

Surname	Centre Number	Candidate Number
Other Names		2



**GCE AS/A Level**

1071/01

**BIOLOGY/HUMAN BIOLOGY – BY1**

A.M. WEDNESDAY, 8 January 2014

1 hour 30 minutes

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	5	
2.	6	
3.	9	
4.	12	
5.	11	
6.	10	
7.	7	
8.	10	
<b>Total</b>	<b>70</b>	

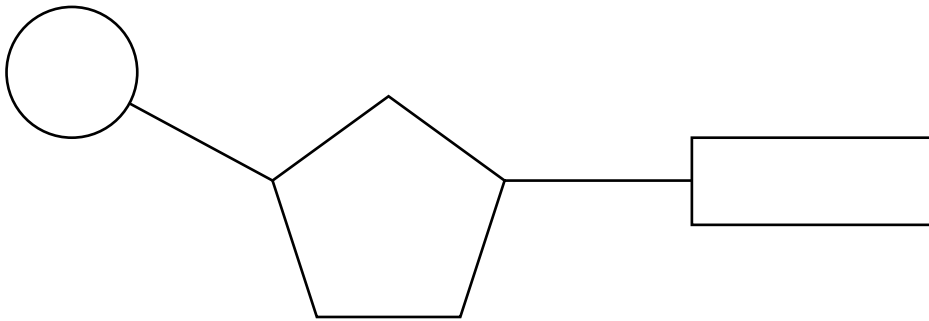
**INSTRUCTIONS TO CANDIDATES**

Use black ink or black ball-point pen. Do not use pencil or gel pen. Do not use correction fluid. Write your name, centre number and candidate number in the spaces at the top of this page. Answer **all** questions. Write your answers in the spaces provided in this booklet.

**INFORMATION FOR CANDIDATES**

The number of marks is given in brackets at the end of each question or part-question. You are reminded of the necessity for good English and orderly presentation in your answers. The quality of written communication will affect the awarding of marks.

1. The diagram below shows a simple nucleotide.



(a) On the diagram above, draw a circle around the component that contains nitrogen. [1]

(b) Describe **two** differences between a DNA nucleotide and an RNA nucleotide. [2]

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An experiment was carried out to determine the relative percentages of the bases in DNA from various organisms. The results are shown in the table below.

Source of DNA	Relative percentage of base in sample			
	Adenine	Guanine	Thymine	Cytosine
human	30.9	19.9	29.4	19.8
sea urchin	32.8	17.7	32.1	17.3
wheat	27.3	22.7	27.1	22.8

- (c) DNA is a double stranded molecule. Explain how the data in the table supports the concept of complementary base pairing. [2]

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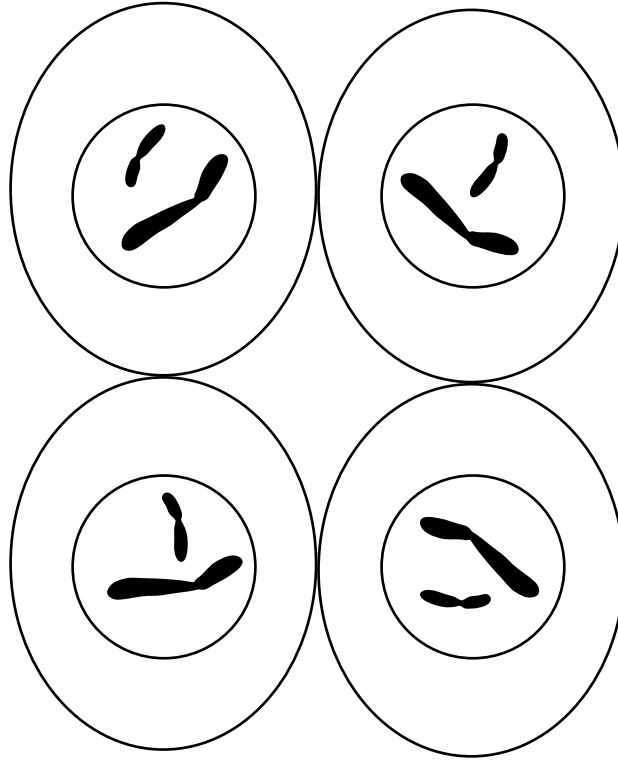
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Cell division also occurs in the ovaries of animals. The diagram below shows the final stage of cell division in the ovary of the same animal.



- (b) (i) Using the diagrams above, describe and explain **one** difference between these cells and those produced in part (a) opposite. [2]

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- (ii) Explain the importance of this type of cell division in the animal. [2]

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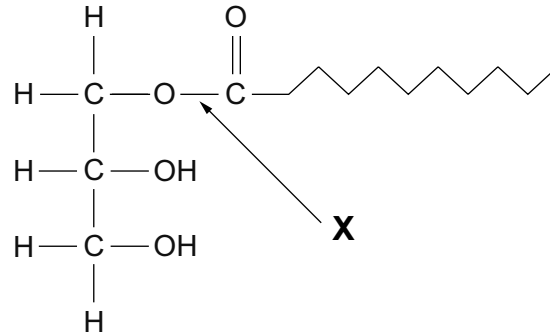
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3. (a) The diagram below shows a monoglyceride.



During the digestion of monoglycerides, the bond labelled **X** is broken down by the enzyme lipase.

- (i) Name the bond labelled **X** in the diagram above. [1]

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- (ii) State the **type** of reaction involved in the breakdown of the monoglyceride. [1]

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- (iii) In the space below **draw** and **name** the products of the breakdown of the monoglyceride. [2]

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(iv) Explain why triglycerides are not considered to be polymers. [1]

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(b) (i) Two fatty acids which are common in triglycerides are stearic acid and oleic acid. Stearic acid has the chemical formula of  $C_{17}H_{35}COOH$  and oleic acid has the chemical formula of  $C_{17}H_{33}COOH$ . What type of fatty acid is oleic acid? Give a reason for your answer. [2]

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(ii) Apart from energy storage, state **two** functions of triglycerides in a mammal. [2]

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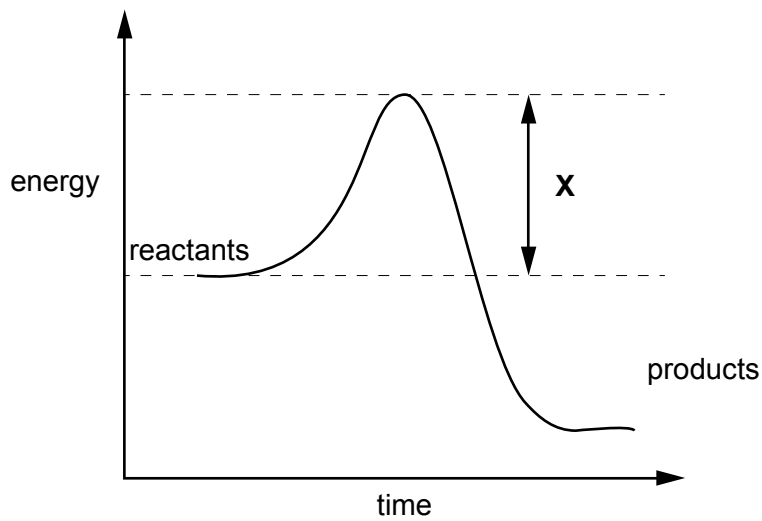
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4. The graph below shows the energy changes that take place during a chemical reaction.

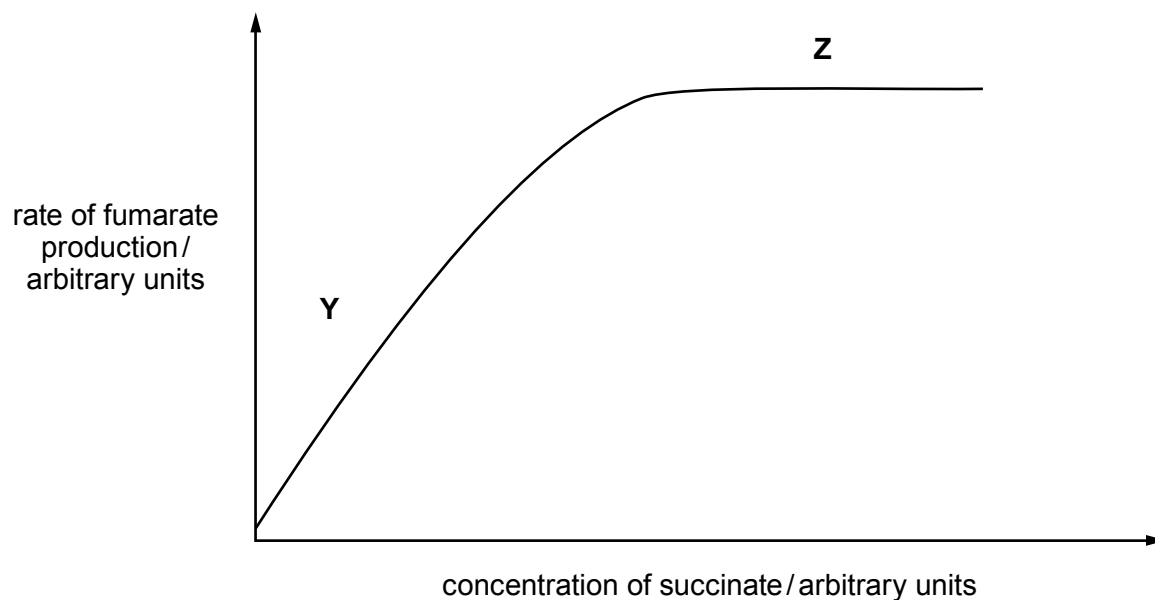


- (a) (i) What is represented by **X** on the graph above? [1]

- (ii) Enzymes are biological catalysts.  
Draw a line on the graph above to show the energy changes that would take place if an enzyme was present during the reaction. [1]

- (b) Succinate dehydrogenase is an enzyme found in mitochondria and is involved in respiration. The enzyme catalyses the conversion of succinate into fumarate. Using your knowledge of enzyme structure, explain why this is the **only** reaction succinate dehydrogenase can catalyse. [2]
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- (c) The graph below shows the rate of fumarate production at varying concentrations of succinate, at optimum temperature and pH with no inhibitors present.

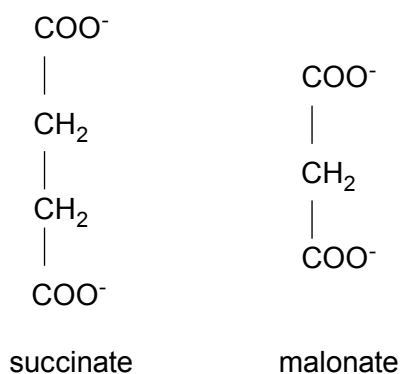


- (i) I State what factor is limiting the rate of reaction in the region marked **Y** on the graph. [1]

- II Use evidence from the graph to support your answer. [1]

- (ii) Explain what is limiting the rate of reaction in the region marked **Z** on the graph. [2]

- (d) Malonate is a competitive inhibitor of succinate dehydrogenase. The diagrams below show the structural formulae of succinate and malonate.



- (i) Using the information in the diagram above and your own knowledge, explain how malonate inhibits succinate dehydrogenase. [3]

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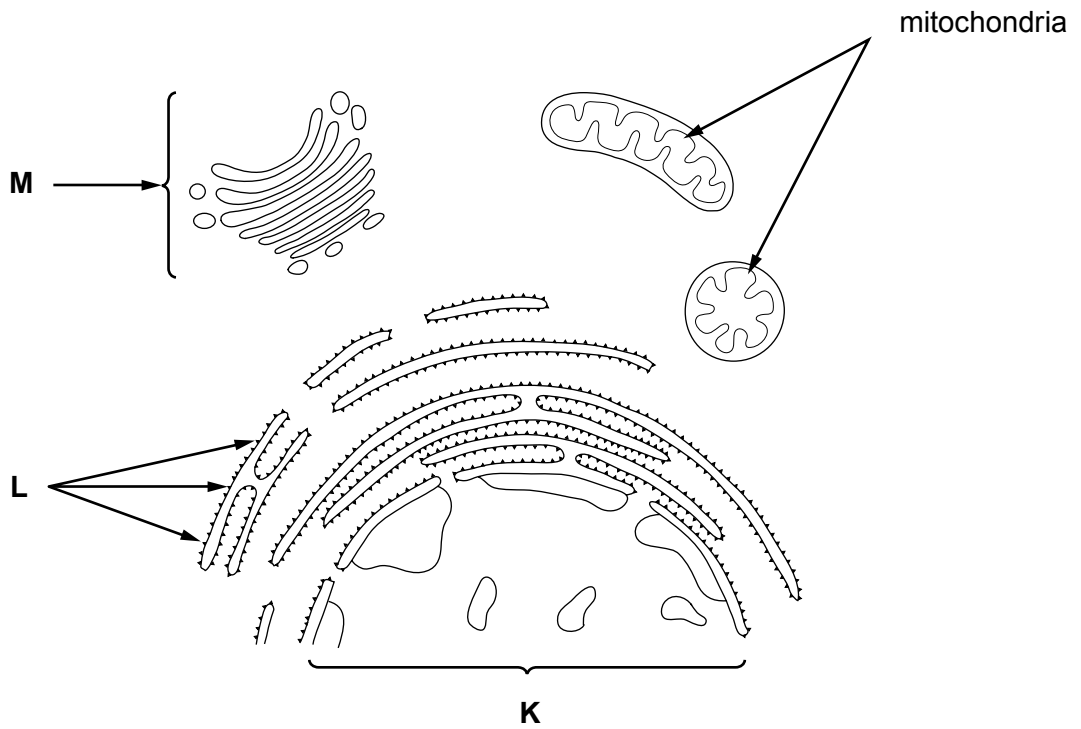
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- (ii) On the graph in part (c) opposite draw a curve to show the rate of reaction when malonate is present. [1]

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5. The diagram below shows part of a generalised animal cell.



(a) Complete the table below.

[6]

Organelle	Name	Function
<b>K</b>		
<b>L</b>		
<b>M</b>		

(b) (i) Explain why the mitochondria labelled in the diagram above appear different from one another. [1]

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- (ii) Nearly all eukaryotic cells possess mitochondria. Mitochondria are similar in size to prokaryotic cells and have features in common with them. This led to the biologist, Lynn Margulis, proposing that mitochondria evolved from ancient prokaryotes. The theory of endosymbiosis proposes that these ancient prokaryotes were engulfed by other bacterial cells and both benefited from the relationship – this led to the evolution of eukaryotic cells.

Using your knowledge, state which **two** structures found in prokaryotic cells are also found in mitochondria. [2]

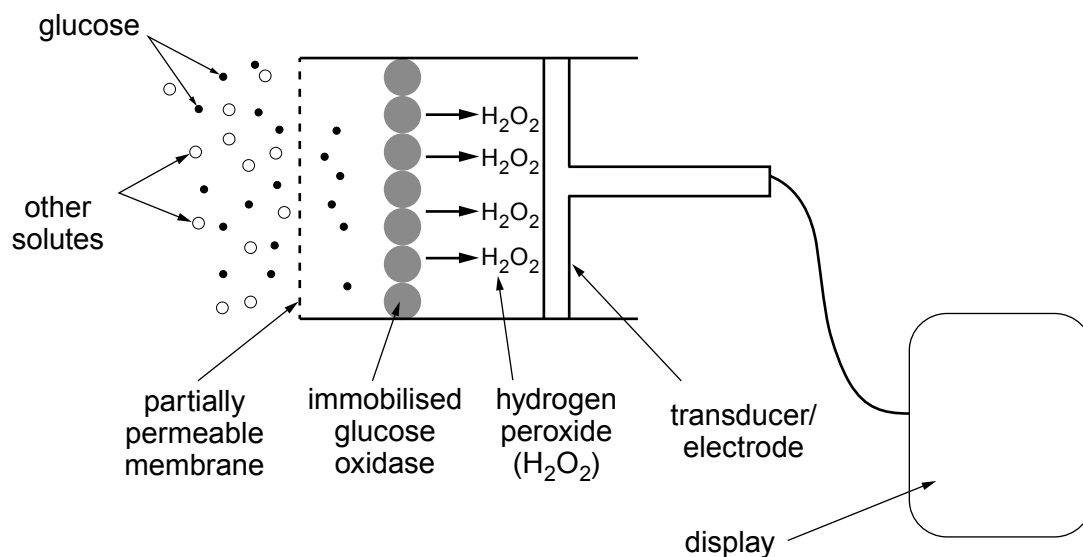
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- (iii) Describe **two** differences between mitochondria and prokaryotic cells such as bacteria. [2]

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6. Biosensors make use of immobilised enzymes to detect specific molecules in a mixture. The diagram below shows a possible structure of a biosensor used to monitor blood glucose concentration.



- (a) (i) Describe the function of the partially permeable membrane in this biosensor. [2]

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- (ii) With reference to the diagram above, describe how the concentration of glucose is transmitted to the display. [3]

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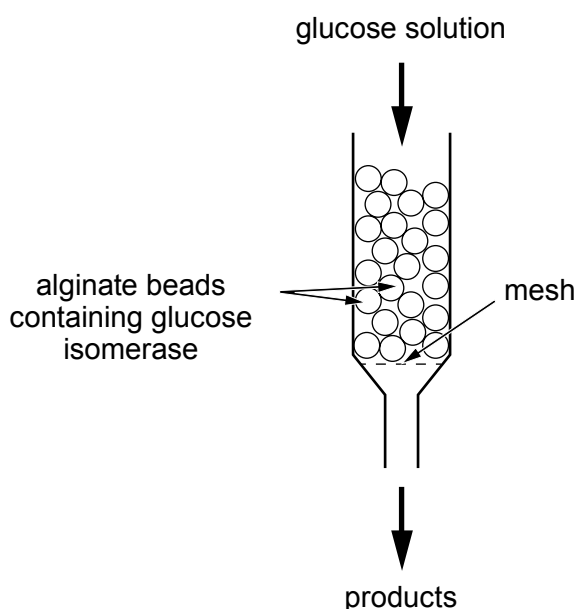
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Immobilised enzymes are also used in the food industry to produce many useful substances, for example fructose syrup. The diagram below shows a simplified version of this process. A glucose solution is passed through a column of the immobilised enzyme glucose isomerase and fructose is released as a product.



- (b) (i) Suggest why the enzyme involved is called glucose isomerase. [1]

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- (ii) One of the advantages of using immobilised enzymes is that the product does not contain the enzyme and therefore does not need to be purified. Describe a biochemical test that could be used to show that the product has not been contaminated by the **enzyme**. [2]

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- (iii) Describe **two other** advantages of using immobilised enzymes. [2]

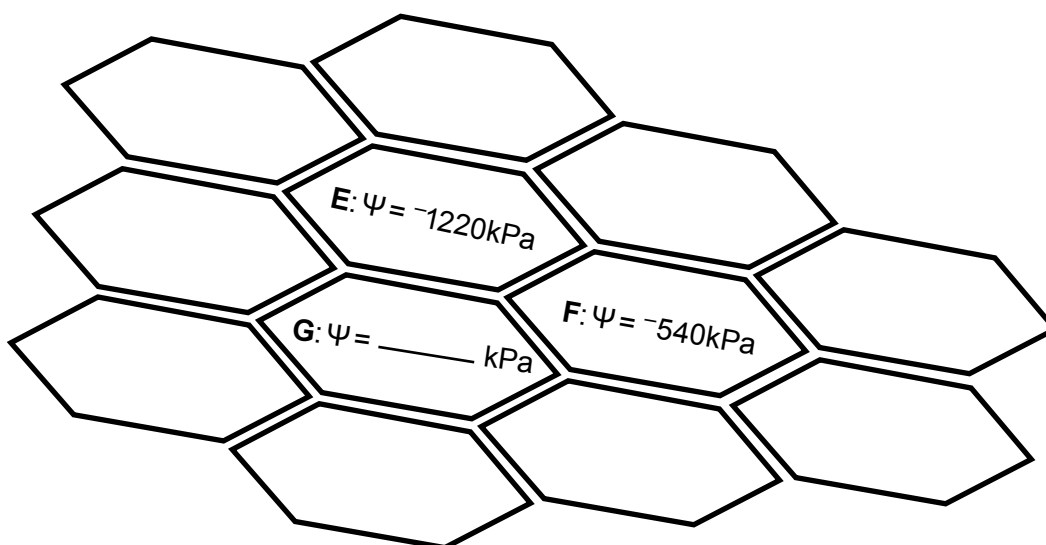
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7. The diagram below shows cells taken from plant tissue. Cells **E**, **F**, and **G** are adjacent cells and the water potential of cells **E** and **F** are given.



The water potential of a plant cell can be determined using the following formula:

$$\psi_{\text{cell}} = \psi_s + \psi_p$$

- (a) (i) The pressure potential of cell **G** is  $900 \text{ kPa}$  and the solute potential is  $-1600 \text{ kPa}$ . Calculate the water potential of cell **G** and write your answer in the space on the diagram above. [1]

- (ii) I Draw arrows on the diagram above to show the net movement of water molecules between these **three** cells. [1]

- II Explain your answer in terms of water potential. [2]

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- (b) (i) In an experiment, a student immersed plant tissue in salt solutions of different concentrations. The student then observed the plant tissue under the microscope. In one of the solutions the student concluded that the cells within the tissue were at incipient plasmolysis.

What observation had the student made that allowed her to make this conclusion?

[1]

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- (ii) The water potential of a cell at incipient plasmolysis was  $-430\text{kPa}$ . Using this information state the value of the solute potential of the cell and explain how you arrived at your answer.

[2]

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8. Answer one of the following questions.  
Any diagrams included in your answers must be fully annotated.

**Either,** (a) Using examples to illustrate your answer, describe how the structures of polysaccharides are related to their functions. [10]

**Or** (b) Globular proteins are an important component of plasma membranes. Describe the structure and function of membrane proteins. [10]

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