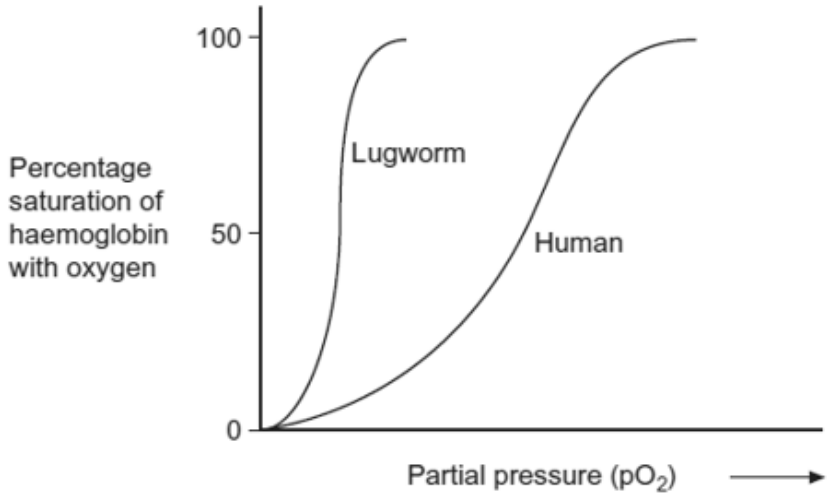
Q1. Lugworms live in mud where the partial pressure of oxygen is low. The graph shows oxygen dissociation curves for a lugworm and for a human.



(a) Explain the advantage to the lugworm of having haemoglobin with a dissociation curve in the position shown.

.....

.....

.....

.....

(2)

(b) In humans, substances move out of the capillaries to form tissue fluid. Describe how this tissue fluid is returned to the circulatory system.

.....

.....

.....

.....

.....

.....

(Extra space) .....

.....

.....

(3)
(Total 5 marks)

Q2. (a) Give **one** feature of starch and explain how this feature enables it to act as a storage substance.

Feature .....

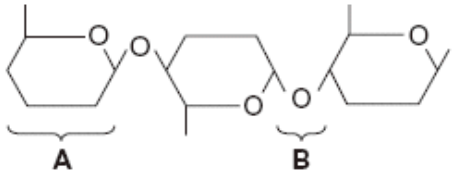
Explanation .....

.....

.....

(2)

(b) The diagram shows part of a cellulose molecule.



(i) Name part **A**.

.....

(1)

(ii) Name bond **B**.

.....

(1)

(c) The structure of cellulose is related to its role in plant cell walls. Explain how.

.....

.....

.....

.....

.....

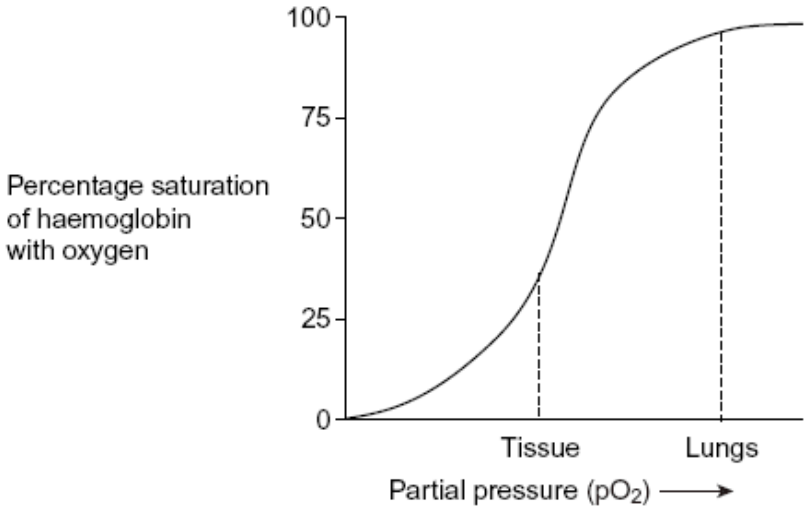
.....

(3)

(Total 7 marks)

Q3. (a) **Figure 1** shows the oxygen dissociation curve for human haemoglobin.

Figure 1



Use **Figure 1** to describe how haemoglobin loads and unloads oxygen in the body.

.....

.....

.....

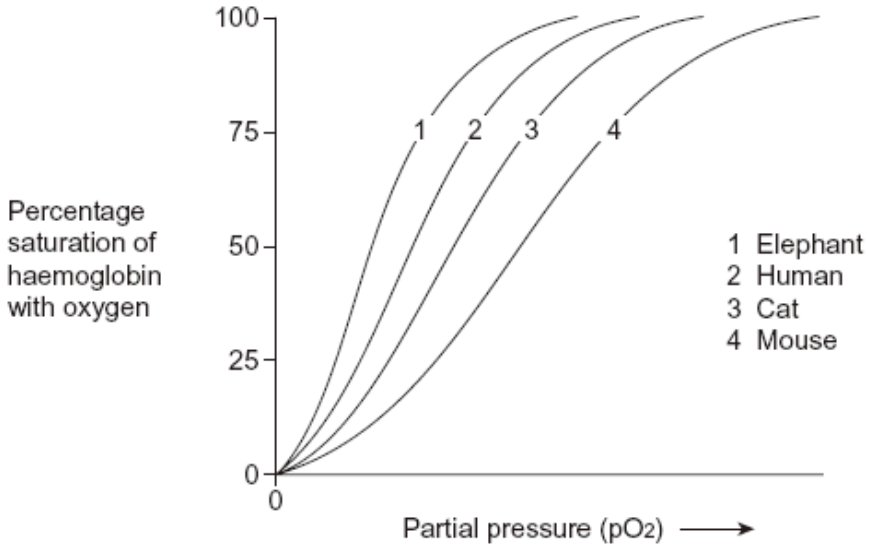
.....

.....

(3)

(b) **Figure 2** shows oxygen dissociation curves from mammals of different size.

Figure 2



(i) Describe the relationship between the size of mammals and the oxygen dissociation curves of their haemoglobins.

.....

.....

(1)

(ii) Heat from respiration helps mammals to maintain a constant body temperature.

Use this information to explain the relationship between the surface area to volume ratio of mammals and the oxygen dissociation curves of their haemoglobins.

.....

.....

.....

.....

.....

.....

.....

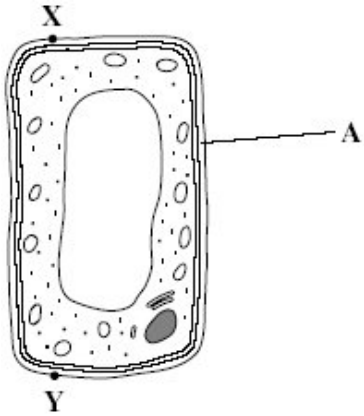
(4)
(Total 8 marks)

Q4. (a) Name the process in which cells become adapted for different functions.

.....

(1)

(b) Palisade cells are found in leaves. The diagram shows a palisade cell.



(i) Name structure **A**.

.....

(1)

(ii) The real length of this cell between **X** and **Y** is 20 micrometres (µm). By how many times has it been magnified? Show your working.

Answer .....

(2)

(iii) Explain **one** way in which this cell is adapted for photosynthesis.

.....

.....

(1)

(Total 5 marks)

Q5. (a) An increase in respiration in the tissues of a mammal affects the oxygen dissociation curve of haemoglobin. Describe and explain how.

.....

.....

.....

.....

(2)

(b) There is less oxygen at high altitudes than at sea level.

(i) People living at high altitudes have more red blood cells than people living at sea level. Explain the advantage of this to people living at high altitude.

.....

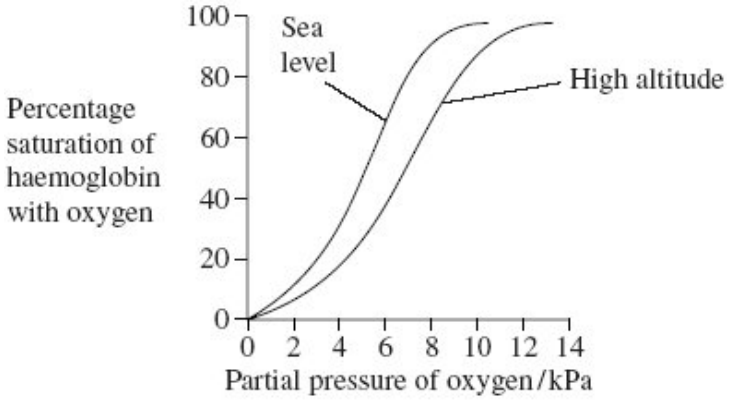
.....

.....

.....

(2)

(ii) The graph shows oxygen dissociation curves for people living at high altitude and for people living at sea level.



Explain the advantage to people living at high altitude of having the oxygen dissociation curve shown in the graph.

.....

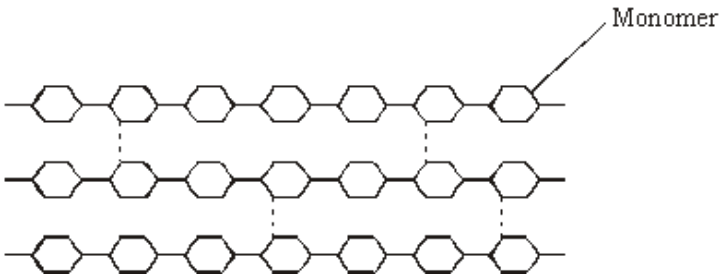
.....

.....

.....

(2)
(Total 6 marks)

Q6. Cellulose is made from one type of monomer. The monomers are held together by bonds. The diagram shows parts of three cellulose molecules in a cell wall.



(a) Name the monomer present in cellulose.

.....

(1)

(b) Name the type of reaction that converts cellulose to its monomers.

.....

(1)

(c) Cotton is a plant fibre used to make cloth. Explain how cellulose gives cotton its strength.

.....

.....

.....

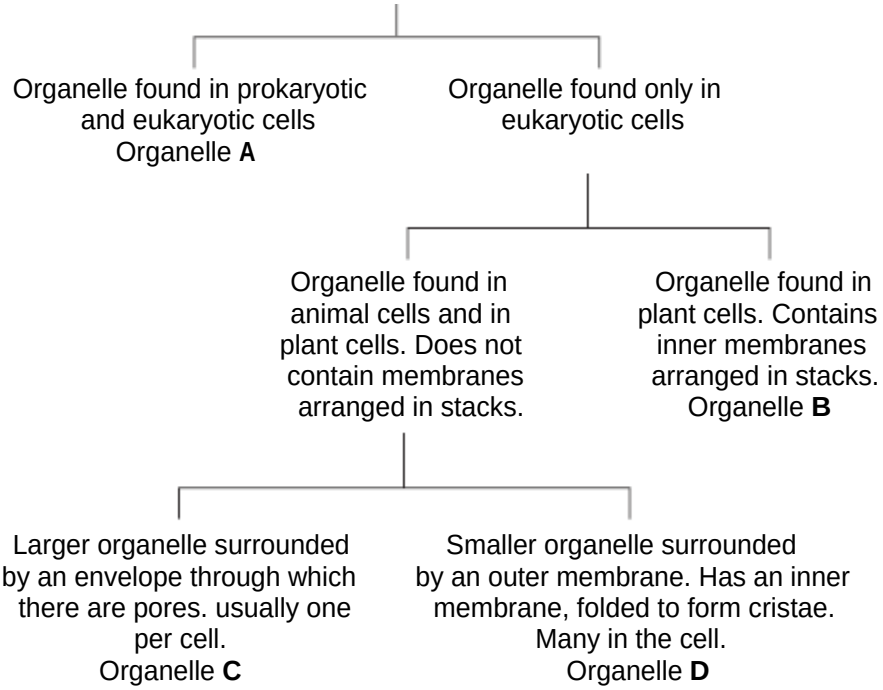
.....

.....

.....

(3)
(Total 5 marks)

Q7. The diagram shows how some organelles may be distinguished from each other.



(a) (i) Name organelle **B**.

.....

(1)

(ii) Describe the function of organelle **B**.

.....

.....

.....

.....

(2)

(b) Which of organelles **A**, **B**, **C** or **D**

(i) is a ribosome;

.....

(1)

(ii) contains most of the DNA found in a plant cell?

.....

(1)

(c) Some liver tissue was ground, filtered and centrifuged to make a suspension of organelle **D**.

(i) Explain why the solution in which the liver tissue was ground should be ice-cold.

.....

.....

(1)

(ii) The ground liver was centrifuged at low speed. The pellet that formed at the bottom of the centrifuge tube was thrown away and the supernatant centrifuged again at higher speed. Explain why it was necessary to first centrifuge the ground liver at low speed in order to obtain a suspension of organelle **D**.

.....

.....

.....

.....

(2)
(Total 8 marks)

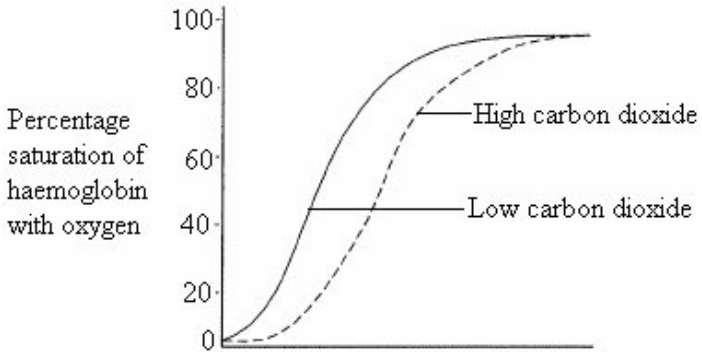
Q8. (a) Haemoglobin is a protein. Its molecules have a quaternary structure. Explain what is meant by a quaternary structure.

.....

.....

(1)

The diagram shows oxygen dissociation curves for human haemoglobin.



(b) Haemoglobin is 96 % saturated with oxygen when it leaves the lungs. Use the graph to explain why.

.....

.....

.....

.....

(2)

(c) (i) There is a high concentration of carbon dioxide in rapidly respiring tissue. Explain why.

.....

.....

(1)

(ii) Carbon dioxide helps haemoglobin to release oxygen to rapidly respiring tissues. Use the graph to explain how.

.....

.....

.....

.....

(2)

(d) Ground squirrels are mammals that spend much of their lives in burrows underground. The table shows the partial pressure of oxygen in a ground-squirrel burrow and in the air above ground.

Source of air sample	Partial pressure of oxygen / kPa
Ground-squirrel burrow	15.8
Above ground	21.1

Suggest the advantage to a ground squirrel of having haemoglobin that has an oxygen dissociation curve to the left of the curve for human haemoglobin.

.....

.....

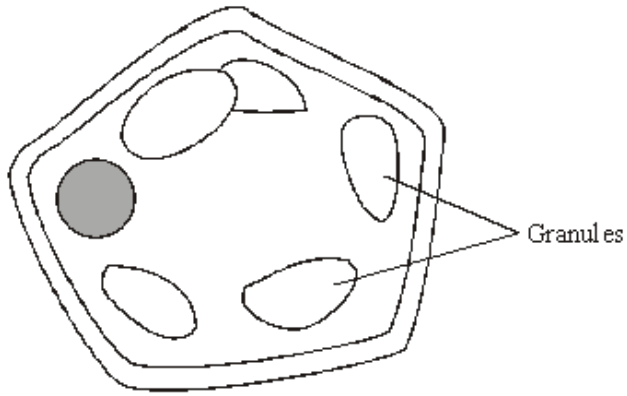
.....

.....

(2)

(Total 8 marks)

Q9. The diagram shows a cell from a potato.



(a) Give **two** features which may be found in a prokaryotic cell which would not be found in this cell.

1 .....

2 .....

(2)

(b) (i) Describe how you could confirm that the granules contained starch.

.....

.....

(1)

.....

(ii) Name **one** polysaccharide other than starch that would be found in this cell.

.....

(1)

(c) Explain **one** advantage of storing starch rather than glucose in potato cells.

.....

.....

.....

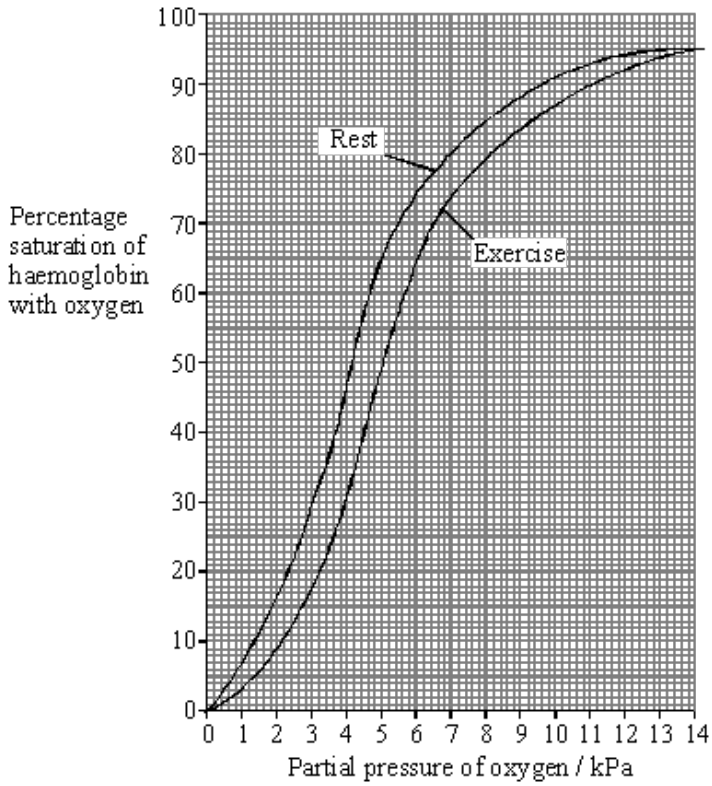
.....

(2)

(Total 6 marks)

Q10. The graph shows dissociation curves for human oxyhaemoglobin at rest and during exercise.

Table 1 gives information about conditions in the body at rest and during exercise.



	Rest	Exercise
Plasma pH	7.4	7.2
Blood temperature / °C	37.0	39.0
Alveolar partial pressure of oxygen / kPa	13.3	13.3
Tissue partial pressure of oxygen / kPa	5.0	4.0

Table 1

(a) What is meant by the term *partial pressure*?

.....

.....

(1)

(b) Use **Table 1** and the graph to calculate the difference in the percentage saturation of haemoglobin in the tissues between rest and exercise.

Answer ..... %

(1)

(c) Explain the differences between the figures shown in **Table 1** for rest and exercise.

.....

.....

.....

.....

.....

.....

.....

.....

(4)

(d) Explain the advantage of the difference in position of the dissociation curve during exercise.

.....

.....

.....

.....

(2)

Table 2 shows how the oxygen concentration in the blood going to and from a muscle changes from rest to heavy exercise.

		Oxygen concentration / cm^3 per 100 cm^3 blood	
		Blood in arteries	**Blood in veins**
At rest	**In solution**	0.3	0.2
	As oxyhaemoglobin	19.5	15.0
	Total oxygen	19.8	15.2
During heavy exercise	**In solution**	0.3	0.1
	As oxyhaemoglobin	20.9	5.3
	Total oxygen	21.2	5.4

Table 2

(e) By how many times is the volume of oxygen removed from the blood by the muscle in **Table 2** during heavy exercise greater than the volume removed at rest?

Show your working.

Answer ..... times

(2)

(f) Does enriching inspired air with oxygen have any effect on the amount of oxygen reaching the tissues? Support your answer with evidence from the graph and **Table 2**.

.....

.....

.....

.....

.....

.....

(3)

S (g) The change to the dissociation curve is one of a number of ways in which the total oxygen supplied to muscles is increased during exercise. Give **two** other ways in which the total oxygen supplied to muscles during exercise is increased.

1 .....

.....

2 .....

.....

(2)
(Total 15 marks)

Q11. Read the following passage.

Straw consists of three main organic substances – cellulose, hemicellulose and lignin. Cellulose molecules form chains which pack together into fibres. Hemicellulose is a small molecule formed mainly from five-carbon (pentose) sugar monomers. It acts as a cement holding cellulose fibres together. Like hemicellulose, lignin is a polymer, but it is not a carbohydrate. It covers the cellulose in the cell wall and supplies additional strength. In addition to these three substances, there are small amounts of other biologically important polymers present.

The other main component of straw is water. Water content is variable but may be determined by heating a known mass of straw at between 80 and 90°C until it reaches a constant mass. The loss in mass is the water content.

Since straw is plentiful, it is possible that it could be used for the production of a range of organic substances. The first step is the conversion of cellulose to glucose. It has been suggested that an enzyme could be used for this process. There is a difficulty here, however. The lignin which covers the cellulose protects the cellulose from enzyme attack.

Use information from the passage and your own knowledge to answer the following questions.

(a) (i) Give **one** way in which the structure of a hemicellulose molecule is similar to the structure of a cellulose molecule.

.....

.....

(1)

(ii) Complete the table to show **two** ways in which the structure of a hemicellulose molecule differs from the structure of a cellulose molecule.

Hemicellulose	Cellulose
....	....
....	....

(2)

(b) Name **one** biologically important polymer, other than those mentioned in the passage, which would be found in straw.

.....

(1)

(c) Explain why the following steps were necessary in finding the water content of straw:

(i) heating the straw *until it reaches constant mass* (line 9);

.....

.....

.....

(1)

(ii) not heating the straw above 90°C (line 9).

.....

.....

.....

.....

(2)

(d) A covering of lignin protects cellulose from enzyme attack (line 14). Use your knowledge of the way in which enzymes work to explain why cellulose-digesting enzymes do not digest lignin.

.....

.....

.....

.....

(2)

(e) Describe the structure of a cellulose molecule and explain how cellulose is adapted for its function in cells.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

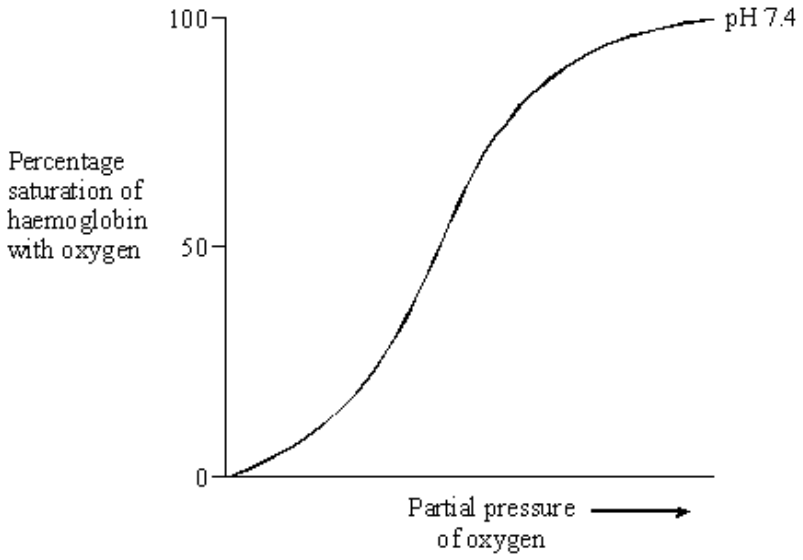
.....

.....

.....

(6)
(Total 15 marks)

Q12. (a) The graph shows a dissociation curve for human haemoglobin at pH 7.4. The position of the curve is different at pH 7.2.



(i) Sketch a curve on the graph to show the likely position of the dissociation curve at pH 7.2.

(1)

(ii) Explain how a change in pH from 7.4 to 7.2 affects the supply of oxygen by haemoglobin to the tissues.

.....

.....

.....

.....

.....

.....

(2)

(b) Explain what causes the pH to be reduced from 7.4 to 7.2 in a tissue.

.....

.....

.....

.....

.....

.....

(3)
(Total 6 marks)