**Q1.**(a)     Describe how you would test a piece of food for the presence of lipid.

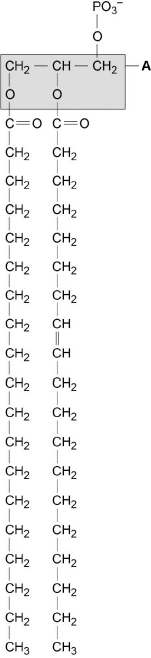
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**(2)**

The figure below shows a phospholipid.

  
**X**         **Y**

(b)     The part of the phospholipid labelled **A** is formed from a particular molecule. Name this molecule.

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**(1)**

(c)     Name the type of bond between **A** and fatty acid **X**.

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**(1)**

(d)     Which of the fatty acids, **X** or **Y**, in the figure above is unsaturated? Explain your answer.

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**(1)**

Scientists investigated the percentages of different types of lipid in plasma membranes from different types of cell. The table shows some of their results.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Type of lipid** | **Percentage of lipid in plasma membrane by mass** | | |
|  | **Cell lining ileum of mammal** | **Red blood cell of mammal** | **The bacterium *Escherichia coli*** |
|  | Cholesterol | 17 | 23 | 0 |
|  | Glycolipid | 7 | 3 | 0 |
|  | Phospholipid | 54 | 60 | 70 |
|  | Others | 22 | 14 | 30 |

(e)     The scientists expressed their results as **Percentage of lipid in plasma membrane by mass**. Explain how they would find these values.

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**(2)**

Cholesterol increases the stability of plasma membranes. Cholesterol does this by making membranes less flexible.

(f)     Suggest **one** advantage of the different percentage of cholesterol in red blood cells compared with cells lining the ileum.

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**(1)**

(g)     *E. coli* has no cholesterol in its cell-surface membrane. Despite this, the cell maintains a constant shape. Explain why.

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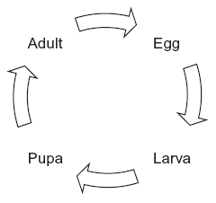
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**(2)**

**(Total 10 marks)**

**Q2.**          The diagram shows the life cycle of a fly.



When the larva is fully grown, it changes into a pupa. The pupa does not feed. In the pupa, the tissues that made up the body of the larva are broken down. New adult tissues are formed from substances obtained from these broken-down tissues and from substances that were stored in the body of the larva.

(a)     Hydrolysis and condensation are important in the formation of new adult proteins.  
Explain how.

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**(2)**

(b)     Most of the protein stored in the body of a fly larva is a protein called calliphorin.  
Explain why different adult proteins can be made using calliphorin.

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**(1)**

The table shows the mean concentration of RNA in fly pupae at different ages.

|  |  |  |
| --- | --- | --- |
|  | **Age of pupa as percentage of total time spent as a pupa** | **Mean concentration of RNA / μg per pupa** |
|  | 0 | 20 |
|  | 20 | 15 |
|  | 40 | 12 |
|  | 60 | 17 |
|  | 80 | 33 |
|  | 100 | 20 |

(c)     Describe how the concentration of RNA changes during the time spent as a pupa.

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**(2)**

(d)     (i)      Describe how you would expect the number of lysosomes in a pupa to change with the age of the pupa. Give a reason for your answer.

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**(2)**

(ii)     Suggest an explanation for the change in RNA concentration in the first 40% of the time spent as a pupa.

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**(2)**

(e)     Suggest an explanation for the change in RNA concentration between 60 and 80% of the time spent as a pupa.

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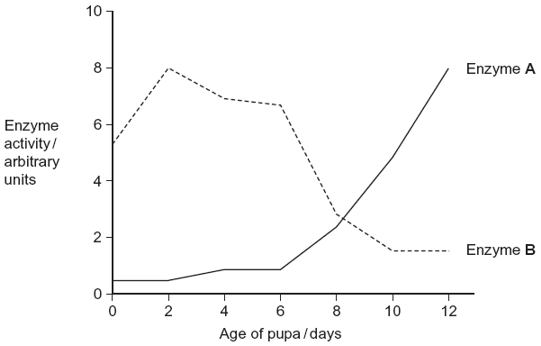
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**(2)**

(f)      The graph shows changes in the activity of two respiratory enzymes in a fly pupa.

•        Enzyme **A** catalyses a reaction in the Krebs cycle

•        Enzyme **B** catalyses the formation of lactate from pyruvate

During the first 6 days as a pupa, the tracheae break down. New tracheae are formed after 6 days. Use this information to explain the change in activity of the two enzymes.

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**(4)**

**(Total 15 marks)**

**Q3.**          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

 5      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.

10     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.

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**(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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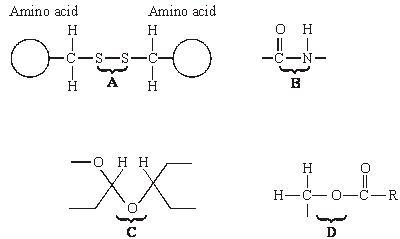
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**(6)**

**(Total 15 marks)**

**Q4.**          The diagrams show four types of linkage, **A** to **D**, which occur in biological molecules.



(a)     Name the chemical process involved in the formation of linkage **B**.

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**(1)**

(b)     Give the letter of the linkage which

(i)      occurs in a triglyceride molecule;

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**(1)**

(ii)     might be broken down by the enzyme amylase;

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**(1)**

(iii)     may occur in the tertiary, but not the primary structure of protein.

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**(1)**

(c)     Describe how a saturated fatty acid differs in molecular structure from an unsaturated fatty acid.

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**(2)**

**(Total 6 marks)**

**Q5.**          (a)     Starch and protein are biologically important polymers.

(i)      Explain what is meant by a polymer.

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**(1)**

(ii)     Give **one** example of a biologically important polymer other than starch or protein.

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**(1)**

(b)     In an investigation, the enzyme amylase was mixed in a test tube with a buffer solution and a suspension of starch. The amylase broke down the starch to maltose. When all the starch had been broken down, a sample was removed from the test tube and tested with biuret reagent.

(i)      Explain why a buffer solution was added to the amylase-starch mixture.

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**(2)**

(ii)     What colour would you expect the sample to go when tested with biuret reagent?

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**(1)**

(iii)     Give an explanation for your answer to part (ii)

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**(2)**

**(Total 7 marks)**

**Q6.**(a)     (i)      The equation shows the reaction catalysed by the enzyme lactase. Complete this equation.

Lactose + ...............................  Glucose + ...............................

**(2)**

(ii)     Name the type of chemical reaction shown in this equation.

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**(1)**

(b)     Lactase is an enzyme. Lactose is a reducing sugar.

(i)      Describe how you could use the biuret test to distinguish a solution of the enzyme, lactase from a solution of lactose.

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**(1)**

(ii)     Explain the result you would expect with the enzyme.

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**(1)**

**(Total 5 marks)**

**Q7.**          (a)     Give **one** feature of starch and explain how this feature enables it to act as a storage substance.

Feature ........................................................................................................

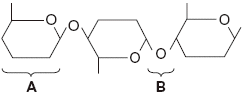
Explanation ..................................................................................................

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**(2)**

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



(i)      Name part **A**.

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**(1)**

(ii)     Name bond **B**.

.............................................................................................................

**(1)**

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

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**(3)**

**(Total 7 marks)**

**Q8.**          (a)     Sucrose, maltose and lactose are disaccharides.

(i)      Sucrase is an enzyme. It hydrolyses sucrose during digestion. Name the products of this reaction.

................................................... and ..................................................

**(2)**

(ii)     Sucrase does **not** hydrolyse lactose. Use your knowledge of the way in which enzymes work to explain why.

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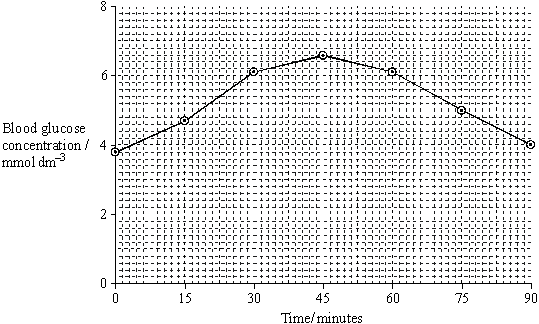
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**(2)**

(b)     A woman was given a solution of sucrose to drink. Her blood glucose concentration was measured over the next 90 minutes. The results are shown on the graph.



(i)      Describe how the woman’s blood glucose concentration changed in the period shown in the graph.

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**(2)**

(ii)     Explain the results shown on the graph.

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**(2)**

**(Total 8 marks)**

**Q9.**          (a)     Omega-3 fatty acids are unsaturated. What is an unsaturated fatty acid?

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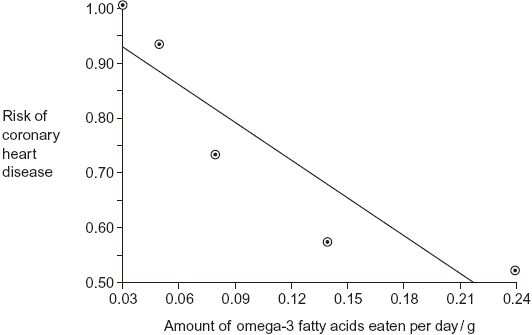
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**(2)**

(b)     Scientists investigated the relationship between the amount of omega-3 fatty acids eaten per day and the risk of coronary heart disease. The graph shows their results.



Do the data show that eating omega-3 fatty acids prevents coronary heart disease? Explain your answer.

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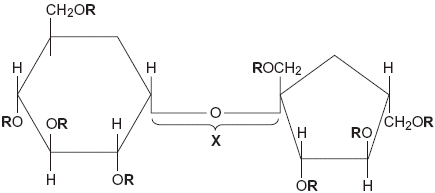
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**(3)**

(c)     Olestra is an artificial lipid. It is made by attaching fatty acids, by condensation, to a sucrose molecule. The diagram shows the structure of olestra. The letter **R** shows where a fatty acid molecule has attached.



(i)      Name bond **X**.

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**(1)**

(ii)     A triglyceride does **not** contain sucrose or bond **X**. Give **one** other way in which the structure of a triglyceride is different to olestra.

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**(1)**

(iii)     Starting with separate molecules of glucose, fructose and fatty acids, how many molecules of water would be produced when one molecule of olestra is formed?



**(1)**

**(Total 8 marks)**

**Q10.**(a)    The table shows some statements about three carbohydrates. Complete the table with a tick in each box if the statement is true.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Statement** | **Starch** | **Cellulose** | **Glycogen** |
|  | Found in plant cells |  |  |  |
|  | Contains glycosidic bonds |  |  |  |
|  | Contains β-glucose |  |  |  |

**(3)**

(b)     Name the type of reaction that would break down these carbohydrates into their monomers.

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**(1)**

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

Feature...........................................................................................................

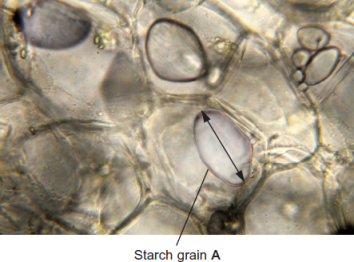
Explanation.....................................................................................................

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**(2)**

(d)     The picture shows starch grains as seen with an optical microscope. The actual length of starch grain **A** is 48 μm. Use this information and the arrow line to calculate the magnification of the picture. Show your working.

  
                                                                               © iStock/Thinkstock

Magnification ...................................... times

**(2)**

**(Total 8 marks)**

**Q11.**Read the following passage.

|  |  |  |
| --- | --- | --- |
|  | Aspirin is a very useful drug. One of its uses is to reduce fever and inflammation. Aspirin does this by preventing cells from producing substances called prostaglandins. Prostaglandins are produced by an enzyme-controlled pathway. Aspirin works by inhibiting one of the enzymes in this pathway. Aspirin attaches permanently to a chemical group on one of the monomers that make up the active site of this enzyme. | 5 |
|  | The enzyme that is involved in the pathway leading to the production of prostaglandins is also involved in the pathway leading to the production of thromboxane. This is a substance that promotes blood clotting. A small daily dose of aspirin may reduce the risk of myocardial infarction (heart attack). | 10 |

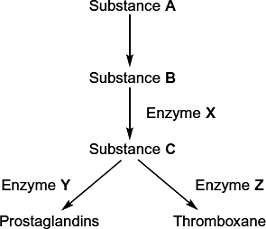
Use information from the passage and your own knowledge to answer the following questions.

(a)     Name the monomers that make up the active site of the enzyme (lines 6 – 7).

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**(1)**

(b)     The diagram shows the pathways by which prostaglandins and thromboxane are formed.



(i)      Aspirin only affects one of the enzymes in this pathway. Use information in lines 5 - 7 to explain why aspirin does **not** affect the other enzymes.

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**(2)**

(ii)     Which enzyme, **X**, **Y** or **Z**, is inhibited by aspirin? Explain the evidence from the passage that supports your answer.

Enzyme ................................................................................................

Explanation ...........................................................................................

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**(2)**

(c)     Aspirin is an enzyme inhibitor. Explain how aspirin prevents substrate molecules being converted to product molecules.

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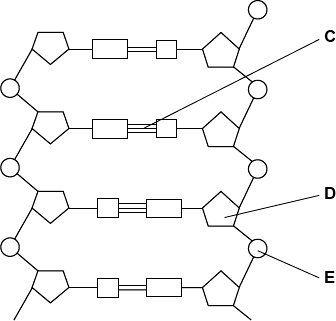
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**(2)**

**(Total 7 marks)**

**Q12.**The diagram shows part of a DNA molecule.



(a)     (i)      DNA is a polymer. What is the evidence from the diagram that DNA is a polymer?

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**(1)**

(ii)     Name the parts of the diagram labelled **C**, **D** and **E**.

|  |  |  |
| --- | --- | --- |
|  | Part **C** | ....................................................................... |
|  | Part **D** | ....................................................................... |
|  | Part **E** | ....................................................................... |

**(3)**

(iii)    In a piece of DNA, 34% of the bases were thymine.

Complete the table to show the names and percentages of the other bases.

|  |  |  |
| --- | --- | --- |
|  | **Name of base** | **Percentage** |
|  | Thymine | 34 |
|  |  |  |
|  |  | 34 |
|  |  |  |

**(2)**

(b)     A polypeptide has 51 amino acids in its primary structure.

(i)      What is the minimum number of DNA bases required to code for the amino acids in this polypeptide?

|  |  |
| --- | --- |
|  |  |

**(1)**

(ii)     The gene for this polypeptide contains more than this number of bases.

Explain why

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**(1)**

**(Total 8 marks)**

**Q13.**         The equation shows the breakdown of lactose by the enzyme lactase.

Lactose + water   galactose + monosaccharide **X**

(a)     (i)      Name the type of reaction catalysed by the enzyme lactase.

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**(1)**

(ii)     Name monosaccharide **X**.

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**(1)**

(b)     (i)      Describe how you would use a biochemical test to show that a reducing sugar is present.

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**(2)**

(ii)     Lactose, galactose and monosaccharide **X** are all reducing sugars.  
After the lactose has been broken down there is a higher concentration of reducing sugar. Explain why.

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**(1)**

(c)A high concentration of galactose slows down the breakdown of lactose by lactase.  
Use your knowledge of competitive inhibition to suggest why.

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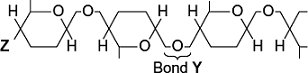
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**(2)**

**(Total 7 marks)**

**Q14.**          The diagram shows one end of a cellulose molecule.



(a)     (i)      Name the monomers that form a cellulose molecule.

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**(1)**

(ii)     Name bond **Y**.

...............................................................................................................

**(1)**

(iii)    What chemical group is at position **Z**?

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**(1)**

(b)     (i)      Complete the table to show **two** ways in which the structure of cellulose is different from the structure of starch.

|  |  |  |
| --- | --- | --- |
|  | **Starch** | **Cellulose** |
|  |  |  |
|  |  |  |

**(2)**

(ii)     Explain **one** way in which the structure of cellulose is linked to its function.

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**(2)**

**(Total 7 marks)**

**Q15.**(a)     Messenger RNA (mRNA) is used during translation to form polypeptides.  
Describe how mRNA is produced in the nucleus of a cell.

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**(6)**

(b)     Describe the structure of proteins.

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**(5)**

(c)     Describe how proteins are digested in the human gut.

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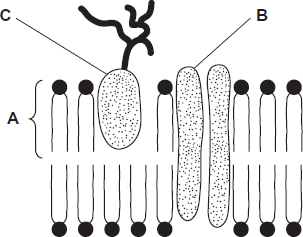
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**(4)**

**(Total 15 marks)**

**Q16.**The diagram shows the structure of the cell-surface membrane of a cell.



(a)     Name **A** and **B.**

**A**.....................................................................................................................

**B**.....................................................................................................................

**(2)**

(b)     (i)      **C** is a protein with a carbohydrate attached to it. This carbohydrate is formed by joining monosaccharides together. Name the type of reaction that joins monosaccharides together.

Name the type of reaction that joins monosaccharides together.

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**(1)**

(ii)     Some cells lining the bronchi of the lungs secrete large amounts of mucus. Mucus contains protein.

Name **one** organelle that you would expect to find in large numbers in a mucus-secreting cell and describe its role in the production of mucus.

Organelle...............................................................................................

Description of role..................................................................................

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**(2)**

**(Total 5 marks)**

**Q17.**(a)    Name the monosaccharides of which the following disaccharides are composed.

(i)      Sucrose

monosaccharides.....................................and.......................................

**(1)**

(ii)     Lactose

monosaccharides.....................................and.......................................

**(1)**

(b)     Amylase and maltase are involved in the digestion of starch in the small intestine.

Complete the table by identifying where these enzymes are produced and the product of the reaction they catalyse.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Name of enzyme** | **Where the enzyme is produced** | **Product of the reaction catalysed by the enzyme** |
|  | Amylase |  |  |
|  | Maltase |  |  |

**(2)**

**(Total 4 marks)**

**Q18.**A student investigated the effect of chewing on the digestion of starch in cooked wheat.

He devised a laboratory model of starch digestion in the human gut. This is the method he used.

1.      Volunteers chewed cooked wheat for a set time. The wheat had been cooked in boiling water.

2.      This chewed wheat was mixed with water, hydrochloric acid and a protein-digesting enzyme and left at 37 °C for 30 minutes.

3.      A buffer was then added to bring the pH to 6.0 and pancreatic amylase was added. This mixture was then left at 37 °C for 120 minutes.

4.      Samples of the mixture were removed at 0, 10, 20, 40, 60 and 120 minutes, and the concentration of reducing sugar in each sample was measured.

5.      Control experiments were carried out using cooked wheat that had been chopped up in a blender, not chewed.

(a)     What reducing sugar, or sugars, would you expect to be produced during chewing?  
Give a reason for your answer.

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**(2)**

(b)     In this model of digestion in the human gut, what other enzyme is required for the complete digestion of starch?

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**(1)**

(c)     What was the purpose of step 2, in which samples were mixed with water, hydrochloric acid and pepsin?

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**(1)**

(d)     In the control experiments, cooked wheat was chopped up to copy the effect of chewing.

Suggest a more appropriate control experiment. Explain your suggestion.

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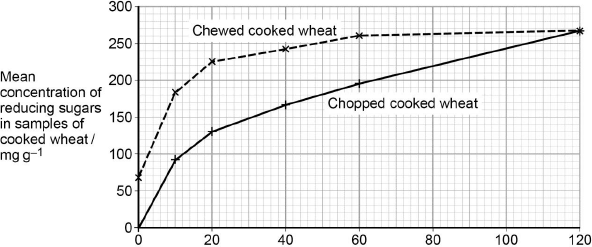
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**(2)**

(e)     The figure below shows the student’s results.

  
                               Incubation time / minutes

Explain what these results suggest about the effect of chewing on the digestion of starch in wheat.

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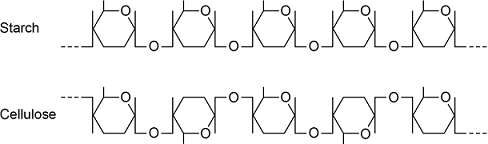
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**(3)**

**(Total 9 marks)**

**Q19.**Starch and cellulose are two important plant polysaccharides.

The following diagram shows part of a starch molecule and part of a cellulose molecule.



(a)     Explain the difference in the structure of the starch molecule and the cellulose molecule shown in the diagram above.

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**(2)**

(b)     Starch molecules and cellulose molecules have different functions in plant cells. Each molecule is adapted for its function.

Explain **one** way in which starch molecules are adapted for their function in plant cells.

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........................................................................................................................

........................................................................................................................

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**(2)**

(c)     Explain how cellulose molecules are adapted for their function in plant cells.

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**(Extra space)** ................................................................................................

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........................................................................................................................

**(3)**

**(Total 7 marks)**

**M1.**(a)     1.      Dissolve in alcohol, then add water;

2.      White emulsion shows presence of lipid.

**2**

(b)     Glycerol.

**1**

(c)     Ester.

**1**

(d)     **Y** (no mark)

Contains double bond between (adjacent) carbon atoms in hydrocarbon chain.

**1**

(e)     1.      Divide mass of each lipid by total mass of all lipids (in that type of cell);

2.      Multiply answer by 100.

**2**

(f)     Red blood cells free in blood / not supported by other cells so cholesterol helps to maintain shape;

*Allow converse for cell from ileum – cell supported by others in endothelium so cholesterol has less effect on maintaining shape.*

**1**

(g)     1.      Cell unable to change shape;

2.      (Because) cell has a cell wall;

3.      (Wall is) rigid / made of peptidoglycan / murein.

**2 max**

**[10]**

**M2.**          (a)     1.      Hydrolysis breaks proteins / hydrolyses proteins / produces amino acids (from proteins);

2.      Protein synthesis involves condensation;

**2**

(b)     Amino acids (from calliphorin) can be joined in different sequences /   
rearranged;

**1**

(c)     1.      Fall, rise and fall;

2.      Rise after 40 and fall after 80;

*Ignore concentration values.*

**2**

(d)     (i)      Fall / increase then fall;

Lysosomes associated with tissue breakdown;

**2**

(ii)     1.      Tissues / cells are being broken down;

2.      RNA is digested / hydrolysed / broken down;

3.      By enzymes from lysosomes;

4.      New proteins not made / no new RNA made;

**2 max**

(e)     1.      (RNA) associated with making protein;

2.      New / adult tissues are forming;

**2**

(f)      1.      In the first 6 days no / little oxygen supplied / with breakdown of tracheae, no / little oxygen supplied;

2.      (Without tracheae) respire anaerobically;

3.      Anaerobic respiration involves reactions catalysed by enzyme **B**  / conversion of pyruvate to lactate / involves lactate production;

4.      Enzyme **A** / Krebs cycle is part of aerobic respiration;

*Or, with emphasis on aerobic respiration:*

*1. Tracheae supply oxygen / after 6 days oxygen supplied;*

*2. (With tracheae) tissues can respire aerobically.*

**4**

**[15]**

**M3.**          (a)     (i)      both are polymers / polysaccharides / built up from many sugar units / both contain glycosidic bonds / contain (C)arbon, (H)ydrogen and (O)xygen;

**1**

(ii)     hemicellulose shorter / smaller than cellulose / fewer carbons;  
hemicellulose from pentose / five-carbon sugars and cellulose from  
hexose / glucose / six-carbon sugars;

*(only credit answers which compare like with like.)*

**2**

(b)     protein / nucleic acid / enzyme / RNA / DNA / starch / amylose / amylopectin polypeptide;

**1**

(c)     (i)      to make sure that all the water has been lost;

**1**

(ii)     only water given off below 90 °C;  
(above 90°C) other substances straw burnt / oxidised / broken down; and lost as gas / produce loss in mass;

**2**

(d)     enzymes are specific;  
shape of lignin molecules will not fit active site (of enzyme);  
*OR*shape of active site (of enzyme);  
will not fit molecule;

**2 max**

(e)     1. made from β-glucose;  
2. joined by condensation / removing molecule of water / glycosidic bond;  
3. 1 : 4 link specified or described;  
4. “flipping over” of alternate molecules;  
5. hydrogen bonds linking chains / long straight chains;  
6. cellulose makes cell walls strong / cellulose fibres are strong;  
7. can resist turgor pressure / osmotic pressure / pulling forces;  
8. bond difficult to break;  
9. resists digestion / action of microorganisms / enzymes;

*(allow maximum of 4 marks for structural features)*

**6 max**

**[15]**

**M4.**          (a)     (i)      condensation;

**1**

(b)     (i)      **D**;

**1**

(ii)     **C**;

**1**

(iii)     **A**;

**1**

(c)     absence of a double bond;  
in the (hydrocarbon) chain;  
unable to accept more hydrogen / saturated with hydrogen;

**2 max**

**[6]**

**M5.**          (a)     (i)      (Molecule) made up of many identical / similar molecules / monomers / subunits;

*Not necessary to refer to similarity with monomers.*

**1**

(ii)     Cellulose / glycogen / nucleic acid / DNA / RNA;

**1**

(b)     (i)      To keep pH constant;  
A change in pH will slow the rate of the reaction / denature  
the amylase / optimum for reaction;

**2**

(ii)     Purple / lilac / mauve / violet;  
*Do not allow blue or pink.*

**1**

(iii)     Protein present / the enzyme / amylase is a protein;  
Not used up in the reaction / still present at the end of  
the reaction;

**2**

**[7]**

**M6.**(a)     (i)      (Lactose +) Water; → (Glucose +) Galactose;

*Accept: H2O for water*

**2**

(ii)     Hydrolysis;

*Accept: if phonetically correct*

**1**

(b)     (i)      (Add Biuret reagent to both solutions) – no mark;

*Neutral: positive / negative result*

         Lactase / enzyme will give purple / lilac / mauve;

*Neutral: incorrect reference to the method*

**OR**

Lactose / reducing sugar will not give purple / lilac / mauve / will remain blue;

**1**

(ii)     Lactase / enzyme is a protein;

*Accept: lactase / enzyme contains peptide bonds*

**1**

**[5]**

**M7.**          (a)     Helical / spiral / coiled;  
Compact / description e.g. ‘tightly packed’;

*Feature = one mark  
Explanation = one mark*

Insoluble;  
Prevents osmosis / uptake of water / does not affect water  
potential / (starch) does not leave cell;

*These must be related for both marks but can be in reverse order.*

Large molecule / long chain;  
Does not leave cell;

*Allow idea of compact / helical / spiral / coiled due to bonding for two marks.*

**2 max**

(b)     (i)      β / beta Glucose;

***Q*** *Reject alpha glucose*

**1**

(ii)     Glycosidic;

**1**

(c)     Long / straight / unbranched chains (of glucose joined by) hydrogen bonds;

***Q*** *Ignore reference to alpha glucose*

Form (micro)fibrils / (macro)fibrils;

Provide rigidity / strength / support;

*Allow suitable descriptions for last point e.g. ‘prevents bursting’;*

**3**

**[7]**

**M8.**          (a)     (i)      Glucose;

Fructose;

*Any order.*

**2**

(ii)     Lactose has a different shape / structure;

Does not fit / bind to active site of enzyme / sucrase;

*Only allow a second mark if reference is made to the active site.  
Max 1 mark if active site is described as being on the substrate.*

**OR**

Active site of enzyme / sucrase has a specific shape / structure; Does not fit / bind to lactose;

*Do not accept same shape.*

**2**

(b)     (i)      Rose and fell;

Peak at 45 (minutes) / concentration of 6.6 (mmol dm–3);

**2**

(ii)     Glucose (produced by digestion) is absorbed / enters blood;

Decrease as used up / stored;

**2**

**[8]**

**M9.**          (a)     Double bond(s);

(Bonds) between carbon;

*C=C bond(s) = 2 marks*

*‘No’ C=C bond(s) disqualifies 1 mark only*

*Accept: does not contain maximum number of H for 1 mark*

*Neutral: contains C=O bonds*

**2**

(b)     Graph shows negative correlation / description given;

Correlation does not mean causation / prevention / shows lower risk not prevention;

May be due to another factor / example given;

*Neutral: refs. to methodology e.g. sample size / line of best fit*

***Q****: Do not allow ‘casual’ relationship*

**3**

(c)     (i)      Glycosidic;

*Accept: if phonetically correct*

*Reject: ester bond*

**1**

(ii)     Contains glycerol / three fatty acids / forms three ester bonds;

*Neutral: contains less fatty acids*

*Answers must refer to a triglyceride*

*Ignore refs. to incorrect bond names*

*Neutral: olestra has eight fatty acids / R groups*

*Reject: contains three glycerols*

**1**

(iii)    9;

**1**

**[8]**

**M10.**(a)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Statement | Starch | Cellulose | Glycogen |
|  | Found in  plant cells |  |  |  |
|  | Contains glycosidic bonds |  |  |  |
|  | Contains β-glucose |  |  |  |

*One mark for each correct row*

**3**

(b)     Hydrolysis;

*Accept: if phonetically correct*

*Do not accept: ‘hydration’*

**1**

(c)     1.      Coiled / helical / spiral;

*Feature = one mark*

*Explanation = one mark*

*Note: these are independent marking points*

*These must be related for both marks but can be in reverse order*

2.      (So) compact / tightly packed / can fit (lots) into a small space;

3.      Insoluble;

4.      (So) no osmotic effect / does not leave cell / does not affect water potential;

*Accept: prevents osmosis*

5.      Large molecule / long chain;

6.      (So) does not leave cell / contains large number of glucose units;

*4. and 6. Accept: can’ t cross membranes*

7.     Branched chains;

8.     (So) easy to remove glucose;

**2 max**

(d)     Two marks for correct answer of 479 - 521;

*Accept: measured and actual lengths in different but correct units for 1 mark*

One mark for incorrect answers in which candidate clearly divides measured length by actual length;

*The actual range is 23 - 25mm, If they just divide this by 48 they gain 1 mark*

*Just writing the formula is insufficient, numbers must be used*

**2**

**[8]**

**M11.**(a)     Amino acid / amino acids ;

*If anything else is given as well do not award mark.*

**1**

(b)     (i)      1.      Affects one monomer / amino acid;

*i.e. What is affected*

2.      Not found in all active sites;

*i.e. Where it is found.*

*2. Must relate to active site. Enzyme is insufficient.*

**2**

(ii)     1.      **X**;

2.      Enzyme in both pathways;

*2. Award independently*

**2**

(c)     1.      Occupies / blocks / binds to active site;

*i.e. What it does in terms of the active site.*

2.      Substrate will not fit / does not bind / no longer complementary to / enzyme-substrate complex not formed;

*1. Ignore references to change in shape and shape of aspirin molecule.*

*Ignore reference to competitive inhibitor i.e. Consequence required*

**2**

**[7]**

**M12.**(a)     (i)     Repeating units / nucleotides / monomer / molecules;

*Allow more than one, but reject two*

**1**

(ii)     1.      C = hydrogen bonds;

2.      D = deoxyribose;

*Ignore sugar*

3.      E = phosphate;

*Ignore phosphorus, Ignore molecule*

**3**

(iii)

|  |  |  |
| --- | --- | --- |
|  | **Name of base** | **Percentage** |
|  | Thymine | 34 |
|  | Cytosine / Guanine | 16 |
|  | Adenine | 34 |
|  | Cytosine / Guanine | 16 |

*Spelling must be correct to gain MP1*

*First mark = names correct*

*Second mark = % correct, with adenine as 34%*

**2**

(b)     (i)     153;

**1**

(ii)     Some regions of the gene are non-coding / introns / start / stop code / triplet / there are two DNA strands;

*Allow addition mutation*

*Ignore unqualified reference to mutation*

*Accept reference to introns and exons if given together*

*Ignore ‘junk’ DNA / multiple repeats*

**1**

**[8]**

**M13.**          (a)     (i)      Hydrolysis;

*Accept phonetic spelling.*

*Ignore reaction.*

**1**

(ii)     (Alpha) glucose;

*Accept α glucose.*

*Reject β glucose / beta glucose*

**1**

(b)     (i)      Add Benedict’s (reagent) and heat / warm;

Red / orange / yellow / green (colour);

*Reject Add HCl*

*Accept brown, reject other colours*

**2**

(ii)     2 products / 2 sugars produced;

*Look for idea of* ***two***

*Accept named monosaccharides produced.*

*“More” insufficient for mark*

*Neutral if incorrect products named*

*Neutral “lactose is a polysaccharide”*

*Neutral “lactose is not a reducing sugar”*

*Neutral: Reference to surface area.*

**1**

(c)     1.      Galactose is a similar shape / structure to lactose / both complementary;

*Q Reject: Same shape / structure*

2.      (Inhibitor / Galactose) fits into / enters / binds with active site (of enzyme);

*Accept blocks active site*

3.      Prevents / less substrate fitting into / binding with (active site) / fewer or no E-S complexes;

*Look for principles:*

*1. Shape*

*2. Binding to active site*

*3. Consequence*

**2 max**

**[7]**

**M14.**         (a)     (i)     β / Beta glucose;

*Accept b / B*

*Reject any reference to alpha /* ***α***

**1**

(ii)     Glycosidic;

*Reject references to* ***α****(1-4) glycosidic bond, but allow beta 1-4, or unspecified reference to 1-4 (1,4)*

**1**

(iii)    OH / hydroxyl / HO;

*Reject hydroxide*

*Reject OH / HO molecule*

*Ignore alcohol*

**1**

|  |  |  |
| --- | --- | --- |
| (b)     (i) | **Starch** | **Cellulose** |
|  | 1. (1,4 and) 1,6     bonds / contains 1,6     bonds / branching | 1. 1,4 bonds / no 1,6     bonds /      unbranched /      straight; |
|  | 2. All glucoses /      monomers same     way up | 2. Alternate     glucoses /     monomers     upside down; |
|  | 3. Helix /     coiled / compact | 3. Straight; |
|  | 4. Alpha glucose | 4. Beta glucose; |
|  | 5. No (micro / macro)     fibrils / fibres | 5. Micro / macro     fibrils / fibres; |

*1 mark per pair of contrasts, both starch and cellulose required*

*Accept other comparable differences eg hydrogen bonds* ***within*** *starch but* ***between*** *cellulose molecules*

**2 max**

(ii)     1.      H-bonds / micro / macro fibrils / fibres;

*Reject strong hydrogen bonds*

2.      Strength / rigidity / inelasticity;

*‘Strong hydrogen bonds’ = 0 but ‘Strong hydrogen bonds give strength (to the molecule)’ = 1*

**2**

**[7]**

**M15.**(a)      1.      Helicase;

2.      Breaks hydrogen bonds;

3.      Only one DNA strand acts as template;

4.      RNA nucleotides attracted to exposed bases;

5.      (Attraction) according to base pairing rule;

6.      RNA polymerase joins (RNA) nucleotides together;

7.      Pre-mRNA spliced to remove introns.

**6 max**

(b)     1.      Polymer of amino acids;

2.      Joined by peptide bonds;

3.      Formed by condensation;

4.      Primary structure is order of amino acids;

5.      Secondary structure is folding of polypeptide chain due to hydrogen bonding;

*Accept alpha helix / pleated sheet*

6.      Tertiary structure is 3-D folding due to hydrogen bonding and ionic / disulfide bonds;

7.      Quaternary structure is two or more polypeptide chains.

**5 max**

(c)     1.      Hydrolysis of peptide bonds;

2.      Endopeptidases break polypeptides into smaller peptide chains;

3.      Exopeptidases remove terminal amino acids;

4.      Dipeptidases hydrolyse / break down dipeptides into amino acids.

**4**

**[15]**

**M16.**(a)     1.       **A**: phospholipid (layer);

*1. Reject hydrophobic / hydrophilic phospholipid*

2.      **B**: pore / channel / pump / carrier / transmembrane / intrinsic / transport protein;

*2. Ignore unqualified reference to protein*

**2**

(b)     (i)      Condensation (reaction);

**1**

(ii)     Organelle named; Function in protein production / secretion;

*Function must be for organelle named*

*Incorrect organelle = 0*

eg

1.      Golgi (apparatus);

*1. Accept smooth endoplasmic reticulum*

2.      Package / process proteins;

***OR***

3.      Rough endoplasmic reticulum / ribosomes;

*3. Accept alternative correct functions of rough endoplasmic reticulum. ER / RER is insufficient*

*3. Accept folding polypeptide / protein*

4.      Make polypeptide / protein / forming peptide bonds;

***OR***

5.      Mitochondria;

6.      Release of energy / make ATP;

*6. Reject produce / make energy*

*6. Accept produce energy in the form of ATP*

***OR***

7.      Vesicles;

8.      Secretion / transport of protein;

**2**

**[5]**

**M17.**(a)     (i)      Glucose and fructose;

*Ignore reference to alpha and beta*

*Either way around*

**1**

(ii)     Glucose and galactose;

*Ignore reference to alpha and beta*

*Either way around*

**1**

(b)     1.      (Amylase) pancreas, produces maltose;

*Place and product = 1 mark*

*(mark horizontally)*

2.      (Maltase) in / on epithelium (of small intestine), produces glucose;

*Ignore references to salivary glands or saliva*

*Accept wall / lining of small intestine*

*Ignore reference to cells alone*

*Ignore reference to ribosomes / rER*

**2**

**[4]**

**M18.**(a)     1.      Maltose;

2.      Salivary amylase breaks down starch.

**2**

(b)     Maltase.

**1**

(c)     (Mimics / reproduces) effect of stomach.

**1**

(d)     1.      Add boiled saliva;

2.      Everything same as experiment but salivary amylase denatured.

**2**

(e)     1.      Some starch already digested when chewing / in mouth;

2.      Faster digestion of chewed starch;

3.      Same amount of digestion without chewing at end.

*Accept use of values from graph*

**3**

**[9]**

**M19.**(a)     1.      Starch formed from α-glucose but cellulose formed from β-glucose;

2.      Position of hydrogen and hydroxyl groups on carbon atom 1 inverted.

**2**

(b)     1.      Insoluble;

2.      Don’t affect water potential;

***OR***

3.      Helical;

*Accept form spirals*

4.      Compact;

***OR***

5.      Large molecule;

6.      Cannot leave cell.

**2**

(c)     1.      Long and straight chains;

2.      Become linked together by many hydrogen bonds to form fibrils;

3.      Provide strength (to cell wall).

**3**

**[7]**

**E2.**          This question was intended to be synoptic and as such required a basic understanding of principles established in other units. There were some outstanding answers but it was also disappointing to note that there were many candidates who clearly had little idea of the functions of cell organelles or of the role of ribosomes and RNA in protein synthesis.

(a)     There were, perhaps inevitably, candidates who confused condensation and hydrolysis but most were able used the terms appropriately in the context of protein digestion and synthesis.

(b)     Those who understood protein structure usually gained credit, but almost two-thirds of all candidates made no progress here. While the most frequent problems stemmed from confusing amino acids with bases, others appeared uncertain that proteins could be digested.

(c)     Most, but by no means all, candidates identified the overall trend of decrease, increase, decrease but rather fewer supported this with data from the table relating to the age of the pupa. Where the age was quoted, it was not uncommon to see it given in days or years. A little common sense might have excluded the latter.

(d)     Answers to part (i) might have been better had more candidates distinguished between the roles of lysosomes and ribosomes. There were many responses associating an increase in lysosomes with increased protein synthesis towards the end of the time spent as a pupa.

Others linked lysosomes with disease and answered in terms of increased exposure to bacterial infection. A major misconception in the answers to part (ii) was that protein synthesis would decrease RNA concentration as it was “used up” in the process.

(e)     Although some of the candidates answering this part of the question were unable to identify the trend in the table, most recognised that tissue formation involved protein synthesis and hence the increase in RNA.

(f)      This question discriminated very effectively over the range of available marks but, at all levels of ability, candidates appeared to find difficulty with spelling the words aerobic and anaerobic. Examiners try to avoid being unnecessarily pedantic over the spelling of technical terms but the onus is on candidates to make their intentions clear, particularly when the words concerned are closely similar. A considerable number of candidates failed to equate tracheae with insect gas exchange and wrote of breathing and the lungs.

**E3.**          (a)     (i)      Answers to parts of this question were not infrequently marred by lack of knowledge of the basic structure of cellulose as a polymer of β-glucose. Thus, although all that was required here was to note that both molecules were polymers, many disqualified their answers by referring to cellulose as also being a pentose.

(ii)     Limited question technique frequently restricted the credit available. Many candidates concentrated on functional rather than structural differences. As a consequence, the answer boxes were often so full that they rarely compared like with like and offered a valid comparison. Among the better, more focused, answers were some which unfortunately were a little too concise, referring to hemicellulose as a pentose and cellulose as a hexose. Questions requiring structural similarities are likely to remain a feature of BYA1. Candidates clearly need an effective strategy for answering them.

(b)     Starch and protein were correctly identified by many, but a range of incorrect responses included glycogen, phospholipid and various monosaccharides.

(c)     (i)      Answers suggested that, although candidates were clearly familiar with the term “constant mass”, they were by no means all conversant with the idea that it represented the point at which all water had been lost.

(ii)     There were many correct answers. Answers to this second part, such as “Going over 90 °C would start to boil the water so that we would be unable to calculate the water content” were frequent and suggested that candidates had failed to focus on the information provided in the second paragraph of the passage. The better candidates at whom this question was directed were generally able to point out, however, that high temperatures might lead to other substances being broken down and a consequent loss in mass.

(d)     Although most candidates were aware of the specific nature of enzyme action, they experienced varying degrees of difficulty in relating the general concepts involved to the context of this question. Those candidates who gained least credit were inclined to reword the question and offer an explanation in terms of the lignin covering. Others offered responses centred around lignin acting as an enzyme inhibitor. Better candidates clearly understood the concepts of molecular shape and fit and were able to apply them to this situation.

(e)     Answers to this part of the question ranged from those of the more able candidates who wrote clearly and logically about cellulose structure and function, often with a pleasing level of accuracy and detail, to those which did not gain credit. Among the latter were many who failed to attempt this part of the question and others who confused cellulose with other molecular components of plant cells such as starch and plasma membranes. There was much confusion between hydrogen bonds and glycosidic bonds, and between α-glucose and β-pleated sheets.

Other incorrect assertions which frequently arose were that cellulose is formed from alternating α- and β-glucose residues, and that it contains both 1-4 and 1-6 linkages. Many candidates correctly identified strength as one of the molecule’s properties and went further in discussing the importance of this in withstanding pressures resulting from osmosis. A frequent error, however, was to assign the function of energy storage to cellulose.

**E4.**          (a)     The vast majority of candidates gained the mark, with only a few confusing hydrolysis with condensation.

(b)     Most candidates scored full marks, the most common error occurring in (ii) where the substrate of amylase was identified as protein.

(c)     The difference between the types of fatty acids was well understood in terms of double bonds but very few candidates then went on to mention the location of the bonds or describe saturation with reference to hydrogen. Weaker candidates identified the bonds involved as hydrogen and therefore failed to obtain any marks.

**E5.**          (a)     Imprecise expression frequently limited the marks awarded for part (i). Care clearly needed to be taken to avoid suggesting too few components, with answers such as that a polymer consisted of ‘two or more’ monomers. Those who did not make use of the term ‘monomer’ needed to indicate, in some way, the similarity of the constituents. They did not always do this. The most frequent reason for failing to gain credit for part (ii) was where candidates gave substances, such as haemoglobin and amylopectin, which were excluded by the wording of the question. Nevertheless, many candidates gave correct answers.

(b)     In part (i), most candidates recognised the importance of buffers in maintaining pH, although some associated them with temperature. Better candidates could generally develop the idea and usually gained a second mark through reference to denaturation. Unfortunately, some saw parts (ii) and (iii) as a trick and pointed out that since starch was not a protein, it would give a negative result. Others made the same error by simply failing to focus on the right component of the mixture. Perhaps more disturbing is the continued failure of so many candidates at this level to learn the relevant information relating to basic biochemical tests. There was again much confusion over test and result, apparent both here and in the answers to Question **4** (b).

**E6.**(a)     (i)      It was disappointing that only one third of candidates scored full marks on this question, given that it was targeted at grade E and involved straightforward recall. However, most candidates gained at least one mark for correctly naming water as the reactant or galactose as the product. A common incorrect response for the missing reactant was ‘lactase’, despite this being given in the stem of the question. There was a wide variety of suggestions for the missing product. These included water, fructose, maltose and sucrose.

(ii)     Over 70% of candidates correctly named the reaction as hydrolysis. The most common incorrect responses seen were ‘digestion’ and ‘condensation’.

(b)     There was widespread failure to read the stem of each question part, which resulted in only a minority of candidates gaining full credit. It was also clear that many candidates had failed to distinguish between the terms ‘describe’ and ‘explain’ for part (i) and (ii) respectively.

(i)      There were numerous references to the Benedict’s test for reducing sugars and, to a lesser extent, iodine solution and universal indicator. It was also clear from the colour changes given that many candidates were not familiar with basic food tests. Candidates who did refer to the biuret test often limited their answer to describing the method and naming the reagents involved. For those who did mention a purple colour, it was not often clear if they were referring to lactose or lactase.

(ii)     Many candidates gave the answer to (b)(i) here but failed to explain why this result would be achieved.

**E7.**          (a)     Most candidates obtained at least one mark, often for indicating that starch is insoluble or has a coiled structure. Approximately a third of candidates obtained a second mark for explaining how a particular feature of starch enables it to act as a storage substance. However, a significant minority of candidates scored zero, often by failing to provide sufficient details or by describing the structure of a protein.

(b)     (i)      Just over half the candidates correctly named part A as beta glucose. Glucose on its own as an answer was not credited. Common incorrect responses included alpha glucose, deoxyribose and amino acid.

(ii)     Most candidates correctly named bond B as glycosidic. A common incorrect response was hydrogen.

(c)     Very few candidates failed to gain at least one mark on this question. Almost a third of candidates gained all three marks. Most candidates mentioned that the cell wall provides strength and support with many also referring to the presence of hydrogen bonds. Better candidates included reference to the long, straight chains of glucose and described how microfibrils or macrofibrils are formed.

**E8.**          (a)     Most candidates were able to identify glucose as one of the monomers from which a molecule of sucrose was formed, but there was less certainty about the other. Part (ii) was designed to be accessible to grade E candidates and, in view of this, it was disappointing to see so few gaining full credit. There were a number of predictable errors such as in describing the active site as being on the substrate, and in maintaining that active site and substrate were the same shape. Credit was generally lost however because of a lack of precision in the answers. There were many general references to specificity that were simply worded in terms of sucrose and lactose not being ‘specific to each other’ or enzymes being specific to a particular substrate. Good answers amplified the concepts of shape and fit with appropriate reference to complementarity and the active site of the enzyme.

(b)     It is encouraging to note that most candidates were able to describe the data in the graph with appropriate precision and gained full credit for their answers to part (i). There were, however, candidates who failed to distinguish between the terms ‘describe’ and ‘explain’ and offered inappropriate responses both here and in part (ii). In part (ii), better candidates generally identified the role of absorption in raising the glucose concentration and respiration or storage resulting in the fall after 45 minutes. Difficulties arose where candidates referred imprecisely to sugar, and there were many answers where the examiners were left unclear as to whether glucose or sucrose was being discussed. It was also apparent that many candidates considered the graph to be showing some aspect of enzyme activity and responded in terms of the effect of a particular parameter on substrate or product concentration.

**E9.**          (a)     42% of candidates were aware that an unsaturated fatty acid contains carbon-carbon double bonds and gained full credit. However, most candidates gained one mark for the idea of double bonds. Weaker candidates often wrote about the health benefits of unsaturated fatty acids.

(b)     Nearly 60% of candidates gained at least two marks. This was typically for appreciating that the graph shows a reduced risk, not prevention, of coronary heart disease or that other factors may also reduce the risk. Many candidates also described the negative correlation. However, weaker candidates sometimes left this as ‘there is a correlation’.

(c)     (i)      Just over 60% of candidates correctly identified X as a glycosidic bond. Common incorrect responses seen were ‘peptide, ‘ester’, ‘ionic’, ‘covalent’ and ‘hydrogen’.

(ii)      Just over half of the candidates gained the mark for stating that a triglyceride contains glycerol or three fatty acids. However, some candidates clearly confused a triglyceride with a phospholipid and made reference to a phosphate group or two fatty acids. Weaker candidates were often let down by poor expression or a lack of detail. These candidates often referred to a triglyceride containing three glycerol molecules and some confused glycerol with glycogen.

(iii)     Only 20% of candidates gave the correct response 9.

**E10.**Given that this question was targeted at grade **E**, it is surprising that all parts proved to be good discriminators.

(a)     Nearly half of students gained full marks. Students who did not showed a vast range of incorrect answers.

(b)     Most students correctly named the type of reaction as ‘hydrolysis’. The most common incorrect response was ‘condensation’.

(c)     Just over 60% of students gained full marks. This was usually for relating the insolubility of starch to no osmotic effect, or the coiled shape of starch to being compact. However, some students were prevented from scoring full marks due to giving a definition of ‘compact’. The response ‘compact so can fit a lot into a small space’ was frequently seen.

(d)     Nearly half of students scored full marks. A common error seen in weaker responses was to divide the actual length by the measured length. Similarly, the ability to convert between millimetres and micrometres proved to be a good discriminator.

**E11.**There was much evidence from the answers to different parts of this question of the difficulties that many students experience with comprehension questions. It appeared that many of those of more limited ability took very little note of the information in the passage or of instructions embedded within the questions. They identified this question as relating to enzyme inhibition and sought refuge in set responses, many of which were largely irrelevant. Further evidence of the difficulties that the question presented was provided by the number of answers that were crossed through and rewritten on extra sheets.

(a)     Most students correctly identified the monomers concerned as amino acids.

(b)     Students, who read the question carefully and noted the information to which the lines referred, should have been able to point out in their answers to part (i) that aspirin would bind to one of the amino acids making up the active site and that different enzymes would have different amino acid sequences. Responses along these lines were made by disappointingly few students. Better students produced economical answers to part (ii) in which they correctly identified enzyme **X** and explained that it was involved in the production of both prostaglandins and thromboxane. Others wrote at great length with tortuous logic and often included detailed quotes from the passage of marginal relevance.

(c)     Many students appeared to be of the opinion that aspirin was a non-competitive inhibitor and described it binding at some site on the enzyme other than the active site. Most of these students, however, were able to gain some credit for correctly pointing out that the substrate itself could not bind and produce an enzyme-substrate complex.

**E12.**(a)      (i)       Students were aware that polymers were made of many monomers, but in many cases went on to include descriptions in their answers that implied they did not understand what the monomers in this case were. A number of answers suggested that each strand was a monomer or that the monomers were amino acids.

(ii)      Most students knew the names of the parts of the diagram; the most common mistake was giving ‘sugar’ or ‘ribose’ instead of deoxyribose.

(iii)     In order to gain both marks, students had to show that they knew the names of the bases. This proved very revealing in that almost all knew the initial letters of the four bases but only a minority could write down the names correctly. About half were able to complete the simple calculation to give the percentage of the other three bases.

(b)     (i)       Those who failed to gain credit often did so because they were, apparently, of the opinion that one base coded for three amino acids.

(ii)      Introns, non-coding DNA, start and stop codes were all known to be non-coding DNA and, thus, adding to the length of the gene without contributing to the polypeptide. Some students also mentioned addition mutations or the fact that there are two strands. A minority of students incorrectly linked the degeneracy of the genetic code to the difference in number of bases.

**E13.**          (a)     (i)      Most candidates correctly named the type of reaction as hydrolysis.

(ii)     Most candidates correctly named glucose.

(b)     (i)      Most candidates gained full marks for describing the test for reducing sugars accurately. Some did not mention the need for heat, and a few could not recall the correct test – the biuret test being the most common error. A few candidates lost credit because they described the non-reducing sugar test and hydrolysed with hydrochloric acid first.

(ii)     The majority of the candidates could explain the idea that one molecule of lactose was being hydrolysed to give two molecules of product, both of which were reducing sugars. The commonest reason for missing the mark was when students paraphrased the stem of the question, stating that the reason there was a higher concentration of reducing sugar was because there was more reducing sugar present. A surprising number of candidates gave answers relating to an increase in surface area.

(c)     Although many candidates gained full marks on this question there was a significant number who were confused about the position of the active site, placing it on the sugar rather than the enzyme. A number of candidates thought that galactose would bind to lactose rather than lactase.

**E14.**         (a)      (i)      This was generally well known, although a significant number of students did not qualify the beta glucose. Amino acids and bases were given by a few students.

(ii)     Also generally well known, with most students gaining the mark.

(iii)    This was answered less well than the first two parts of this question. Incorrect answers included ‘hydrogen’, ‘hydroxide’ and ‘alkali’ showing students knew what should be there but not the correct term for the group.

(b)     (i)      This question was answered well. The most frequent correct responses were for identifying the glucose isomer and molecular shape. Incorrect responses gave functional comparisons, rather than structural, or failed to compare like with like.

(ii)     Quite a high proportion failed to attempt this question otherwise it was generally answered well, with a variety of explanations that showed good understanding. Incorrect references to ‘strong hydrogen bonds’ resulted in a number of students failing to gain credit.

**E16.**(a)     The majority of students gained both of the marks on this question, although some failed to score because they made unqualified references to protein or lipid. Although some students had learnt the term ‘integral protein’, few qualified this to show they recognised this integral protein spanned the membrane. A few answers referred to guard cells, microvilli and mitochondria, suggesting that the students had not understood the difference between the molecular structure of a membrane and the gross structure of cells or organelles.

(b)     (i)       Most students knew this term although some were clearly guessing between condensation and hydrolysis, having written both down and then crossed out one or other of the terms.

(ii)     The great majority of students gave mark points 3 and 4, with a few failing to score because they used abbreviations such as ER or RER. These abbreviations were not accepted, since students were asked to name the organelle. The full name endoplasmic reticulum is given in the specification, with no abbreviation offered as an alternative. Where Golgi was given as the organelle, the associated function was not often correctly linked to protein formation. For mark point 6 (release of energy / make ATP), references to producing or making energy were not given credit. Incorrect references to cilia, microvilli, stomach acids and lysosomes suggested that some students did not understand what was meant by the term organelle.

**E17.**(a)     It was pleasing to find that the vast majority of students are familiar with the monosaccharides in sucrose and lactose.

(b)     This proved to be one of the most challenging questions on the paper. Only about ten percent of students got both marks and sixty-five percent scored zero. The question clearly asks about digestion of starch in the small intestine. Despite this, many had the salivary glands as the site of production of the amylase active in the intestine (which was ignored by the examiners). Very few had any idea where maltase is produced and answers ranged from the thyroid gland to the pancreas.