

Friday 11 January 2013 – Afternoon

AS GCE APPLIED SCIENCE

G623/02 Cells and Molecules

Candidates answer on the Question Paper.

OCR supplied materials:

None

Other materials required:

- Electronic calculator
- Ruler (cm/mm)

Duration: 45 minutes




Candidate forename		Candidate surname	
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Centre number							Candidate number				
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INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. If additional space is required, you should use the lined pages at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **45**.
-  Where you see this icon you will be awarded marks for the quality of written communication in your answer. This means, for example, you should:
 - ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear;
 - organise information clearly and coherently, using specialist vocabulary when appropriate.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.
- This document consists of **16** pages. Any blank pages are indicated.

For Examiner's Use			
1			
2			
3			
4			
Total			

Answer **all** the questions.

- 1 Fig. 1.1 is a photomicrograph of a plant cell produced by research students using an electron microscope to study cell structure.

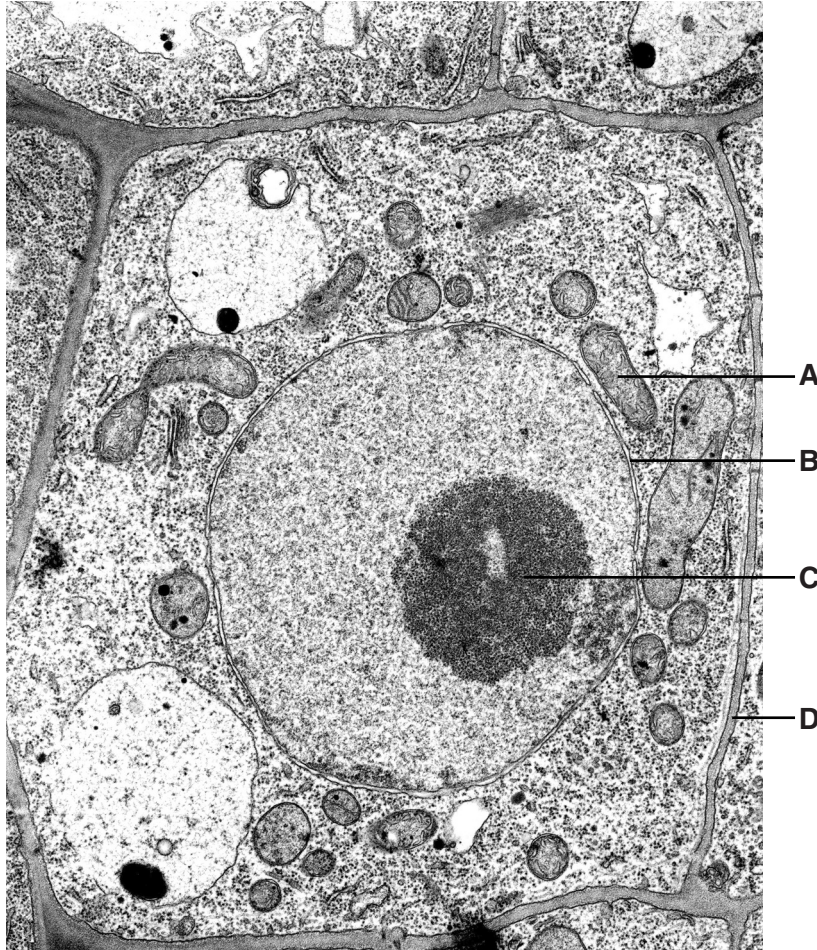


Fig. 1.1

- (a) State the names of the parts of the cell labelled **A** to **D**.

A

B

C

D

[4]

- (b) Why does the specimen in an electron microscope have to be viewed in a vacuum?

.....

..... [1]

(c) State **one other** cellular organelle that can only be seen with an electron microscope and describe its function.

organelle

function

.....
[2]

(d) The research students also use light microscopes.

State **one** advantage and **one** disadvantage of light microscopy.

advantage

.....

disadvantage

.....
[2]

[Total: 9]

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- 2 Water is an important constituent of living cytoplasm. It acts as a solvent for a large variety of solutes and provides the medium for most of the chemical reactions in a cell.

The surface membrane of a cell is selectively permeable and has a structure that can be described using the fluid mosaic model.

- (a) Fig. 2.1 shows the arrangement of molecules in the cell surface membrane according to the fluid mosaic model.

Add names to the labels **A**, **B**, **C** and **D** below.

Choose your answers from the following list:

cholesterol

glycolipid

glycoprotein

phospholipid

protein

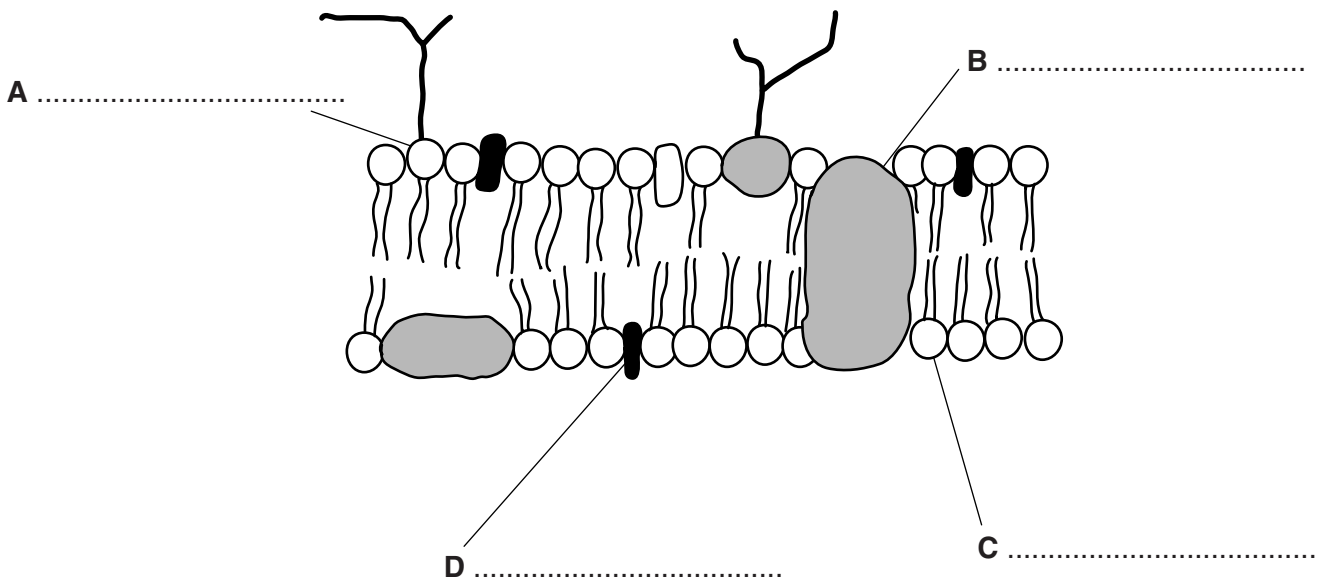


Fig. 2.1

[4]

- (b) A group of students carried out an experiment using an artificial membrane that formed the boundary of a model cell. They placed a solution of different sugars inside this 'cell' which was then placed in a beaker containing a solution of sucrose and glucose.

The artificial membrane is called *Visking tubing*, which is made from cellulose.

The artificial membrane is:

- permeable to monosaccharides (e.g. glucose and fructose) and water
- not permeable to disaccharides (e.g. maltose and sucrose)
- flexible.

Fig. 2.2 shows the 'cell', together with the concentrations of the sugars inside the 'cell' and in the surrounding solution. The figures represent the concentration of sugars in mol dm^{-3} .

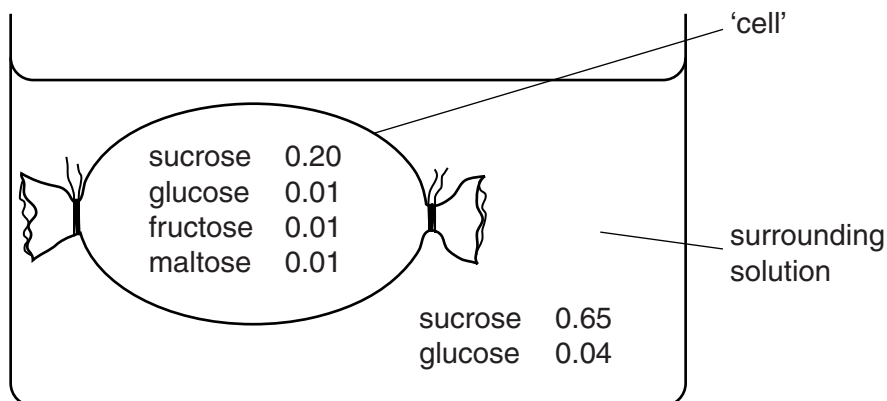


Fig. 2.2

- (i) Describe a test that the students could use to confirm the presence of glucose in the surrounding solution in the beaker.

.....

 [2]

- (ii) State which sugar or sugars will show a net movement **out** of the 'cell'.

..... [1]

- (iii) State which sugar or sugars will show a net movement **into** the 'cell'.

..... [1]

PLEASE DO NOT WRITE ON THIS PAGE

3 Athletes in training need a balanced and varied diet to achieve their training goals. An ideal training diet is high in carbohydrates and low in lipids, with a good mix of proteins, vitamins and minerals.

(a) State the **four** chemical elements that are **always** found in proteins.

.....
 [1]

(b) Fig. 3.1 shows the structure of a molecule of α -glucose (alpha glucose).

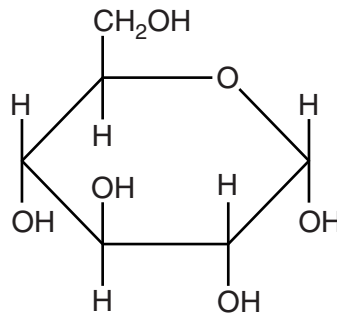


Fig. 3.1

Using the space below, draw a diagram to show how two molecules of α -glucose combine to form a disaccharide. On your diagram label the glycosidic bond.

[2]

(c) Many athletes prefer to eat food containing lipids (triglycerides) that are unsaturated.

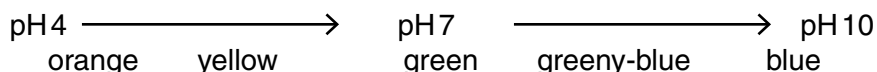
State how the structure of **unsaturated** lipids is different from **saturated** lipids.

.....
 [1]

(d) A sports dietician carried out a series of experiments on unskimmed creamy milk. The following were mixed together:

- a. 20 cm³ of unskimmed creamy milk
- b. a few drops of universal (pH) indicator
- c. a few drops of dilute sodium carbonate solution (an alkali)
- d. 4 cm³ of lipase, an enzyme that hydrolyses triglycerides.

Note: Universal indicator changes colour at different pH values.



The mixture was divided between two test tubes, **A** and **B**. Tube **B** was boiled for 2 minutes and then cooled. Both tubes **A** and **B** were placed in a water bath and incubated at 35 °C for 4 hours, after which time, the contents of one tube had changed colour.

(i) Why was the sodium carbonate added?

.....
 [1]

(ii) Suggest why both test tubes were incubated at 35 °C.

.....
 [1]

(iii) State the colour of the mixture before it was divided between the two test tubes.

..... [1]

(iv) State and explain the colour of the contents of tube **A** after incubation in the water bath.

colour

explanation

.....

[3]

(v) State and explain the colour of the contents of tube **B** after incubation in the water bath.

colour

explanation

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

[2]

(vi) Explain the observations from tube **B**, using your knowledge of the tertiary structure of enzymes.

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

[2]

[Total: 14]

4 Technicians who work in medical laboratories in hospitals often need to look at blood smears.

(a) Suggest **one** reason why technicians look at blood smears.

.....
 [1]

(b) Fig. 4.1 is a scale diagram of blood cells.

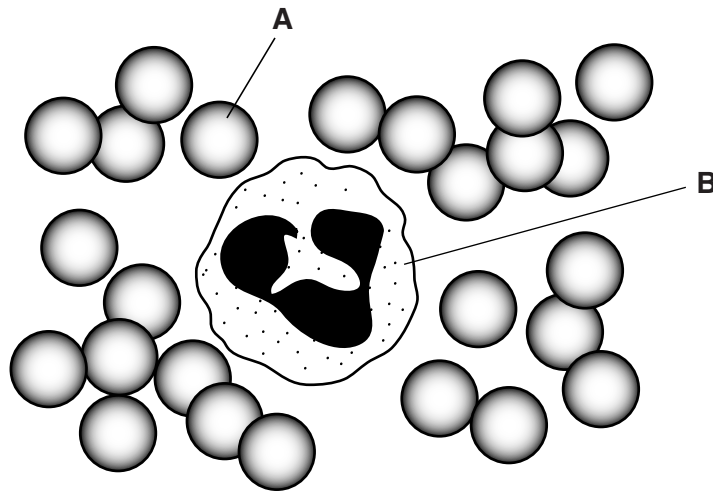


Fig. 4.1

Cell **A** is a normal red cell with a diameter of $7.2\mu\text{m}$.

Use Fig. 4.1 to calculate the maximum diameter of cell **B**.

Show your working.

maximum diameter = μm [3]

(c) A technician examined a blood smear taken from a patient. The blood smear contained a much higher number of type **B** cells than in a normal smear.

Suggest **one** medical condition that could account for the higher number of type **B** cells.

.....
 [1]

- (d) Technicians in laboratories may use a special slide called a haemocytometer to determine the number of blood cells in a specific volume of blood.

The following list, **A** to **J**, includes instructions that when taken together, describe how to use a haemocytometer.

However, they are **not** in the correct order.

- A** The slide is left on the microscope stage for 5 minutes to allow the cells to settle on the grid.
- B** If cells lie on the triple line boundary between adjoining squares, only include cells that lie on the North and West sides of those squares.
- C** The blood cell suspension is shaken to distribute cells.
- D** The $\times 40$ objective lens is selected.
- E** The coverslip is firmly placed over the grooves of the haemocytometer to ensure good contact with the slide.
- F** The number of cells in the top left (TL), top right (TR), middle (M), bottom left (BL) and bottom right (BR) triple lined squares are counted.
- G** The blood cell suspension is serially diluted with saline solution.
- H** The $\times 10$ objective lens is used to locate the central area grid.
- I** Interference rings can be seen at the margins of the coverslip.
- J** A pipette is used to inject the diluted blood cell suspension under the coverslip, to cover the central area grid.

List the letters in the correct order below. Some have been done for you.

C		E	I	J	A				B
----------	--	----------	----------	----------	----------	--	--	--	----------

[4]

[Total: 9]

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional answer space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margins.

A large area of lined paper for writing answers. It features a vertical margin line on the left side and horizontal dotted lines for writing. The lines are evenly spaced and extend across the width of the page.

A grid of horizontal dotted lines for writing, with a solid vertical line on the left side. The grid consists of 28 horizontal rows, each defined by two dotted lines. The solid vertical line is positioned on the left side of the page, creating a margin.

A large area of the page is reserved for writing, featuring a vertical solid line on the left side and horizontal dotted lines extending across the page.



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