OCR
RECOGNISING ACHIEVEMENT

Thursday 12 January 2012 – Afternoon

AS GCE APPLIED SCIENCE

G623 Cells and Molecules

G611350111

Candidates answer on the Question Paper.

OCR supplied materials:
None

Other materials required:
- Electronic calculator
- Ruler (cm/mm)

Duration: 45 minutes

G6623

Candidate forename		Candidate surname	

Centre number						Candidate number				

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. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- 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 teacher prepared the following revision questions for a lesson on cell structure and molecules that occur in cells.

(a) Name the three chemical elements present in a simple lipid (triglyceride) molecule.

1. .....

2. .....

3. ..... **[1]**

(b) Fig. 1.1 below represents a typical lipid (triglyceride) molecule.

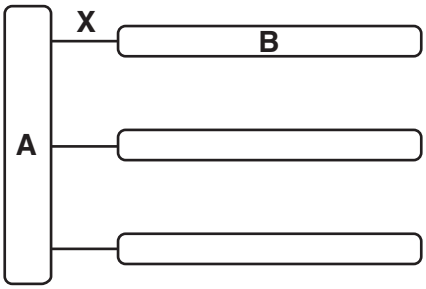

Fig. 1.1

(i) Name component **A**.

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

(ii) State the name of the chemical bond that joins components **A** and **B** together at **X**.

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

(iii) What chemical was **released** when components **A** and **B** were bonded together at **X**?

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

(iv) Describe how to carry out a test for lipids.

.....

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

(c) Fig. 1.2 represents a model of the structure of a biological membrane.

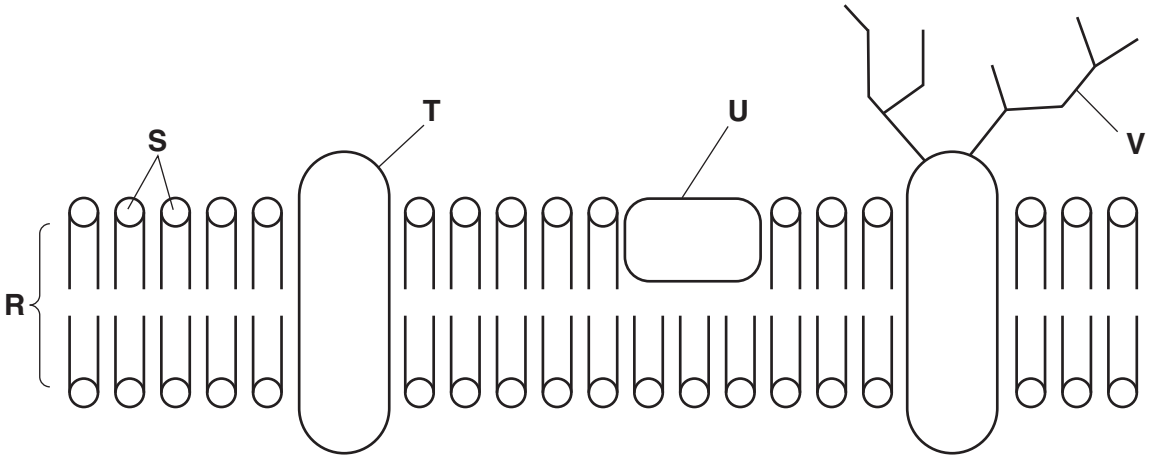

Fig. 1.2

(i) Identify the label **R**, **S**, **T**, **U** or **V** that indicates the hydrophobic region of the membrane.

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

(ii) Explain why the membrane is impermeable to most biological molecules.

.....

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

(iii) Give **two** reasons why the model of membrane structure shown in Fig. 1.2 can be described as 'fluid mosaic'.

reason 1 .....

.....

reason 2 .....

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

[Total: 9]

2 Food science students were investigating the effects of the enzyme lipase on fats.

(a) What is the structure and function of an enzyme?

structure .....

.....

function .....

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

(b) The students added the same concentration of lipase to different concentrations of fat suspension at 40 °C in a series of test tubes. The time taken for each reaction to be completed was recorded.

The rates of reaction were calculated and are shown in Fig. 2.1.

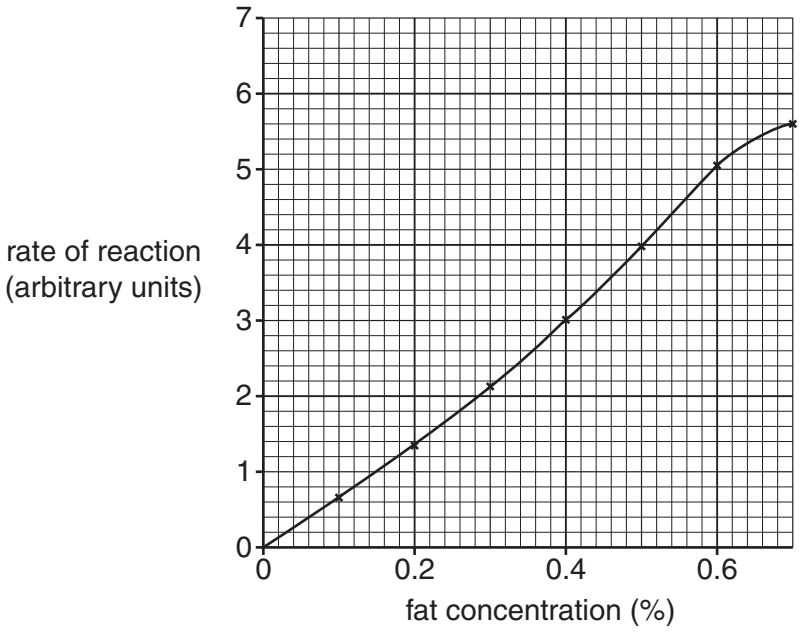

Fig. 2.1

(i) State why the investigation was carried out at 40 °C.

.....

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

(ii) Describe the effect of increasing the fat concentration on the rate of reaction.
Use data from the graph, Fig. 2.1, in your answer.

.....

.....

.....

.....

.....

..... **[3]**

(c) The students repeated the investigation under two sets of conditions.

- at 20 °C
- or using a higher concentration of the enzyme lipase.

Draw **two** lines **on Fig. 2.1** to show the likely results obtained under these conditions.

- Label one line **20 °C**.
- Label the second line **lipase**.

[3]

(d) The students went on to investigate the effect of pH on the activity of lipase.
They found that the highest level for enzyme activity was at pH 8.

Draw a line on Fig. 2.2 to show the results obtained.

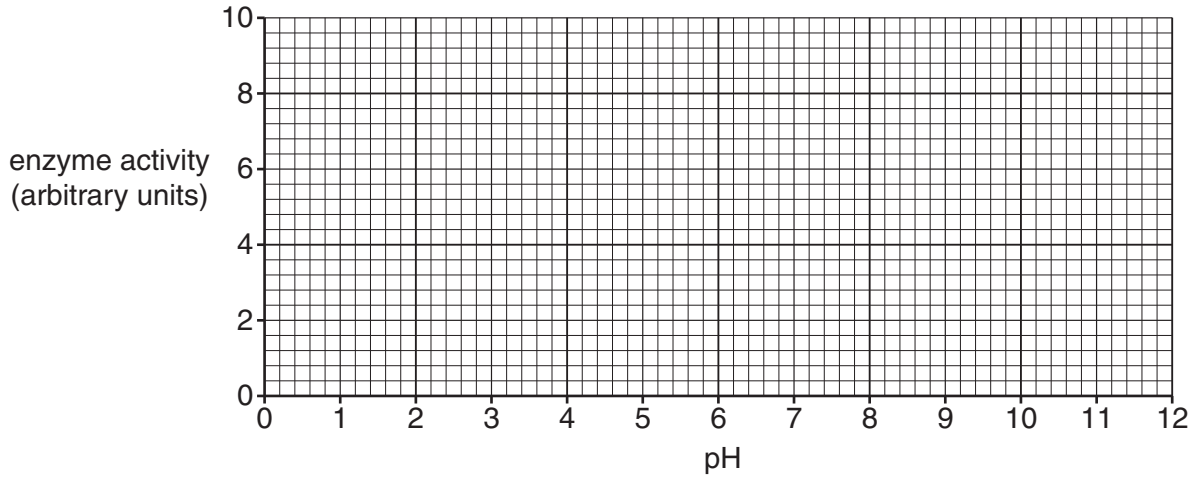

Fig. 2.2

[2]

[Total: 11]

3 Stem cells in the bone marrow divide to form reticulocytes. These are immature red blood cells which lack a nucleus but retain some RNA in their cytoplasm. Some of these reticulocytes leave the bone marrow before becoming fully developed red blood cells.

Fig. 3.1 represents a section through part of a stem cell, as seen under an electron microscope.

Fig. 3.1

(a) Name structures **P** and **Q** and describe **one** function of each structure.

P .....

function .....

.....

Q .....

function .....

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

(b) Measure the maximum length of the mitochondrion on Fig. 3.1 and use this to calculate the **actual** length.

measured length of mitochondrion = ...

actual length = ... μm **[3]**

(c) Suggest **one** reason why reticulocytes retain some RNA in their cytoplasm.

.....

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

(d) Samples of blood were taken from two athletes living in Peru and analysed by a sports scientist working in a laboratory. Athlete **1** trained at sea level and later at high altitude. The number of red blood cells was counted in each sample of blood.

Table 3.1 compares the results from the blood samples taken from the athletes.

Table 3.1

	athlete **1** at sea level	athlete **2** at sea level	athlete **1** at high altitude
red blood cell count $/\times 10^{12}\,dm^{-3}$	5.0	3.2	6.4

(i) Calculate the percentage increase in the red blood cell count when athlete **1** goes from sea level to high altitude.

percentage increase = ... % **[2]**

(ii) Explain **one** reason why a sports scientist would study the effect of altitude on the number of red blood cells in the athlete's blood.

.....

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

(iii) The red blood cell count of athlete **2** is much lower than normal.
Suggest a reason for this.

.....

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

(e) Fig. 3.2 is a diagram of a Coulter counter.
Sports scientists might use Coulter counters to obtain data from blood samples.

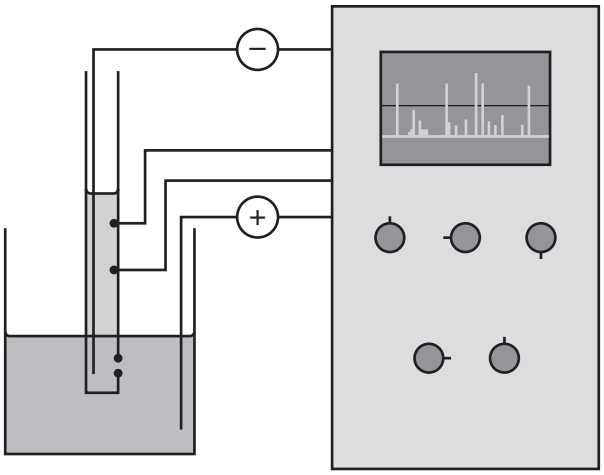

Fig. 3.2

(i) Describe how a Coulter counter is used to measure red blood cell counts.

.....

.....

.....

.....

.....

.....

.....

.....

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

(ii) Suggest **one** reason why a Coulter counter may overestimate the number of living red blood cells in a blood sample.

.....

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

[Total: 17]

4 Huntington's disease (chorea) is a genetic disorder. The symptoms of the disease usually develop when people are between 30 and 50 years old.

(a) John, a doctor, has a family history of Huntington's disease. He is concerned that he is showing early symptoms of the condition.

State two clinical symptoms that John might identify as early indicators of this genetic disease.

1. .....

.....

2. .....

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

(b) John's wife, Anya, becomes pregnant. Anya and John decide to consult a clinical geneticist for counselling to discuss prenatal (before birth) diagnostic testing.

Suggest two moral and/or ethical implications of this testing which Anya and John should consider.

1. .....

.....

.....

2. .....

.....

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

(c) Monoclonal antibodies may be used to identify diseases. In the same way they can be used to confirm pregnancy. Human chorionic gonadotrophin (hCG) is a glycoprotein found in a woman's urine during early pregnancy.

Fig. 4.1 shows a plastic strip used to test for pregnancy. The strip contains monoclonal antibodies, linked to a blue marker, that bind to the hCG in the urine of the pregnant woman. During the pregnancy test, the bottom of the strip is placed in a sample of urine.

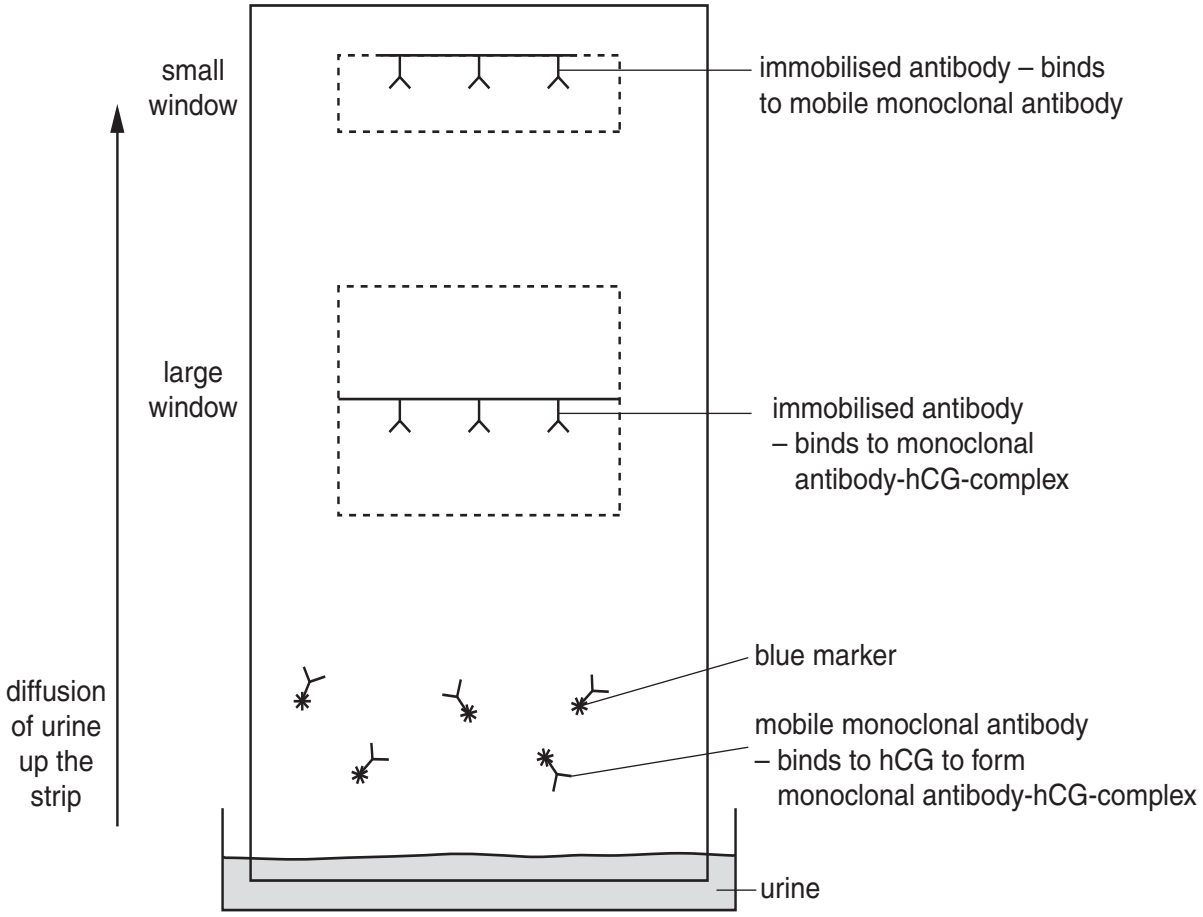

Fig. 4.1

(i) Use Fig. 4.1 to explain why a blue line would appear in the large window if the urine sample contains the glycoprotein, hCG.

.....

.....

.....

.....

.....

.....

..... **[3]**

(ii) Use Fig. 4.1 to explain why the test must continue until a blue line appears in the small window.

.....

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

[Total: 8]

END OF QUESTION PAPER

PLEASE DO NOT WRITE ON THIS PAGE