RECOGNISING ACHIEVEMENT

ADVANCED SUBSIDIARY GCE

APPLIED SCIENCE

G623

Cells and Molecules

Candidates answer on the question paper.

OCR supplied materials:
None

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

Thursday 26 May 2011
Morning

Duration: 45 minutes

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. Pencil may be used for graphs and diagrams only.
- 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).
- Answer **all** the questions.
- 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 Students were learning about the electron microscope and how it is used to study the structure of cells.

They were given a crossword about the electron microscope to complete at the beginning of one of their lessons. This is shown in Fig. 1.1.

(a) Imagine you are one of the students. Answer the clues and complete the crossword.

Across

2. The state of the specimen when observed (4) _ _ _ _

4. Used to focus the beam (14) _ _ _ _ _ _ _ _ _ _ _ _ _ _

5. Type of environment inside the electron microscope (6) _ _ _ _ _ _

Down

1. Used for staining the specimen (5,6) _ _ _ _ _ _ _ _ _ _ _ _

3. Fired from a tungsten gun (9) _ _ _ _ _ _ _ _ _

[5]

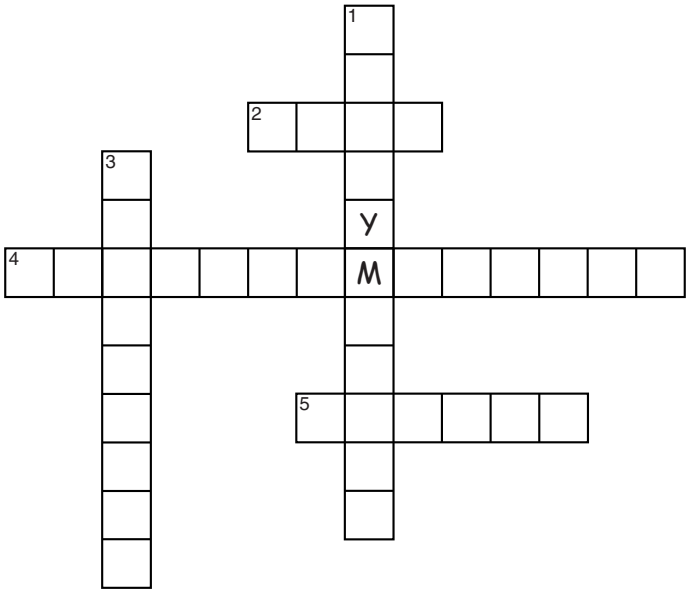

Fig. 1.1

(b) Explain why the specimen in an electron microscope has to be thin in section.

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.....

.....

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

(c) State **one** advantage and **two** disadvantages of using an electron microscope.

advantage .....

.....

disadvantages .....

.....

.....

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

[Total: 10]

2 The students went on to learn about the use of yeast cells in the brewing industry.

The students were given a drawing of an electron micrograph of the yeast *Saccharomyces cerevisiae*. This is shown in Fig. 2.1.

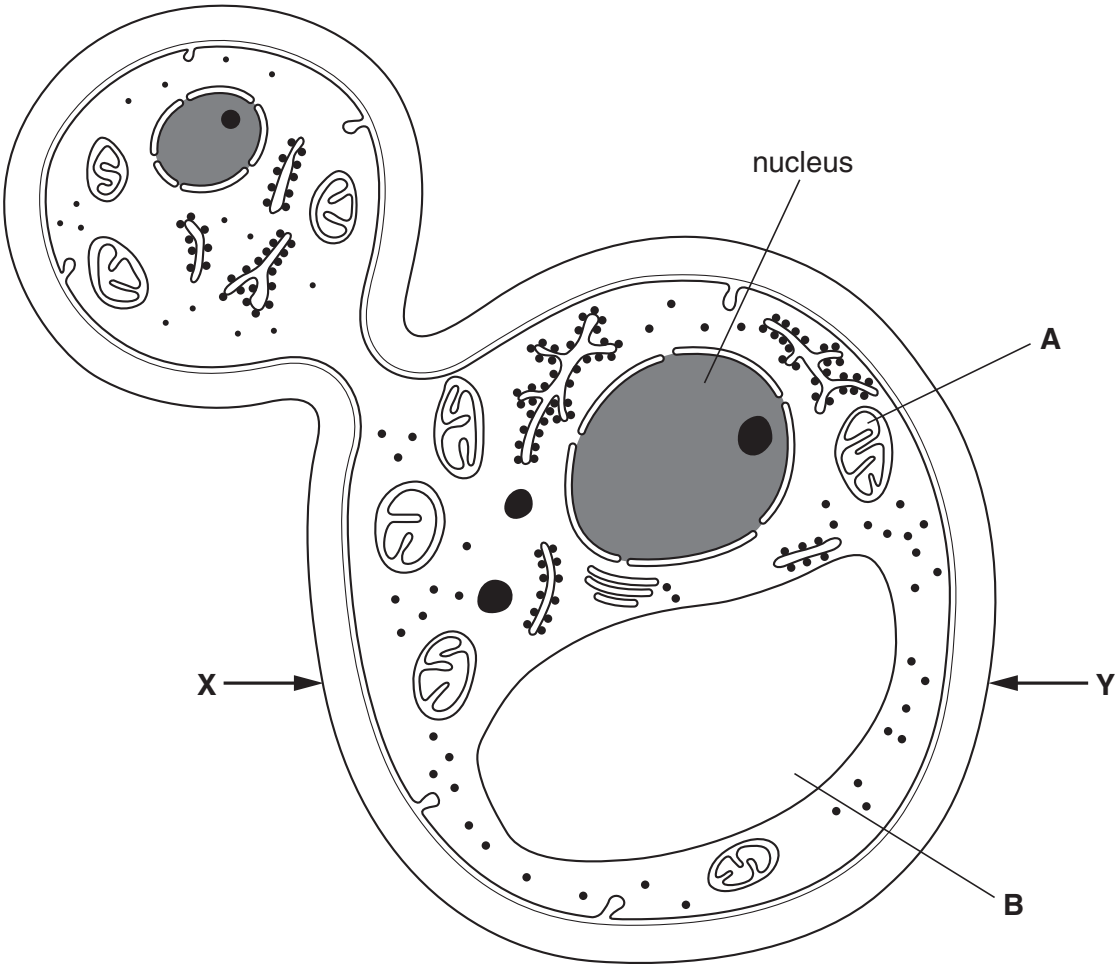

Fig. 2.1

(a) Identify the structures labelled **A** and **B**.

A .....

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

(b) The actual distance between **X** and **Y** is 24 μm.

Measure the distance between **X** and **Y** on Fig. 2.1 to calculate the magnification of the diagram.

distance between **X** and **Y** = ... mm

magnification of the diagram = ... **[3]**

(c) Glucose concentration affects the growth of yeast cells. The students were asked to count yeast cells in a given sample over a period of time using a haemocytometer.

Describe how the students would obtain **reliable** yeast cell counts using a haemocytometer.

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

(d) Some scientists in the brewing industry work in laboratories. One of their roles is to monitor the growth of yeast cells in a large number of samples.

(i) Suggest one **other** factor that may be monitored by these scientists.

.....

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

(ii) Why do scientists in the brewing industry use a Coulter counter rather than a haemocytometer to monitor the numbers of yeast cells?

.....

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

(iii) Suggest one reason why the use of a Coulter counter may give unreliable data.

.....

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

[Total: 12]

3 Biological washing powders contain enzymes. An investigation was carried out to determine the effect of a biological washing powder known as '*Bio-White*' in digesting a protein stain, such as egg, from cotton fabric. Standard samples of stained fabric were soaked in 1% Bio-White at different temperatures.

The results are given in Table 3.1.

Table 3.1

temperature/°C	15	25	35	45	55	65	75
time taken for digestion of stain/hours	4.0	1.4	0.71	0.50	1.0	.....	5.0
rate of digestion/hour^{-1}	0.25	0.71	1.4	.....	1.0	0.40	0.20

(a) Name a simple chemical test for a protein and give the result that would indicate that protein is present.

name .....

chemical result ..... **[2]**

(b) Albumen is a protein found in egg. It is known as a globular protein. It has a specific tertiary structure.

Describe and explain what is meant by the tertiary structure of a globular protein.

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.....

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.....

.....

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

(c) (i) Use Table 3.1 to calculate the missing values for the rate of digestion at 45 °C and the time taken for digestion of the stain at 65 °C. Enter the missing values in the table. **[2]**

(ii) Use the data in Table 3.1 to plot the results on the axes provided in Fig. 3.1.

The first three points have been plotted for you. **[2]**

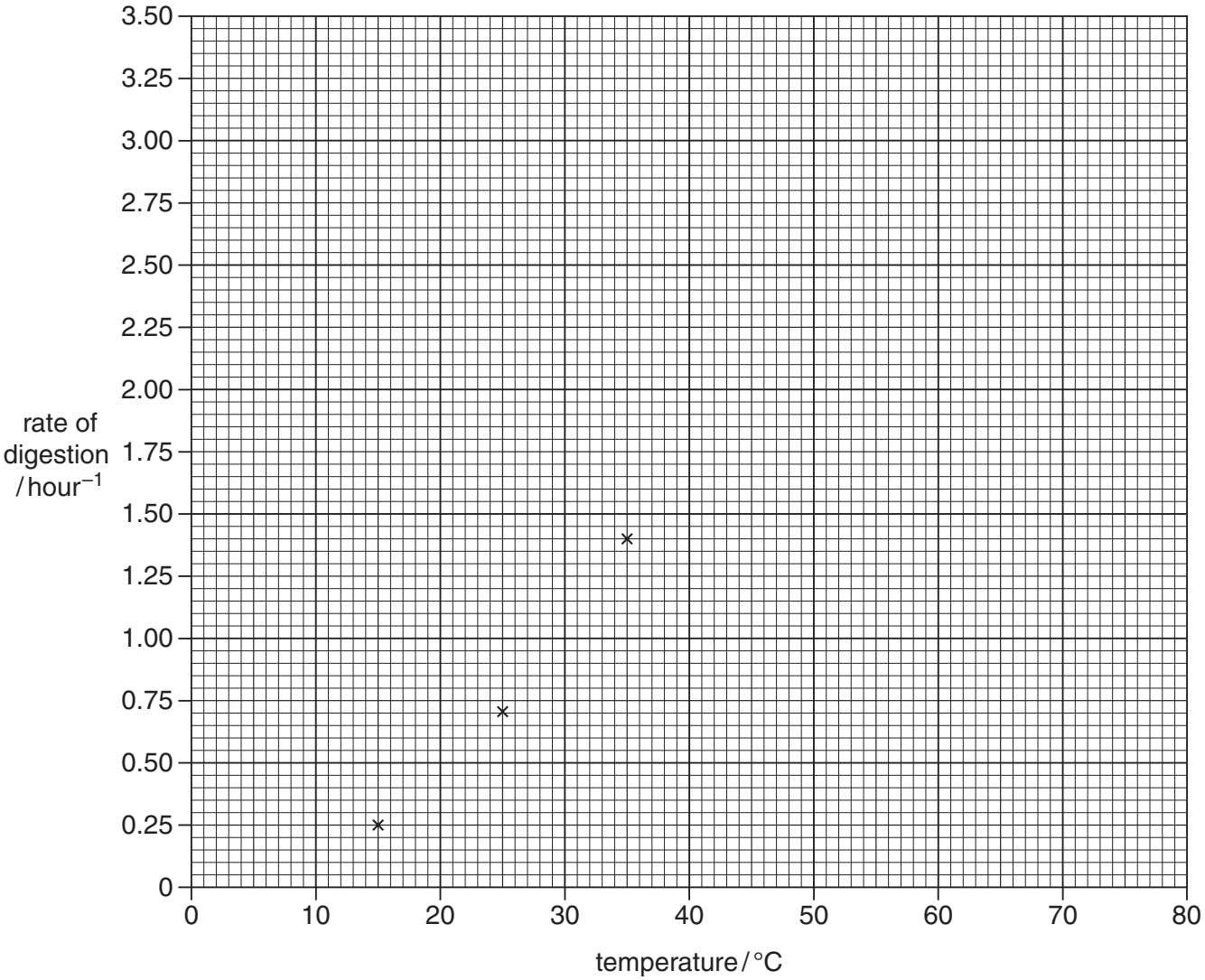

Fig. 3.1

(iii) Draw a suitable line to complete the graph, Fig. 3.1. **[1]**

(d) Explain how the experiment could be extended to find more precisely, the optimum temperature at which 'Bio-White' digests protein stains.

.....

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

(e) Use the graph, Fig. 3.1, to describe and explain the effect of temperature on 'Bio-White' activity between 45 °C and 75 °C.

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

[Total: 14]

4 Cystic fibrosis (CF) is an inherited condition that affects over 8500 people in the UK. It is caused by mutations in the CFTR (cystic fibrosis transmembrane regulator) gene.

(a) Name the biological molecule in which mutations are likely to occur and suggest how a **structural** change in this biological molecule could take place.

name .....

structural change .....

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

(b) The CFTR gene codes for a protein that is essential for the movement of chloride ions between cells.

Use your knowledge of osmosis to explain why people with CF produce mucus which is abnormally thick and sticky.

.....

.....

.....

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

(c) Cystic fibrosis affects epithelial cells in the pancreas and respiratory tract and causes congestion of the lungs.

(i) Describe three consequences of congestion of the lungs.

1. .....

.....

2. .....

.....

3. .....

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

(ii) Suggest two reasons why people with cystic fibrosis need to take tablets containing digestive enzymes.

1. .....

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2. .....

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

[Total: 9]

END OF QUESTION PAPER

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