1)

(a) Yeast reproduces asexually by a process called budding. During this process, cell division occurs.

(i) Name the type of cell division that occurs in asexual reproduction.

..... **[1]**

(ii) Before the division of the nucleus of a cell, the genetic material must replicate.

Explain why this is essential.

..... **[2]**

(b) Unlike yeast, the nuclei of most eukaryotic organisms contain homologous pairs of chromosomes.

Explain what is meant by a *homologous pair of chromosomes*.

..... **[3]**

(c) In most multicellular organisms, the cells produced by cell division are organised into tissues.

(i) State what is meant by the term *tissue*.

.....

.....

.....

..... **[2]**

(ii) Complete Table 1.1 below comparing two types of epithelium, squamous epithelium and ciliated epithelium.

For each type of epithelium, state **one** function of the tissue and **one** specific location in the human body where it is found.

Table 1.1

type of epithelium	function of tissue	specific location in the human body
squamous		
ciliated		

[4]

[Total: 12]

2)

Fig. 2.1 is a diagram of a cell showing the organelles involved in the production and secretion of an extracellular protein. The rough endoplasmic reticulum (RER) is shown enlarged at the side of the diagram.

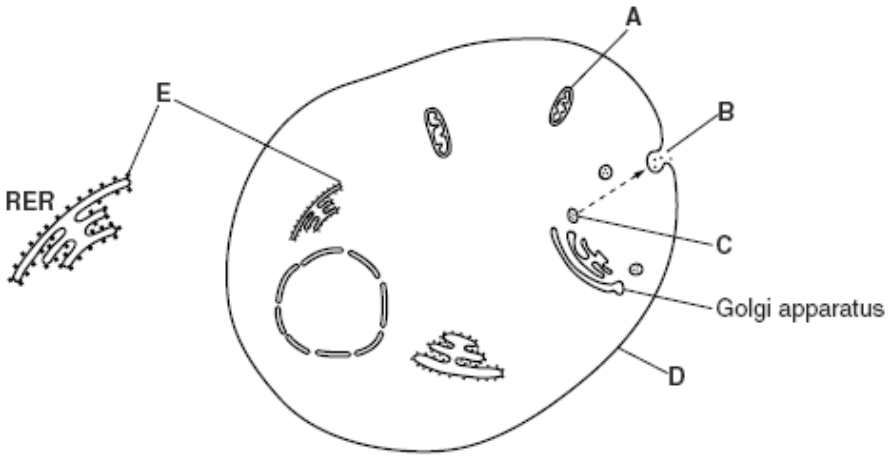

Fig. 2.1

(a) (i) Name the structures labelled **C**, **D** and **E**.

.....[3]

(ii) Suggest **one** type of extracellular protein secreted at **B**.

..... [1]

(iii) Organelle **A** provides ATP which is a source of energy.

Suggest **one** stage during the secretion of a protein that requires energy.

..... [1]

(iv) Outline the role of the Golgi apparatus.

.....[2]

(b) The cell shown in Fig. 2.1 is a eukaryotic cell.

(i) Identify **two** features, **visible in Fig. 2.1**, which would **not** be present in a prokaryotic cell.

..... **[2]**

(ii) Name **one** feature that would be present in the cytoplasm of a prokaryotic cell that is **not** found in a eukaryotic cell.

..... **[1]**

[Total: 10]

3)

(a) A student wanted to observe some red blood cells under the microscope. The student placed a small sample of blood onto a microscope slide and added a drop of distilled water. When viewed at high power, the student observed that the red blood cells had burst.

In a similar procedure using plant epidermis, the student observed that the plant cells did not burst.

(i) Explain these observations.

In your answer you should use appropriate technical terms, spelt correctly.

..... **[5]**

(ii) Suggest how the student could modify the procedure to observe red blood cells without them bursting.

..... **[1]**

(b) Oxygen enters red blood cells as they pass through the capillaries in the lungs.

Name the mechanism by which oxygen enters the red blood cells.

..... **[1]**

(c) The cells in the epidermis of a plant root are specialised to absorb minerals from the surrounding soil.

State the process by which root epidermal cells absorb minerals from the soil **and** describe how these cells are specialised to achieve absorption.

..... **[3]**

[Total: 10]

4)

Fig. 6.1 shows an aphid feeding from a plant stem. The aphid feeds by inserting its tube-like mouthparts into the tissue that transports sugar solution. Some details of this transport tissue are shown in the vertical section.

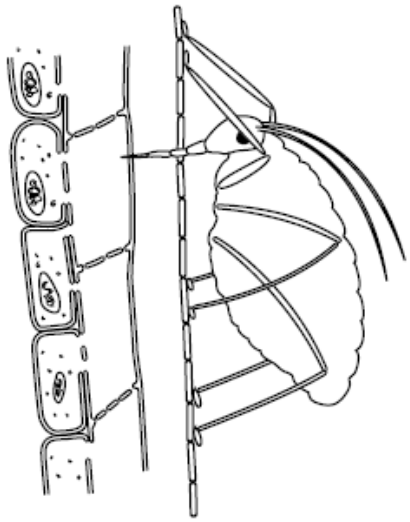

Fig. 6.1

(a) (i) Name the sugar most commonly transported through the stem of a plant **and** the tissue that transports this sugar.

sugar .....

tissue ..... **[1]**

(ii) Sugar molecules are actively loaded into the transport tissue.

Describe how active loading takes place.

..... **[3]**

(b) A classic experiment investigated the effect of temperature on the rate of sugar transport in a potted plant.

Aphid mouthparts were used to take samples of sugar solution from the transport tissue in the stem. The sugary solution dripped from the mouthparts. The number of drips per minute was counted.

The procedure was repeated at different temperatures.

Table 6.1 shows the results obtained.

Table 6.1

temperature (°C)	number of drips per minute
5	3
10	6
20	14
30	26
40	19
50	0

Suggest brief explanations for these results.

..... **[3]**

5)

(a) Fig. 1.1 represents a mechanism of enzyme action.

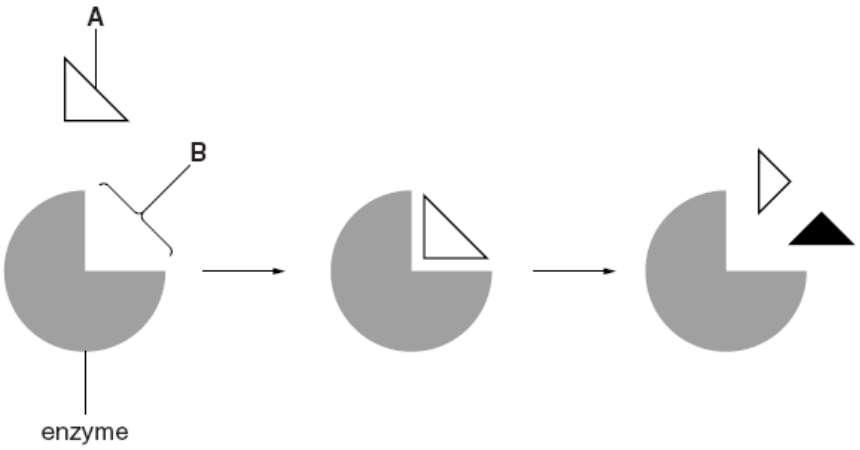

Fig. 1.1

(i) Name the structures represented by the letters **A** and **B**.

A .....

B ..... **[2]**

(ii) The mechanism of enzyme action was originally explained in terms of the 'lock-and-key model'. It is now more often explained in terms of the 'induced-fit' model.

Suggest why the lock-and-key and induced-fit explanations are termed **models**.

..... **[1]**

(iii) Suggest why most scientists now accept the induced-fit model rather than the lock-and-key model.

..... **[1]**

(b) Many fish live in the Antarctic where the water temperature can be close to 0 °C.

- Scientists have studied enzymes from these Antarctic fish and also from non-Antarctic fish that live in water at a temperature of 10 °C.
- One of the enzymes studied has been lactate dehydrogenase (LDH), an important enzyme involved in cell metabolism.
- One way in which LDH works is to catalyse the conversion of lactate to an important compound known as pyruvate.

(i) Scientists investigated the rates of reaction of LDH from Antarctic and non-Antarctic fish at a range of temperatures.

Suggest **three** variables that should be controlled in an investigation of this type.

1 .....

2 .....

3 ..... **[3]**

(ii) Some suggested controls used in this investigation are listed below.

J	water, lactate and heated LDH (non-Antarctic at 10 °C)
K	lactate alone at all temperatures
L	lactate and water at all temperatures
M	boiled LDH (Antarctic and non-Antarctic) at all temperatures
N	pyruvate and water at all temperatures

Select the letter, **J**, **K**, **L**, **M** or **N**, that represents the most appropriate control to be used in this investigation.

..... **[1]**

(iii) The rate of conversion of lactate to pyruvate at 1 °C was found to be relatively slow when catalysed with LDH from **non-Antarctic fish**.

Suggest reasons for this result.

..... **[2]**

(iv) It was discovered that the rate of conversion of lactate to pyruvate at 1 °C was higher if catalysed with LDH enzyme from Antarctic fish than when catalysed with LDH enzyme from non-Antarctic fish.

Certain parts of the enzyme molecule from the Antarctic fish are more flexible than the equivalent parts of the molecule from the non-Antarctic fish.

Suggest how a more flexible structure might help this enzyme work faster at lower temperatures.

..... **[1]**

(c) Enzymes are proteins. The enzymes in Antarctic fish have a different structure from those found in non-Antarctic fish.

(i) Suggest how the structure of the **enzymes** may differ in Antarctic and non-Antarctic fish.

..... **[2]**

(ii) Suggest how the **DNA** of the Antarctic and non-Antarctic fish might differ.

..... **[2]**

(d) If species of Antarctic fish were to become extinct, their unique enzymes would be lost.

(i) Suggest why the loss of these **enzymes** might be undesirable.

..... **[1]**

(ii) Suggest **two** ways in which the population of Antarctic fish could be conserved.

..... **[2]**

..... **[Total: 18]**

6)

Fig. 4.1 shows a representation of part of a carbohydrate molecule called agarose.

One of the subunits of agarose is a sugar called galactose.

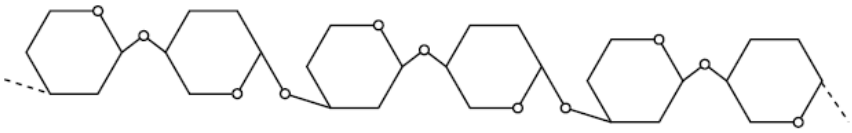

Fig. 4.1

(a) **(i)** Identify the type of carbohydrate molecule of which the carbohydrate agarose is an example.

..... **[1]**

(ii) Starch contains a carbohydrate called amylose. Amylose does not contain galactose.

Using the information in Fig. 4.1, identify **one** similarity and **one further** difference in structure between agarose and amylose.

..... **[2]**.

(b) Agarose forms part of a more complex carbohydrate called agar, which is used as a growth medium for bacteria. Bacteria cannot break down the agarose in agar.

Suggest why bacteria cannot break down agarose.

..... **[1]**.

(c) A student wished to demonstrate experimentally that bacteria cannot break down agarose.

The student used a culture of *E.coli* bacteria which had been grown in a solution containing starch.

Two tubes, **A** and **B**, were set up as follows:

Tube **A**: contained 0.1 cm^3 of the *E.coli* culture and 5 cm^3 of a nutrient solution in which agarose was the only carbohydrate.

Tube **B**: contained 5 cm^3 of a nutrient solution in which agarose was the only carbohydrate.

Both tubes were incubated at 30 °C for 2 hours.

A sample from each tube was then tested for the presence of reducing sugar.

The results are shown in Table 4.1.

Table 4.1

source of sample	conclusion from test
tube **A**	very small amount of reducing sugar present
tube **B**	no reducing sugar present

(i) Explain the purpose of tube **B**.

..... **[2]**

(ii) The student wrote the following conclusion:

My experiment showed that bacteria must be able to break down agarose. This is because reducing sugar was present in tube **A**.

Suggest an alternative explanation for the presence of reducing sugar in tube **A** that is **not** consistent with the student's conclusion.

..... **[1]**

(iii) Suggest **two** ways in which the **reliability** of the experiment could be improved.

..... **[2]**

(d) (i) The student did **not** have access to a colorimeter when testing solutions for the presence of reducing sugar.

Describe how the student could carry out a chemical test for reducing sugar **and** suggest how he could estimate the amount of reducing sugar in the sample from tube **A**.

[5]

(ii) Another student suggested that the agarose may have been broken down to a **non-reducing** sugar.

Describe how the test for reducing sugar could be modified to investigate this hypothesis.

..... **[3]**

[Total: 17]