1 The soils in wet, marshy lands usually have anaerobic conditions that inhibit decomposition. As a result of this, dense layers of semi-decayed organic matter, known as marshland peat, build up.

The table below shows some of the components of marshland peat.

Component	Chemical nature	Main source
Cutin	Polymer of organic acids linked by ester bonds	Waxy layers of leaves and fruits
Lignin	Polymers of phenyl propene	
Hemicellulose	Branched polysaccharide Monomers include hexoses and pentoses linked by glycosidic bonds	Cell walls of all plant cells
Cellulose		Cell walls of all plant cells

(a) Describe the chemical nature of cellulose.

(3)

(b) Name a plant tissue that could be the main source of the lignin found in marshland peat.

(1)

(c) All of the components shown in the table are organic carbon compounds. Describe the role of microorganisms in the recycling of the carbon from these compounds.

(3)

(d) Landscapes rich in peat act as carbon sinks. However, during recent decades, some countries have been draining and clearing marshy peatlands to grow crops, such as palms, to produce biofuels. During this clearance and drainage, the rate of decomposition in the peat increases and the organic debris is burnt.
This change of use of the peatlands has turned carbon sinks into carbon sources.

(i) Suggest **one** reason why some countries may decide to drain their marshy peatlands for the production of biofuels.

(1)

*(ii) Biofuels are considered to be carbon neutral.

Suggest why the continued draining and clearance of peatlands may contribute towards global warming even though they may be used to produce biofuels.

(5)

(Total for Question 1 = 13 marks)

2 The questions below refer to some important biological molecules.
Place a cross (☒) in the most appropriate box that describes the structure or role of these biological molecules.

(a) Disaccharides can be split by

(1)

☒ **A** hydrolysis of glycosidic bonds

☒ **B** condensation of glycosidic bonds

☒ **C** hydrolysis of ester bonds

☒ **D** condensation of ester bonds

(b) Amylose is an example of a

(1)

☒ **A** monosaccharide

☒ **B** disaccharide

☒ **C** polysaccharide

☒ **D** trisaccharide

(c) The role of starch is to

(1)

☒ **A** be a source of energy to plants

☒ **B** store energy in all living organisms

☒ **C** store energy in plants

☒ **D** store energy in animals

(d) Proteins are polymers of amino acids joined by peptide bonds formed between the

(1)

☒ **A** R groups

☒ **B** R group and the amino group

☒ **C** R group and the carboxyl group

☒ **D** carboxyl group and the amino group

(e) The three-dimensional structure of a protein is held together by

(1)

☒ **A** peptide, hydrogen and ionic bonds

☒ **B** hydrogen, ester and ionic bonds

☒ **C** disulphide bridges and ester bonds

☒ **D** disulphide bridges, hydrogen and ionic bonds

(f) DNA consists of mononucleotides joined together by bonds between

(1)

☒ **A** two pentose sugars

☒ **B** one ribose sugar and one phosphate group

☒ **C** one deoxyribose sugar and one phosphate group

☒ **D** two phosphate groups

(g) Water is described as a dipolar molecule because it has a

(1)

☒ **A** positively charged hydrogen end and a negatively charged oxygen end

☒ **B** positively charged hydrogen end and a positively charged oxygen end

☒ **C** negatively charged hydrogen end and a negatively charged oxygen end

☒ **D** negatively charged hydrogen end and a positively charged oxygen end

(Total for Question 2 = 7 marks)

3 The rice plant is a type of grass and reproduces by producing grains.

Tom Myers / Agstockusa / Science Photo Library

(a) The rice grains are full of starch.

(i) Starch is a polymer of one monosaccharide.
Name this monosaccharide.

(1)

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*(ii) Describe **two** ways in which the structure of starch is related to its function.

(4)

Structure .....

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Function .....

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Structure .....

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Function .....

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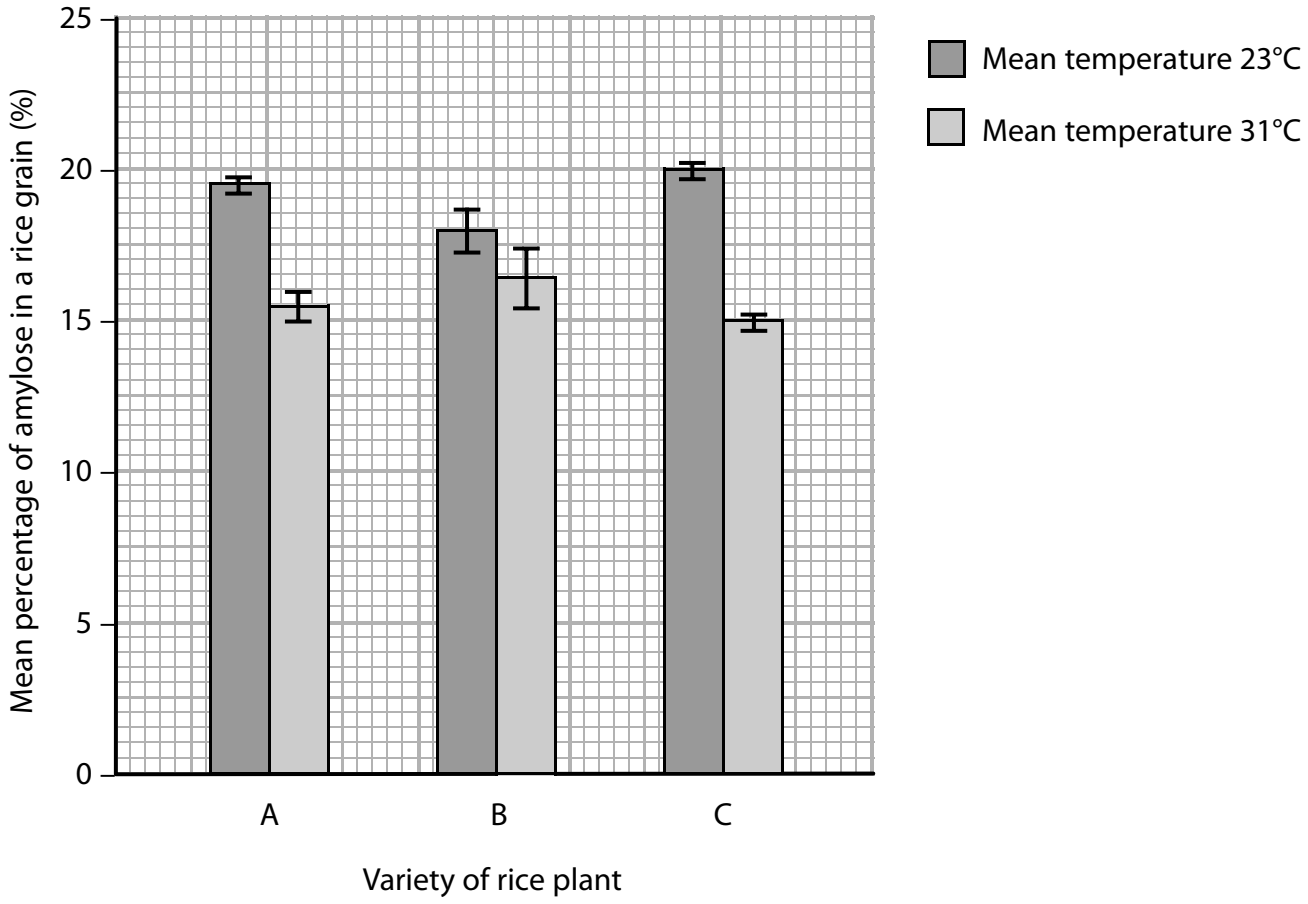
(b) Starch is made up of amylose and amylopectin. An investigation was undertaken to study the effect of temperature on amylose production in rice grains. Three different varieties of rice plant, A, B and C, were grown at a mean temperature of 23°C until they had produced mature rice grains. All other variables were kept constant.

Fifty rice grains were then collected from each variety and the mean percentage of amylose in a rice grain was determined.

This investigation was repeated at a mean temperature of 31°C.

The results are shown in the graph below.



(i) Describe the effect of temperature on the mean percentage of amylose in the rice grains of all three varieties of rice plant.

(2)

(ii) Using the information in the graph, suggest which set of data is least supportive of the statement that 'temperature has an effect on the percentage of amylose present in rice grains'. Explain your answer.

(3)

(Total for Question 3 = 10 marks)

4 Cow pats, formed from the faeces dropped by cattle, are a familiar sight in any field where cattle have been grazing. Apart from water, a cow pat consists of a mixture of organic compounds left over from the digestive processes in the cow.

Cellulose and plant fibres are efficiently digested in cattle. Therefore, the texture of a cow pat is relatively soft in comparison to the faeces of some other herbivores.

(a) (i) Place a cross ☒ in the **two** boxes next to the types of bond that would need to be broken during the digestion of cellulose in cattle.

(2)

ester ☐

hydrogen ☐

glycosidic ☐

peptide ☐

(ii) Name **two** types of plant fibre that may be present in the material eaten by cattle.

(2)

1 .....

2 .....

(b) The first stage in the decomposition of a cow pat is known as putrefaction. Explain how carbon dioxide and ammonia are formed during this stage of decomposition.

(4)

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(c) The table below shows the mean time taken for a cow pat to decompose, at different times of the year, in a field in southern Britain.

Season	Decomposition time for cow pat / days
Early spring	140
Late spring	125
Early summer	110
Late summer	90
Early autumn	120
Late autumn	150

With reference to the data in the table, suggest why the time taken for a cow pat to decompose changes at different times of the year.

(3)

(Total for Question 4 = 11 marks)