

## Tuesday 19 May 2015 – 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 page 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			
<b>Total</b>			

Answer **all** the questions.

- 1 A student prepared a revision table (Table 1.1) on microscopy and cell structure for others in her group to complete.

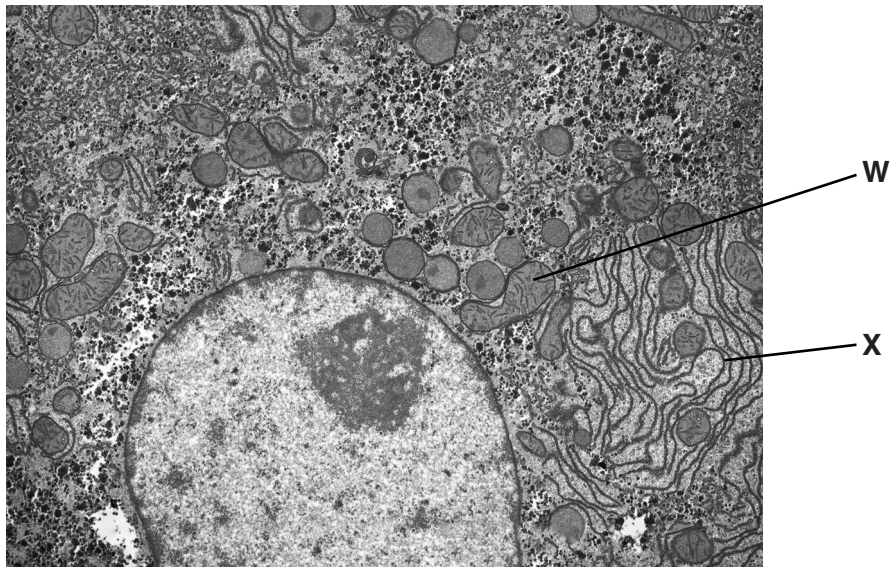
(a) Complete Table 1.1 using the most appropriate word, words or numbers.

Feature	Student microscope	Electron microscope
Beam	.....	electrons
Type of lens	glass	.....
State of specimen	dead or alive	.....
Surroundings of specimen	air or liquid	.....
Maximum magnification	.....	500 000

Table 1.1

[5]

(b) Fig. 1.1 is a photomicrograph of a liver cell.



**Fig. 1.1**

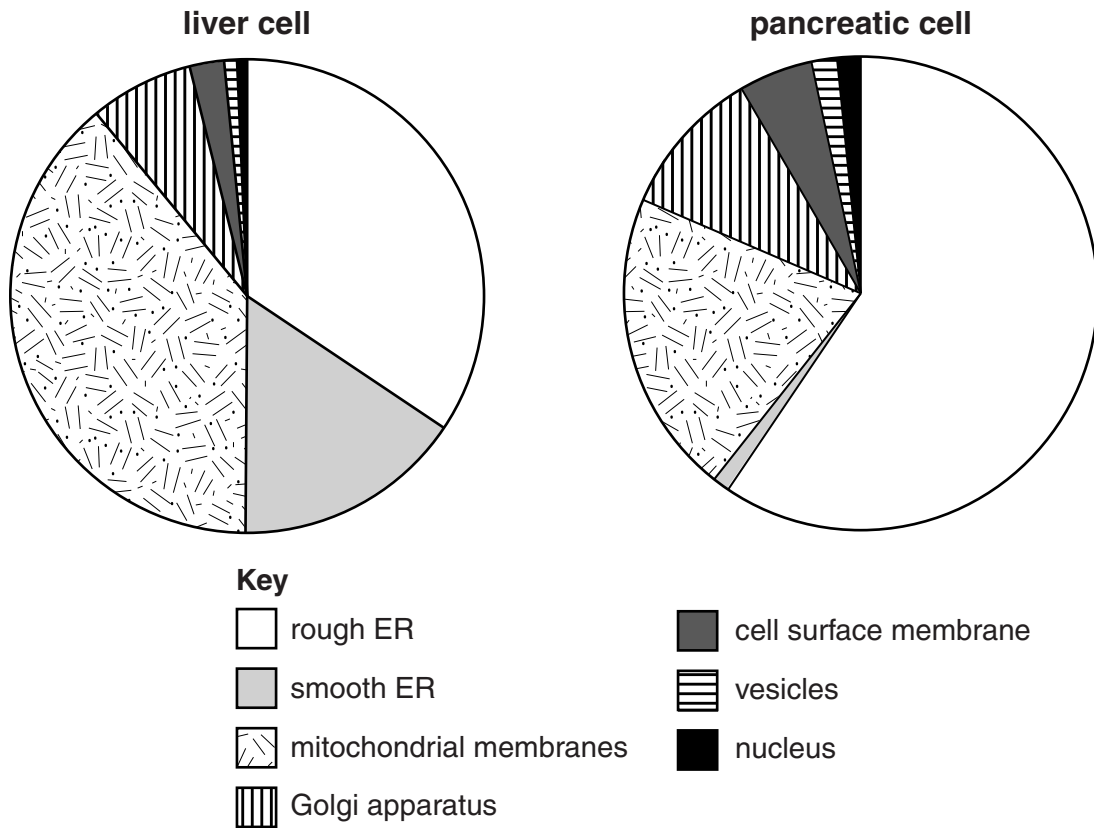
Identify structures **W** and **X** in Fig. 1.1.

**W** .....

**X** .....

[2]

(c) The pie charts in Fig. 1.2 show the relative amounts of types of membrane found in two types of cell.



**Fig. 1.2**

(i) Describe and explain the relative amounts of **mitochondrial membranes** in the two types of cell.

description .....

.....

explanation .....

.....

.....

.....

[2]

(ii) The pancreatic cells secrete more protein than the liver cells.

Use the data in Fig. 1.2 to give **two** pieces of evidence to support this.

.....

.....

.....

..... [2]

[Total: 11]

- 2 Scientists working in a laboratory of a large brewery were studying the growth of yeast cells. During their experiments they used a counting chamber, part of which is shown in Fig. 2.1.

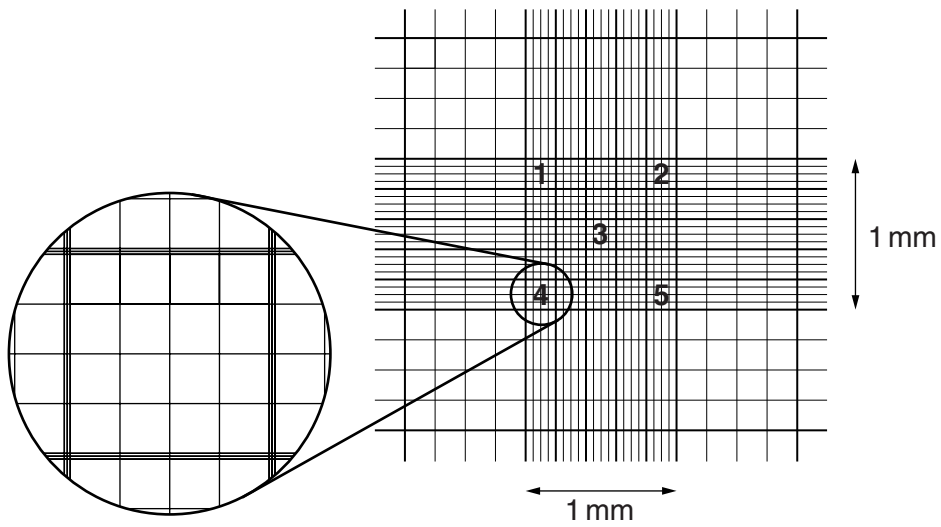


Fig. 2.1

- (a) Name the piece of equipment that contains this type of counting chamber.

..... [1]

- (b) One of the scientists monitored the growth rate of the yeast cells by sampling every four hours.

Fig. 2.2 shows an image of the triple lined square (labelled 4 above) of the first four-hour sample, as viewed under the high power lens of the microscope.

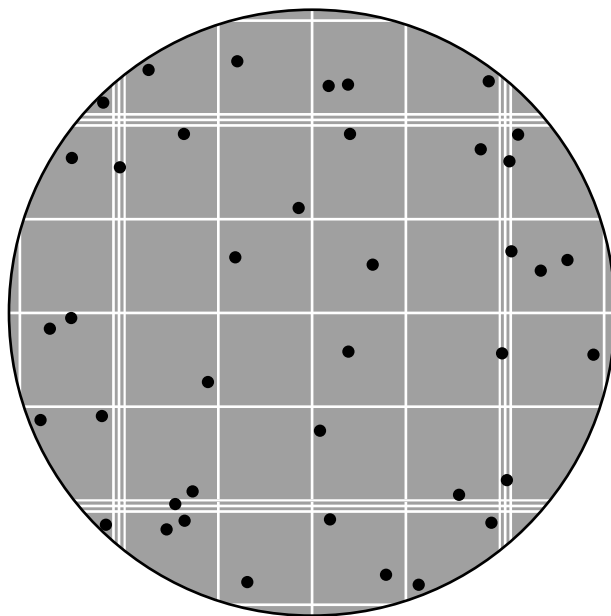


Fig. 2.2

Use Fig. 2.2 to count the number of yeast cells present in the triple lined square.

number of yeast cells = ..... [1]

(c) The counting chamber has a depth of 0.1 mm.

Use the information in Fig. 2.1 to show that the volume of one of the triple lined squares is 0.004 mm<sup>3</sup>.

[The volume of one triple lined square is found by: length × width × depth.]

[2]

(d) Before counting the yeast cells, the scientist diluted the sample by ×1000. The scientist recorded the number of yeast cells counted in each of the five triple lined squares after **eight** hours. The results are shown in Table 2.1.

Diluted sample time / h	Cell counts from each triple lined square				
	1	2	3	4	5
8	26	19	21	22	22

Table 2.1

(i) Suggest **one** reason why the yeast sample was diluted before counting took place.

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

(ii) Use the data in Table 2.1 to calculate the mean number of cells per triple lined square in the diluted sample.

mean = ..... [1]

(iii) The volume of a triple lined square is  $0.004 \text{ mm}^3$ .

Using your answer from **d(ii)**, calculate the number of yeast cells per  $\text{mm}^3$  in the **undiluted** yeast sample after eight hours.

Show your working.

answer = ..... cells per  $\text{mm}^3$  [2]

(e) A Coulter counter is an alternative method to a counting chamber for measuring population growth in yeast.

Suggest **one** advantage and **one** disadvantage of using a Coulter counter.

advantage .....

.....

.....

disadvantage .....

.....

.....

[2]

[Total: 10]



3 Enzymes are used in the food industry to increase the sweetness of foods.

Invertase is an enzyme that converts sucrose into glucose and fructose.

(a) (i) Select the type of bond that must be broken by this enzyme. Tick (✓) **one** box.

Peptide bond

Glycosidic bond

Ester bond

Hydrogen bond

[1]

(ii) Select the reagent(s) that you would use to carry out a test for glucose and fructose (reducing sugars). Tick (✓) **one** box.

Iodine solution

Benedict's reagent

Sodium hydroxide and copper sulfate

Hydrochloric acid, sodium hydroxide & Benedict's reagent

[1]

(iii) State the colour you would expect to see if you carried out this test before and after the action of invertase on sucrose.

before .....

after .....

[2]

(b) Enzymes are also involved in the synthesis of artificial sweeteners such as aspartame.

Aspartame is formed from two amino acids, aspartic acid and phenylalanine. The reaction is catalysed by the enzyme thermolysin.

Indicate on Fig. 3.1, the two groups involved in the formation of the chemical bond needed to produce aspartame.

Put a ring around each group.

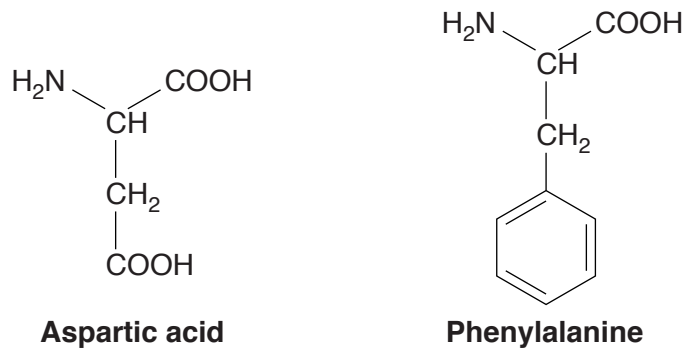


Fig. 3.1

[1]



4 Huntington's disease (Huntington's chorea) is an inherited condition, caused by a mutation in a gene on chromosome 4. The symptoms of the disease usually develop when people are between 30 and 50 years old.

(a) Suggest how a gene mutation might affect protein synthesis.

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

(b) Chris, a nurse, has a family history of Huntington's disease. He is worried that he may be showing early symptoms of progressive chorea (jerky movements).

State two **additional** clinical symptoms that Chris might identify as early indicators of this genetic disease.

1 .....  
.....  
2 .....  
..... [2]

(c) Chris visits a clinical geneticist to find out if he has a mutation which will lead to Huntington's disease. A sample of blood is taken and the number of CAG nucleotide repeats within the Huntington's gene are analysed.

(i) Name the biological molecule in which mutations occur in the Huntington's gene.

..... [1]

(ii) State the names of the **three** components represented by CAG.

C.....

A.....

G.....

[3]



- 5 Monoclonal antibodies may be used to identify and treat diseases. They can also be used to predict ovulation.

Luteinising hormone (LH) is a glycoprotein found in the urine of women. Levels of LH in the urine increase 24 to 36 hours prior to ovulation.

- (a) State what is meant by the term *monoclonal antibodies*.

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

- (b) Fig. 5.1 shows an ovulation test strip. The strip contains monoclonal antibodies that bind to the LH in the urine of a woman. During the ovulation test, the bottom of the strip is placed in a sample of urine.

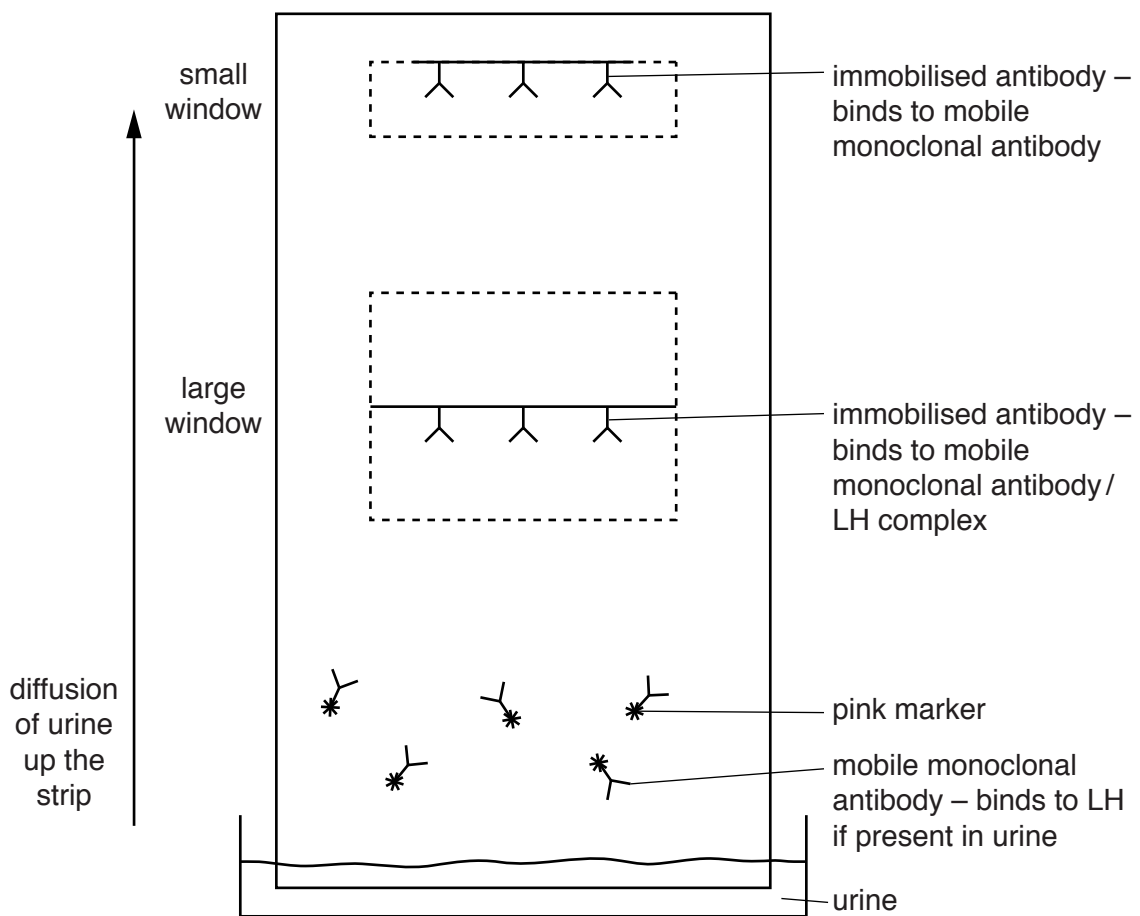


Fig. 5.1

- (i) Use Fig. 5.1 to explain why a pink line would appear in the large window if the glycoprotein LH was present in a urine sample.

.....

.....

.....

..... [2]

- (ii) Use Fig. 5.1 to suggest the purpose of the small window at the top of the strip.

.....

..... [1]

[Total: 4]

**END OF QUESTION PAPER**

**ADDITIONAL ANSWER SPACE**

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

A large rectangular area with a vertical line on the left side and horizontal dotted lines across the page, intended for writing answers.



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