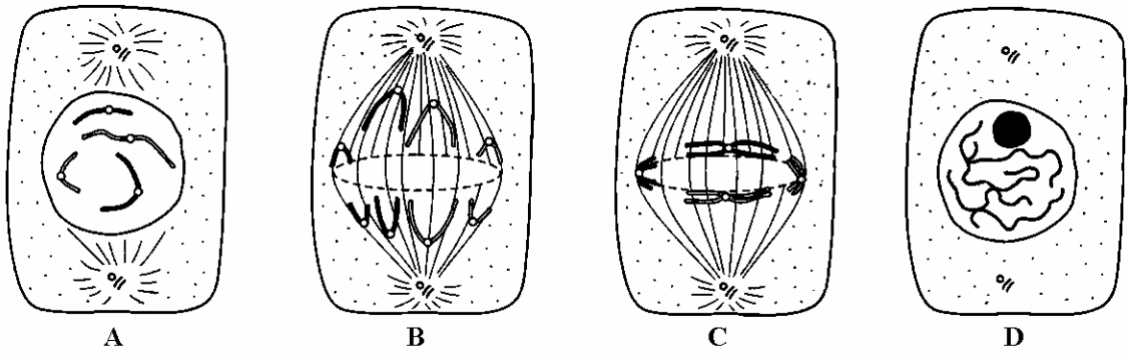
1. (a) (i) The diagrams show some of the stages of mitosis. Arrange the letters **A - D** to give the correct sequence of stages.



Sequence .....

(1)

(ii) Describe the role of the spindle in mitosis.

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(2)

(b) Sexual reproduction involves the fusion of gametes. Explain the importance of meiosis in the life cycle of a sexually reproducing organism.

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(2)

(c) The table shows the mean mass of DNA in the nuclei of different cells in cattle.

Cell	**Mean mass of DNA/ arbitrary units**
Sperm cell	3.42
Red Blood cell	0.00
Liver cell	7.05

(i) Explain the difference in DNA content between sperm and liver cells.

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(1)

(ii) There is no DNA in the red blood cell. Explain why.

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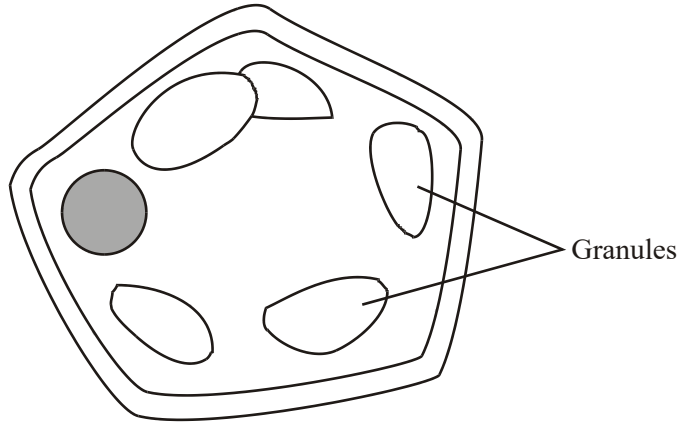
(1)
(Total 7 marks)

2. 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.

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(1)

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

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(1)

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

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(2)
(Total 6 marks)

3. 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.

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(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);

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(1)

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

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(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.

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(2)

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

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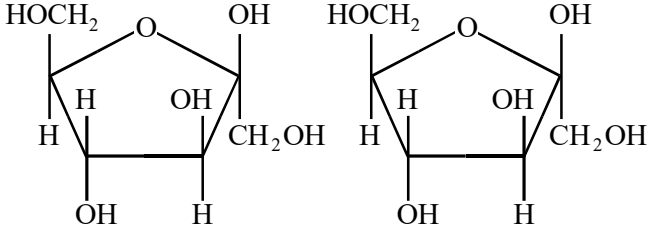
(6)
(Total 15 marks)

4. Grasses store carbohydrate as fructans, which are polymers of a monosaccharide called fructose. The diagram shows the structural formula of each of two fructose molecules.



(a) (i) Draw a box round the parts of the two fructose molecules that would be removed when the two molecules are joined together.

(1)

(ii) Name the process in which monosaccharides join together.

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(1)

(iii) How many carbon atoms does a molecule of fructose contain?

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(1)

(b) The table shows the percentage of carbohydrates in the dry mass of a sample of young grass.

Carbohydrate	**Content of dry mass of grass sample / %**
Monosaccharides & disaccharides	9
Fructans	18
Cellulose	25
Other polysaccharides	21

(i) The sample of young grass contains 80% water.
Calculate the mass of cellulose in 1 kg of this grass. Show your working.

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(2)

(ii) Cellulose, is a constituent of the cell walls of the grass
Explain how the structure of cellulose molecules gives strength to the cell walls

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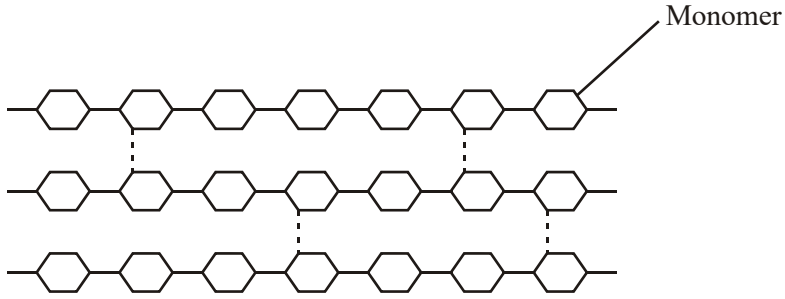
(2)

(Total 7 marks)

5. 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.

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(1)

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

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(1)

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

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(3)

(Total 5 marks)