fructose

(4)

(b) Monosaccharides, such as glucose, are absorbed from the small intestine into the bloodstream. Suggest an explanation for each of the following.

(i) Glucose can be absorbed against its concentration gradient.

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(ii) The absorption of glucose is increased in the presence of sodium ions.

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(iii) Glucose is absorbed faster than fructose.

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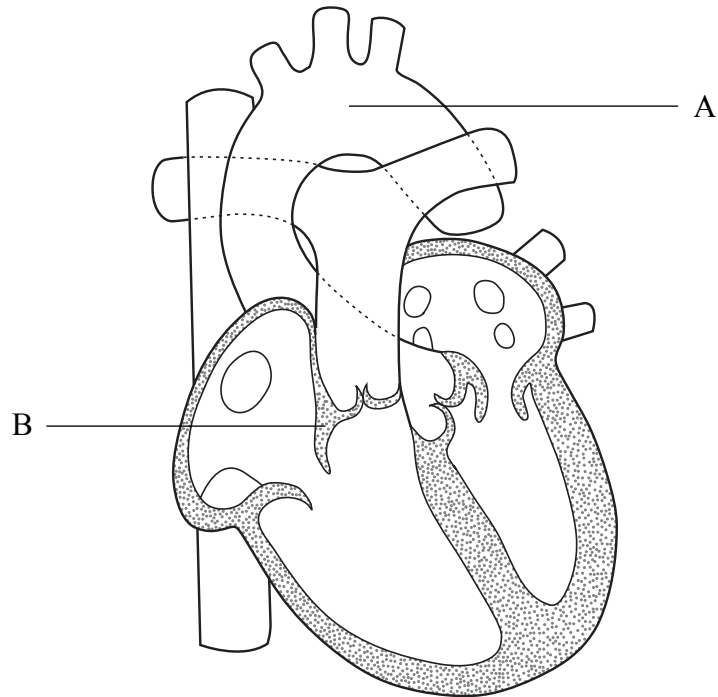
(3)

(Total 7 marks)

Q3



4. (a) The diagram below shows a section through the heart of a mammal.



Name the parts labelled A and B.

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B

(2)



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(b) Heart muscle has a relatively high demand for oxygen. Explain how heart muscle is supplied with oxygen.

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(c) During the cardiac cycle, the atria contract and then the ventricles contract.

Explain how this sequence of events is coordinated.

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(d) The table below shows the effect of exercise on blood flow to the muscles of an adult man.

Blood flow at rest / $\text{dm}^3 \text{ min}^{-1}$	Blood flow during exercise / $\text{dm}^3 \text{ min}^{-1}$
1.0	16.0

Suggest an explanation for the change in blood flow as shown in the table.

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(3)

Q4

(Total 11 marks)



5. (a) Some invertebrates, such as insect larvae, show various adaptations to living in freshwater with a low concentration of dissolved oxygen. Some other invertebrates are adapted to living in fast-flowing water.

(i) Describe and explain **two** ways in which invertebrates are adapted to living in fresh water with a low concentration of dissolved oxygen.

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(4)

(ii) Suggest and explain **one** way in which an invertebrate might be adapted to living in fast-flowing water.

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(b) An experiment was carried out to investigate the relationship between temperature and the concentration of dissolved oxygen in freshwater. The results are shown in the table below.

Temperature / °C	Concentration of dissolved oxygen / mg dm ⁻³
5	12.8
10	11.3
15	10.2
20	9.2
25	8.2
30	7.5

Describe the relationship between temperature and the concentration of dissolved oxygen, as shown by the data.

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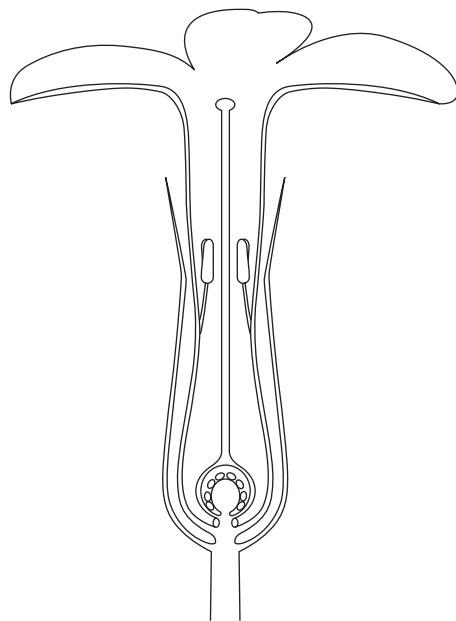
(2)

Q5

(Total 8 marks)



6. (a) The diagram below shows a section through a *Primula* (primrose) flower.



Magnification $\times 2$

Suggest how *Primula* flowers are pollinated. Give an explanation for your answer.

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- (b) An experiment was carried out to measure the rate of growth of a pollen tube in germinating pollen grains. Fresh pollen grains were placed in a 0.5 mol per dm^3 sucrose solution, and kept at a temperature of 20°C . The pollen tube growth rates were recorded at time intervals of 30 minutes for a period of three hours.

The results of this experiment are shown in the table below.

Time / min	Growth rate of pollen tube / mm per 30 min
30	0.156
60	0.169
90	0.182
120	0.169
150	0.052
180	0.032

Describe how the growth rate of the pollen tube changed during this experiment.

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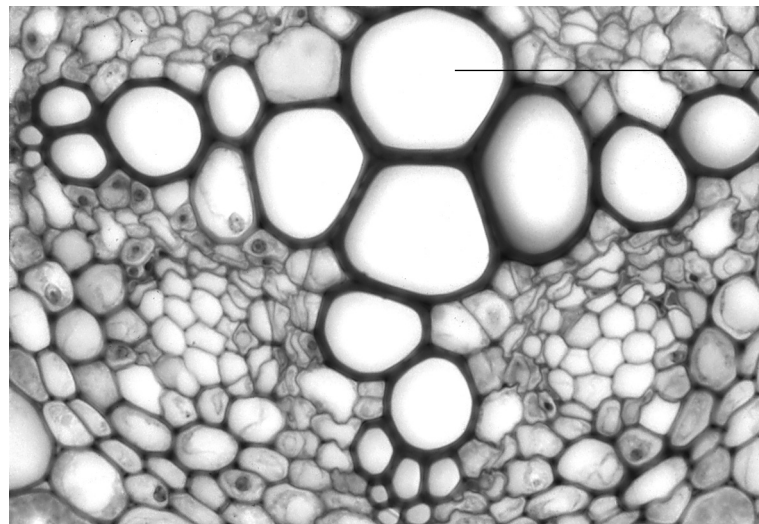
(3)

Q6

(Total 6 marks)



7. (a) The photograph below shows a transverse section through part of a root, as seen using a light microscope.



A

Magnification $\times 400$

Name the part labelled A

..... (1)

(b) Describe the role of the **endodermis**.

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(c) An investigation was carried out into the effect of temperature on the uptake of potassium ions in barley roots. Pieces of barley roots were placed in solutions containing potassium ions, and kept at a range of temperatures. The initial concentration of potassium ions in the solutions was 8 mmol per dm³.

After 10 hours, the concentrations of potassium ions in the root cells were determined. The results are shown in the table below.

Temperature / °C	Potassium concentration in root cells / mmol dm ⁻³
5	32
10	38
15	57
20	80
25	100

(i) Describe the relationship between temperature and the concentration of potassium ions in the root cells.

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(ii) What do these results suggest about the mechanism for the uptake of potassium ions by barley roots? Give an explanation for your answer.

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(Total 9 marks)

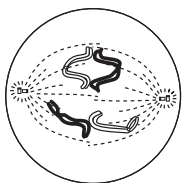
Q7



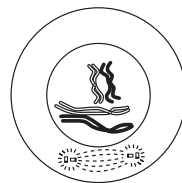
8. (a) The diagrams below show some of the stages of meiosis I in an animal cell. The diploid number ($2n$) of this cell is 4.



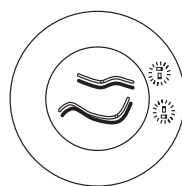
A



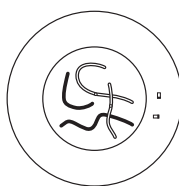
B



C



D



E

Write the letters in the correct order to show the sequence of stages in meiosis I.

..... (2)

- (b) The diploid number of chromosomes in a human cell is 46. State the number of chromosomes present in each of the following.

(i) A spermatogonium

(ii) A spermatid

(2)



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(c) Describe the process of **oogenesis**.

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(4)

Q8

(Total 8 marks)

TOTAL FOR PAPER: 60 MARKS

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