

1: Cells and cell processes – Topic questions

Paper 4

The questions in this document have been compiled from a number of past papers, as indicated in the table below.

Use these questions to formatively assess your learners' understanding of this topic.

Question	Year	Series	Paper number
1	2016	March	42
2	2016	November	43
4	2016	June	41

The mark scheme for each question is provided at the end of the document.

You can find the complete question papers and the complete mark schemes (with additional notes where available) on the School Support Hub at www.cambridgeinternational.org/support

- 1 A researcher used a light microscope to observe epithelial cells from a human cheek. Fig. 1.1 is a photograph that the researcher made of these cells.



Fig. 1.1

- (a) (i) Name the parts labelled **A** and **B**.

A

B [2]

- (ii) The cells in Fig. 1.1 each have a cell membrane.

State **one** of the functions of a cell membrane.

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

- (iii) State how the shape of the cells shown in Fig. 1.1 differs from the shape of a palisade mesophyll cell in a leaf.

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

(b) Fig. 1.2 shows an electron micrograph of a mitochondrion.

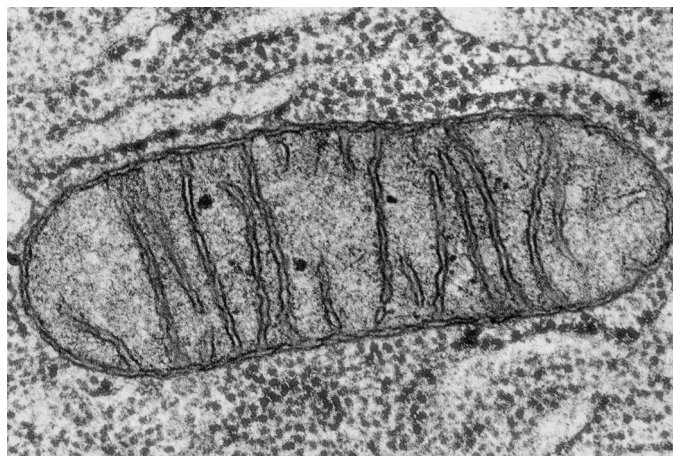


Fig. 1.2

Mitochondria have two membranes, an inner membrane and an outer membrane. The inner membrane is folded and used in respiration.

Suggest why the inner membrane of mitochondria is folded.

.....

.....

.....[1]

- _____

Table 1.1

specialised cell type	average number of mitochondria
liver cell	1000–2000
red blood cell	0
sperm cell	25–75
heart muscle cell	1500

Explain the differences between the average numbers of mitochondria in the cells shown in Table 1.1.

.....[4

[Total: 9]

2 Pectinase is an enzyme used in the production of fruit juice.

(a) Describe in detail how enzymes function, using pectinase as an example.

.....[6]

- (b) An experiment to test the effect of the size of apple pieces on the activity of pectinase was performed by a group of students. Some of their apparatus is shown in Fig. 2.1.

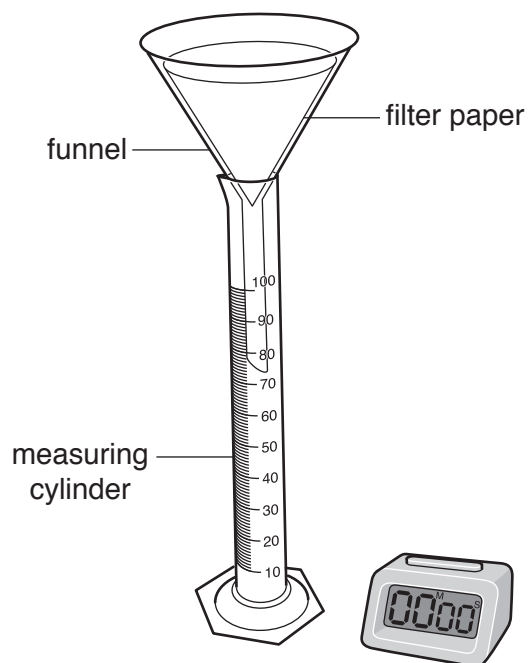


Fig. 2.1

Describe how the students should use the measuring cylinder to obtain **accurate** measurements of volume.

.....

.....

.....

.....

.....[2]

- (c) The students added 1.5 cm^3 of pectinase solution to pieces of apple in a beaker.
They then poured the mixture into the funnel.

They found that it took 10 minutes to collect 19 cm^3 of juice.

- (i) Calculate the rate of the enzyme reaction.

Show your working.

Write your answer to the nearest whole number.

..... cm^3 per min [2]

- (ii) The students performed four experiments using different ways to prepare the apples.

The same total mass and type of apple was used each time.

- A 0.5 cm^3 apple cubes
- B 1.0 cm^3 apple cubes
- C whole peeled small apples
- D whole unpeeled small apples

Predict **and** explain which experiment (A, B, C or D) would result in the fastest rate of reaction.

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

[Total: 12]

4 *Rhabdostyla* is a single-celled organism that has no cell wall and no chlorophyll.

(a) Gases are exchanged across the cell membrane of *Rhabdostyla*.

Name:

the gas produced by *Rhabdostyla*

the process that produces the gas

the method of removal of the gas

[3]

Rhabdostyla lives in freshwater habitats, such as ponds, lakes and rivers.

Freshwater has a very low concentration of solutes.

Rhabdostyla has a contractile vacuole that fills with water and empties at intervals as shown in Fig. 4.1. The contractile vacuole removes excess water.

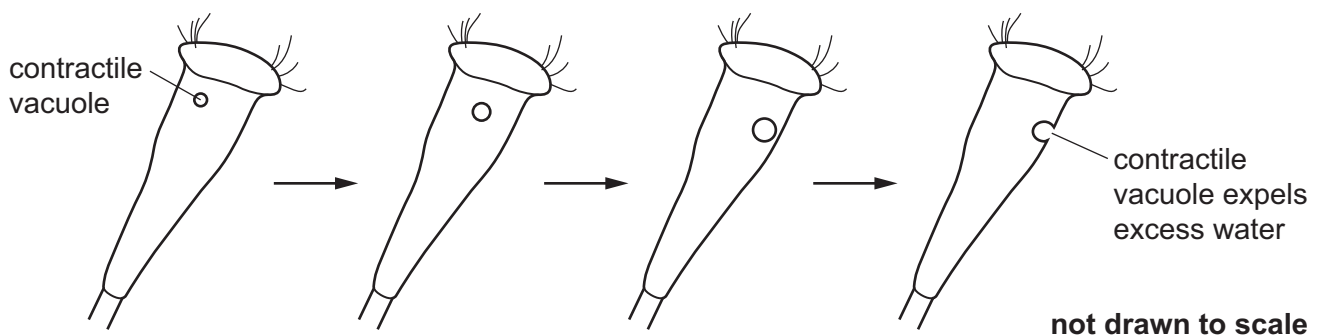


Fig. 4.1

(b) Explain, using the term **water potential**, why *Rhabdostyla* needs to remove excess water.

.....

.....

.....

.....

.....

.....

.....

[3]

In an investigation, individual *Rhabdostyla* were placed into different concentrations of sea water. The rate of water excreted by the contractile vacuole of each organism was determined. The results are shown in Fig. 4.2.

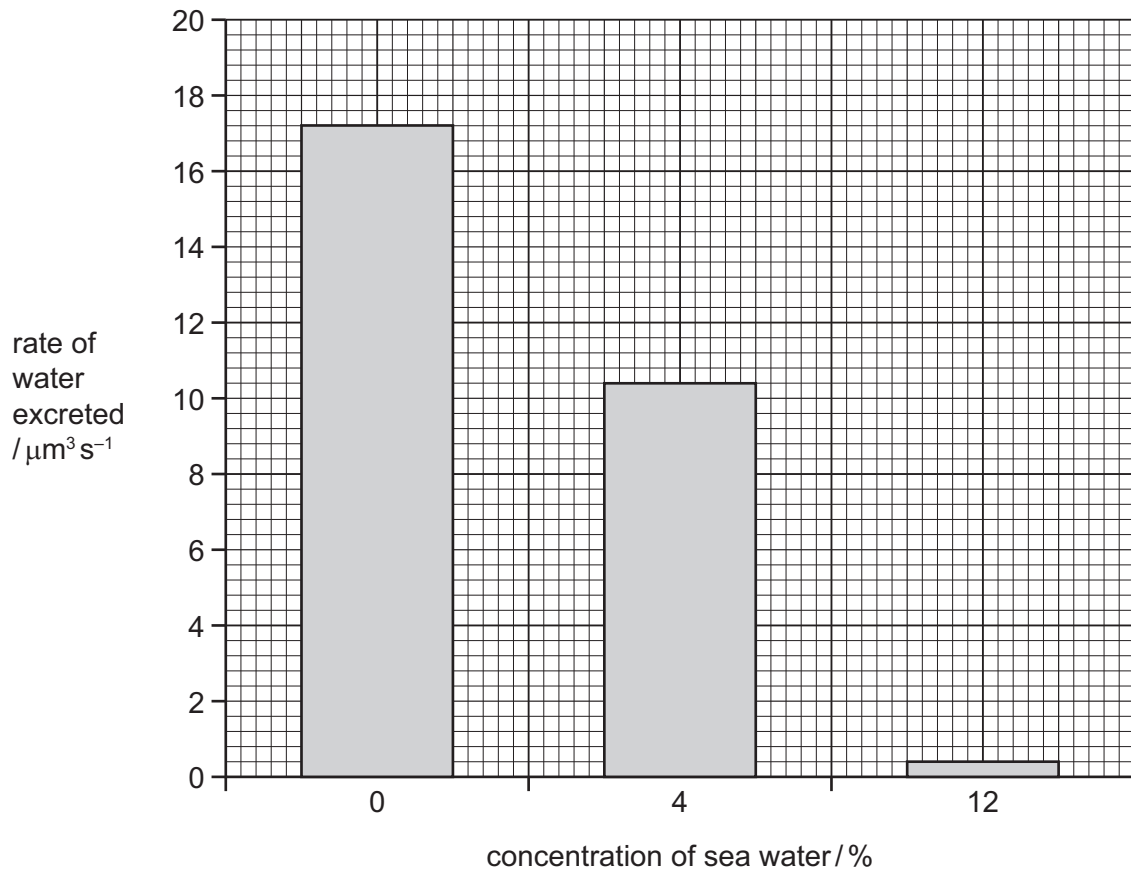


Fig. 4.2

(c) Explain the results shown in Fig. 4.2.

.....

.....

.....

.....

.....

.....

.....

[3]

(d) Single-celled organisms with cell walls do not have contractile vacuoles. Suggest why.

.....

.....

.....

.....

.....

.....

.....

[3]

[Total: 12]

Abbreviations used in the Mark Scheme:

;	separates marking points
/	alternatives
I	ignore
R	reject
A	accept (for answers correctly cued by the question, or guidance for examiners)
AW	alternative wording (where responses vary more than usual)
AVP	any valid point
ecf	credit a correct statement / calculation that follows a previous wrong response
ora	or reverse argument
()	the word / phrase in brackets is not required, but sets the context
<u>underline</u>	actual word given must be used by candidate (grammatical variants excepted)
max	indicates the maximum number of marks that can be given

Question	Answer	Marks
1 (a) (i)	A cytoplasm B nucleus	[2]
1 (a) (ii)	forms a barrier between the cell and its surroundings ; keeps contents of cell inside ; allows / controls / (movement of) substances, into / out, of the cell / across membrane ;	[max 1]
1 (a) (iii)	irregular shape / rounded shape / not columnar / not cylindrical / not rectangular / no specific shape ;	[1]
1 (b)	large surface area ; more surface for respiration ; allows, increased / faster / efficient, respiration ;	[max 1]
1 (c)	1 mitochondria are site of aerobic respiration / production of (most of the) ATP ; 2 liver cell / heart cell, is very active / use lots of energy / respire more; 3 e.g. function of liver cell or heart cell ; 4 sperm cells, are active / swim / beating flagella ; 5 sperm cells have few mitochondria, as they are small ; 6 red blood cells, full of haemoglobin / more space for oxygen / AW ; 7 red blood cells, use less energy / do not actively move ;	[max 4]
		[Total: 9]

Question	Answer	Marks
2(a)	1 enzymes are proteins; 2 enzymes can be reused / are unchanged in a reaction; 3 enzymes are specific; 4 (enzymes are) catalyst / speeds up reaction; 5 lowers (activation) energy needed for the reaction; 6 successful collisions; 7 enzyme-substrate complex / ESC; 8 active site; 9 (enzyme and substrate) complementary shape / AW; 10 ref. to optimum, temperature / pH; 11 too much heat results in denatured enzymes; 12 too little kinetic energy / heat, less (successful) reactions; 13 incorrect pH results in denatured enzymes; 14 (substrate) is pectin / cell wall; 15 results / product, is clear juice; 16 mass / cheaper / more (volume) / yield, juice production;	[6]
2 (b)	read at eye level / avoid error of parallax; read bottom of meniscus; place measuring cylinder on a level / flat, surface; remove funnel / ensure all drops have fallen to the bottom;	[2]
2 (c) (i)	19 ÷ 10 or 17.5 ÷ 10; 2 (cm ³ per min);	[2]
2 (c) (ii)	A / 0.5 (cm ³ cubes); large(st) surface area (to volume);	[1]
		[Total: 12]
4 (a)	carbon dioxide / CO ₂ ; (aerobic) respiration ; (simple) diffusion ;	[3]
4 (b)	water enters by osmosis ; down a water potential gradient / high(er) to low(er) water potential ; through partially permeable membrane ; needs to remove water to prevent bursting ;	[max 3]
4 (c)	as concentration of sea water increases the removal of water decreases ; as concentration of sea water increases the water potential gradient decreases ; therefore less water enters at higher concentrations of sea water ; less excess water ;	[max 3]
4 (d)	cell walls, inelastic / do not stretch / rigid / inflexible / keep shape of cell ; cells, are turgid / have high turgor pressure ; resist any increase in, volume / pressure ; these cells do not absorb excess water ; the cells will not burst ;	[max 3]
		[Total: 12]