

Wednesday 22 May 2013 – Morning

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 **12** pages. Any blank pages are indicated.

For Examiner's Use			
1			
2			
3			
4			
Total			

Answer **all** the questions.

- 1 A medical student was researching cystic fibrosis (CF). CF affects epithelial cells that produce mucus.

The medical student drew two epithelial cells, based on images taken by an electron microscope. These are shown in Fig. 1.1.

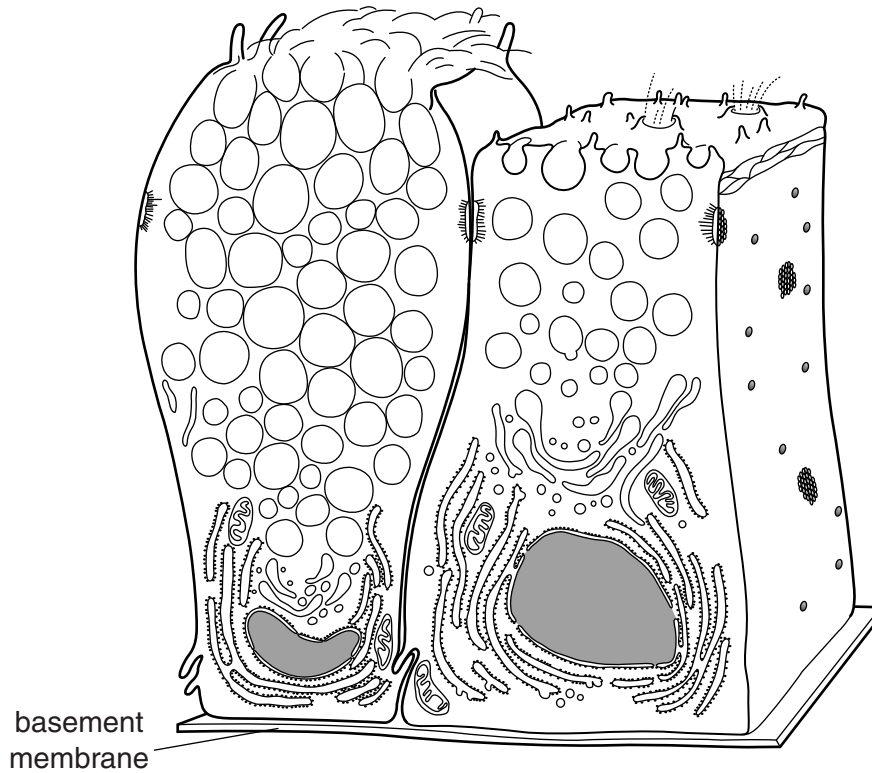


Fig. 1.1

- (a) Describe how to produce a temporary slide of cellular tissue to be viewed with a **light microscope**.

.....

.....

.....

.....

.....

.....

.....

.....

[3]

- (b) Put a **ring** around **one** organelle that may be seen in these epithelial cells when viewed with a **light microscope**.

- nucleus
- ribosome
- rough endoplasmic reticulum
- smooth endoplasmic reticulum

[1]

- (c) State and explain **one** advantage and **one** disadvantage of using an electron microscope to view epithelial cells.

advantage

explanation

.....

disadvantage

explanation

.....

[4]

- (d) With cystic fibrosis (CF), epithelial cells in the pancreatic duct and the intestine produce mucus which is abnormally thick and sticky.

Use this information to suggest **two** problems with nutrition and/or digestion in an individual with CF.

.....

.....

.....

..... [2]

- (e) Pregnant women can have tests at 18 weeks to see if the foetus has CF. The test is 95% accurate and involves analysing cells taken from the fluid surrounding the foetus.

What are the moral **and** ethical issues for a pregnant woman to consider **before** she takes the test?

.....

.....

.....

.....

..... [2]

- (f) Cystic fibrosis is caused by mutations in the gene coding CFTR (cystic fibrosis transmembrane conductance regulator), located on chromosome 7. CFTR is a channel that allows the movement of chloride ions across the membrane of some epithelial cells.

The normal gene codes for an intrinsic membrane protein, composed of 1480 amino acids.

Use your knowledge of the fluid mosaic model to suggest why CFTR is described as an intrinsic membrane protein.

.....
..... [1]

[Total: 13]

- 2 Newborn babies born with cystic fibrosis (CF) show increased levels of a protein called immunoreactive trypsin (IRT) in their blood.

(a) Proteins are made from monomers called amino acids.

Fill in the boxes in Fig. 2.1 to show the general formula of an amino acid.

(R = variable side chain)

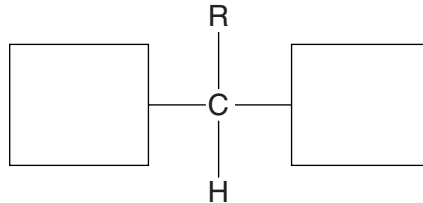


Fig. 2.1

[2]

- (b) State the type of reaction and the type of bond formed when two amino acids are joined together.

type of reaction

type of bond

[2]

- (c) Suggest a suitable diagnostic test that may be used to identify the presence of IRT in the blood plasma of newborn babies.

.....

..... [1]

(d) Use the words from the following list to complete Fig. 2.2, by labelling the boxes to show the sequence of events during protein synthesis.

Each word may be used once, more than once or not at all.

active transport

amino acid

centriole

DNA

histone

hydrolysis

mitochondria

mRNA

tRNA

transcription

translation

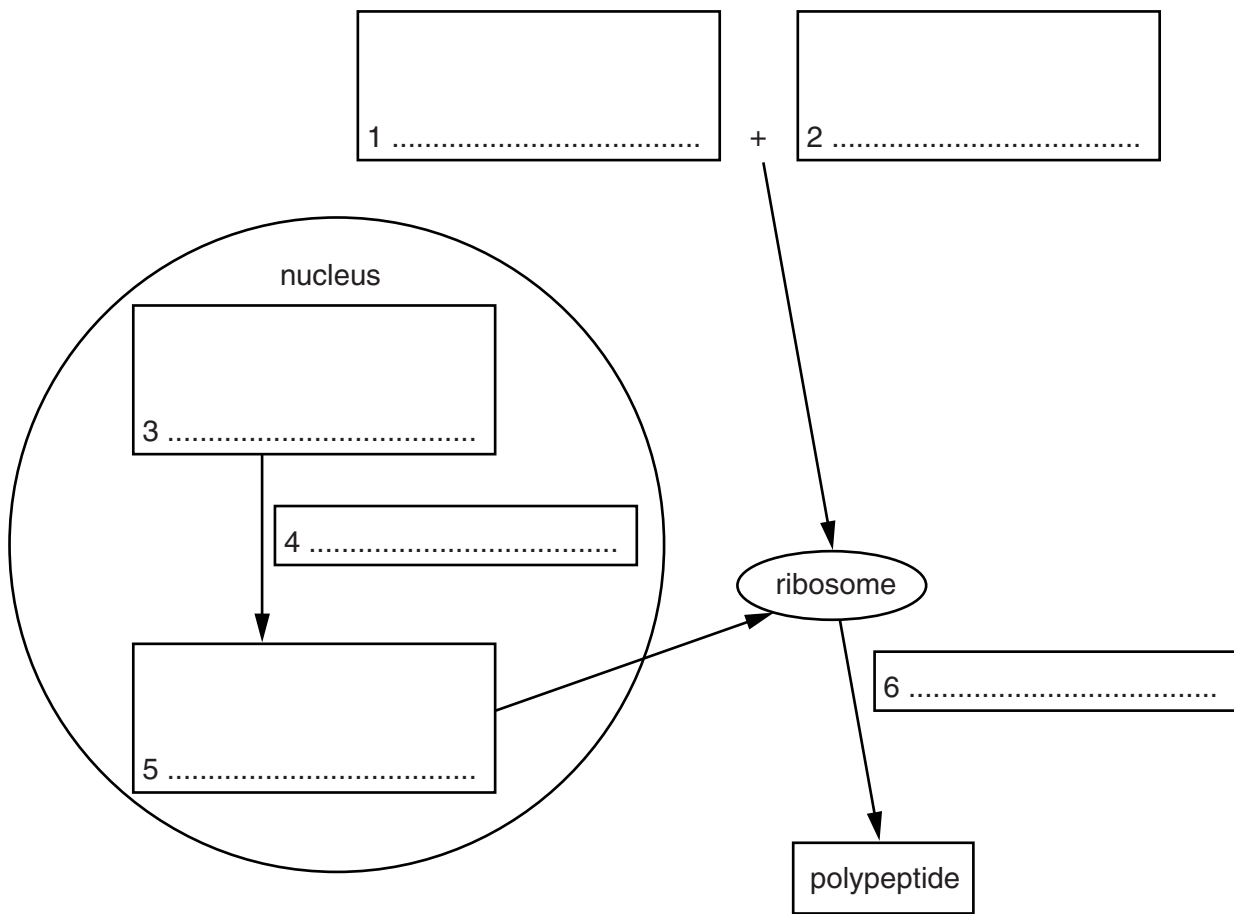


Fig. 2.2

[6]

[Total: 11]

- 3 A food technology student working in a laboratory has been asked to identify the food chemicals present in a high-energy snack bar used by athletes.

(a) Complete the following table on the tests she is likely to carry out.

Food chemical	Reagent(s) used	Result if food chemical is present
.....	Iodine solution	Blue/black
Protein	Lilac/purple
Lipid/fat	White emulsion
Non-reducing sugar	Brick red precipitate

[4]

- (b) Sucrose is a non-reducing sugar that was found in the snack bar. Sucrose is broken down into glucose and fructose by the enzyme, sucrase.

(i) Students sometimes describe enzymes as 'biological catalysts'.

Explain what this means.

.....

 [1]

(ii) All enzymes have some features in common.

Complete the following table.

Feature	Comment
Type of chemical molecule	
Model used to describe enzyme action	
Effect on the activation energy needed	
Factors that affect enzyme activity	factor 1
	factor 2
	factor 3

[6]

[Total: 11]

Turn over

4 Scientists who work in pathology laboratories in hospitals often need to know the size and relative numbers of red and white blood cells in samples of blood.

(a) Suggest **one** reason why scientists need to know the number of white blood cells in a sample of blood.

.....
..... [1]

(b) Fig. 4.1 shows a drawing of a plasma cell, one of the types of white blood cell that produces proteins called antibodies.

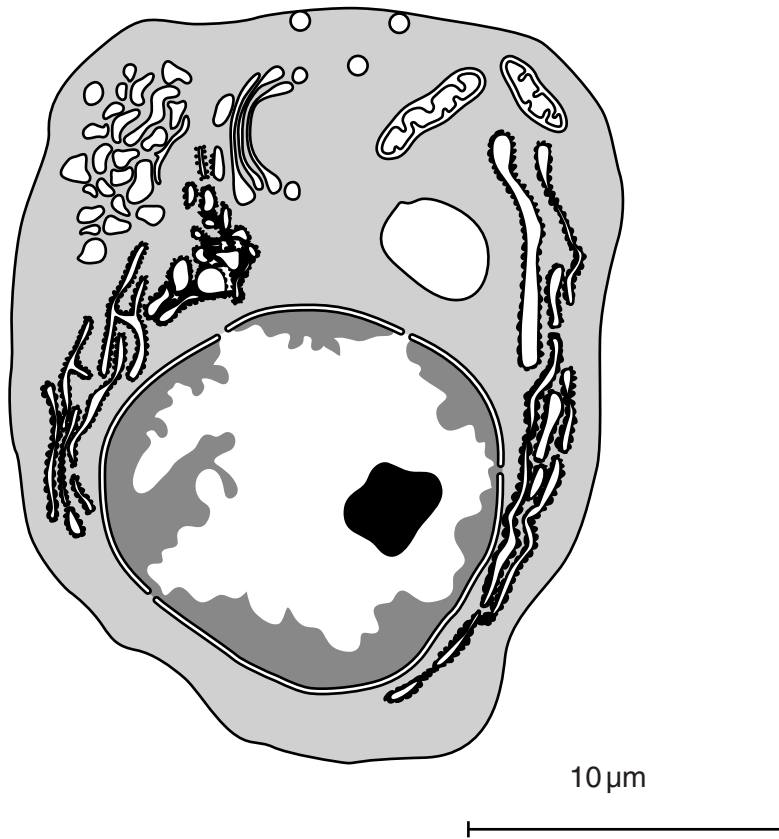


Fig. 4.1

Use Fig. 4.1 to explain how the structure of the cell is adapted to produce protein.

.....
.....
.....
.....
..... [2]

(c) What is the magnification of the cell shown in Fig. 4.1?

Show your working.

magnification = [2]

(d) A haemocytometer may be used by technicians in pathology laboratories to count the number of white blood cells in a specific volume of blood.

The result from a haemocytometer count may not be an accurate measure of the number of white blood cells in a sample of blood from a patient.

Suggest **one** reason why this might occur.

.....
..... [1]

(e) Coulter counters may also be used in laboratories.



Explain **how** and **why** a technician may use a Coulter counter.

.....
.....
.....
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.....
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.....
.....
.....
..... [4]

[Total: 10]

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

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

This section of the page is a large, empty area of lined paper. It consists of approximately 25 horizontal dotted lines spaced evenly down the page. A solid vertical line runs down the left side of this area, creating a margin. The rest of the page is blank white space.

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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