

Cell Biology part 1 AQA Combined Science

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Time: **69 minutes**

Marks: **63 marks**

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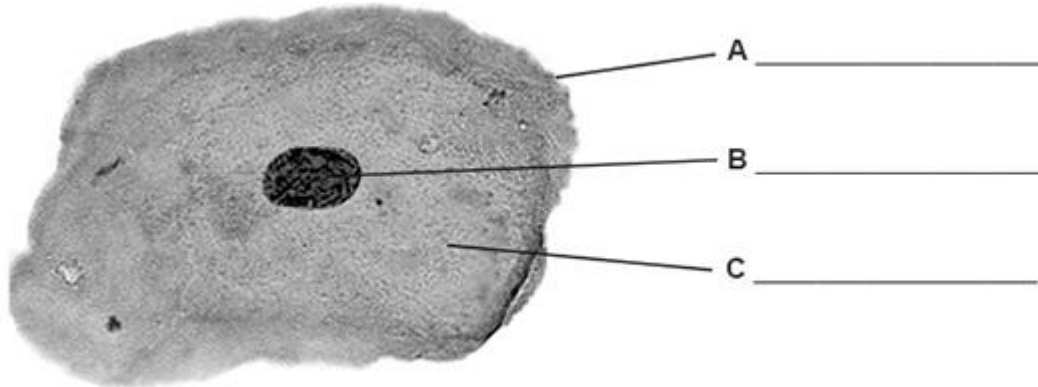
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Q1.

This question is about cells.

Figure 1 shows an animal cell.

Figure 1



(a) Label parts **A**, **B** and **C** on **Figure 1**.

Choose answers from the box.

cell membrane	cell wall	chloroplast
cytoplasm	nucleus	

(3)

(b) What is the function of the nucleus in a cell?

Tick (✓) **one** box.

To contain a solution called cell sap

To control the activities of the whole cell

To control the movement of substances into the cell

(1)

(c) What is the function of the mitochondria in a cell?

Tick (✓) **one** box.

To produce glucose during photosynthesis

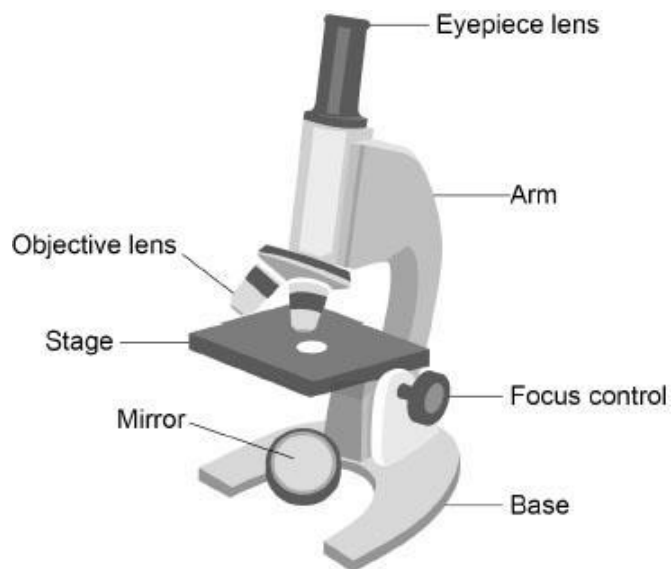
To produce proteins for the cell

To release energy in respiration

(1)

(d) **Figure 2** shows a light microscope.

Figure 2



A student is given a prepared slide of animal cells to view using the microscope.

Complete the sentences.

Use labels from **Figure 2**.

Place the slide on the _____.

Use the objective lens that has low power.

Look through the _____.

Direct the light by moving the _____.

Make the image larger by using the high power _____.

(4)

(e) **Figure 3** shows a different animal cell.

Figure 3



Calculate the magnification of the image in **Figure 3**.

Complete the following steps.

Measure the width of the image from **Y** to **Z**, in millimetres (mm).

Width of image = _____ mm

Give the width of the image in micrometres (μm).

1 mm = 1000 μm

Width of image = _____ μm

The cell in **Figure 3** has a real width of 40 micrometres (μm).

Use the equation to calculate the magnification.

$$\text{magnification} = \frac{\text{width of image in } \mu\text{m}}{\text{real width of cell in } \mu\text{m}}$$

Magnification = \times _____

(4)

(Total 13 marks)

Q2.

A student investigated the concentration of salt in solution **Z**.

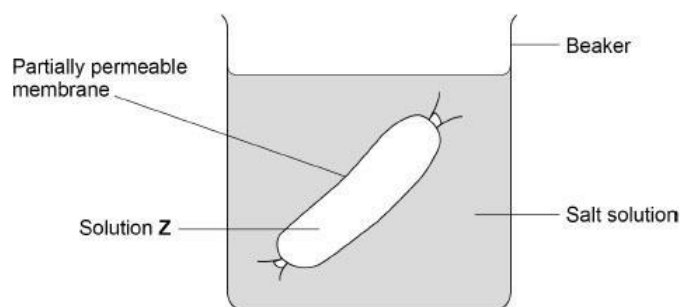
The student used a method involving osmosis.

The student used tubing made of partially permeable membrane.

This is the method used.

1. Cut six pieces of tubing to the same length.
2. Tie one end of each piece of tubing.
3. Put the same volume of solution **Z** into each piece of tubing.
4. Tie the other end of each piece of tubing to form a sealed tube.
5. Record the mass of each tube.
6. Place each tube into a different concentration of salt solution.
7. After 2 hours, remove each tube from the salt solutions.
8. Record the mass of each tube.

Figure 1



(a) What was the independent variable for the investigation?

Tick (✓) **one** box.

Change in mass of tube

Concentration of salt solution

Time in salt solution

Volume of solution **Z**

(1)

- (b) The student dried the outside of each tube with a paper towel before recording the mass.

Why was it important to dry the tubes?

(1)

The table below shows the results.

Concentration of salt solution in mol/dm ³	Mass of tube in grams			Percentage (%) change in mass
	At start	After 2 hours	Change	
0.0	15.54	16.50	0.96	X
0.2	15.16	15.78	0.62	4.1
0.4	15.00	15.35	0.35	2.3
0.6	15.29	15.37	0.08	0.5
0.8	14.95	14.75	-0.20	-1.3
1.0	14.77	14.40	-0.37	-2.5

- (c) Calculate value **X** in the table above.

Give your answer to 1 decimal place.

Value **X** (1 decimal place) = _____ %

(3)

(d) Complete **Figure 2**.

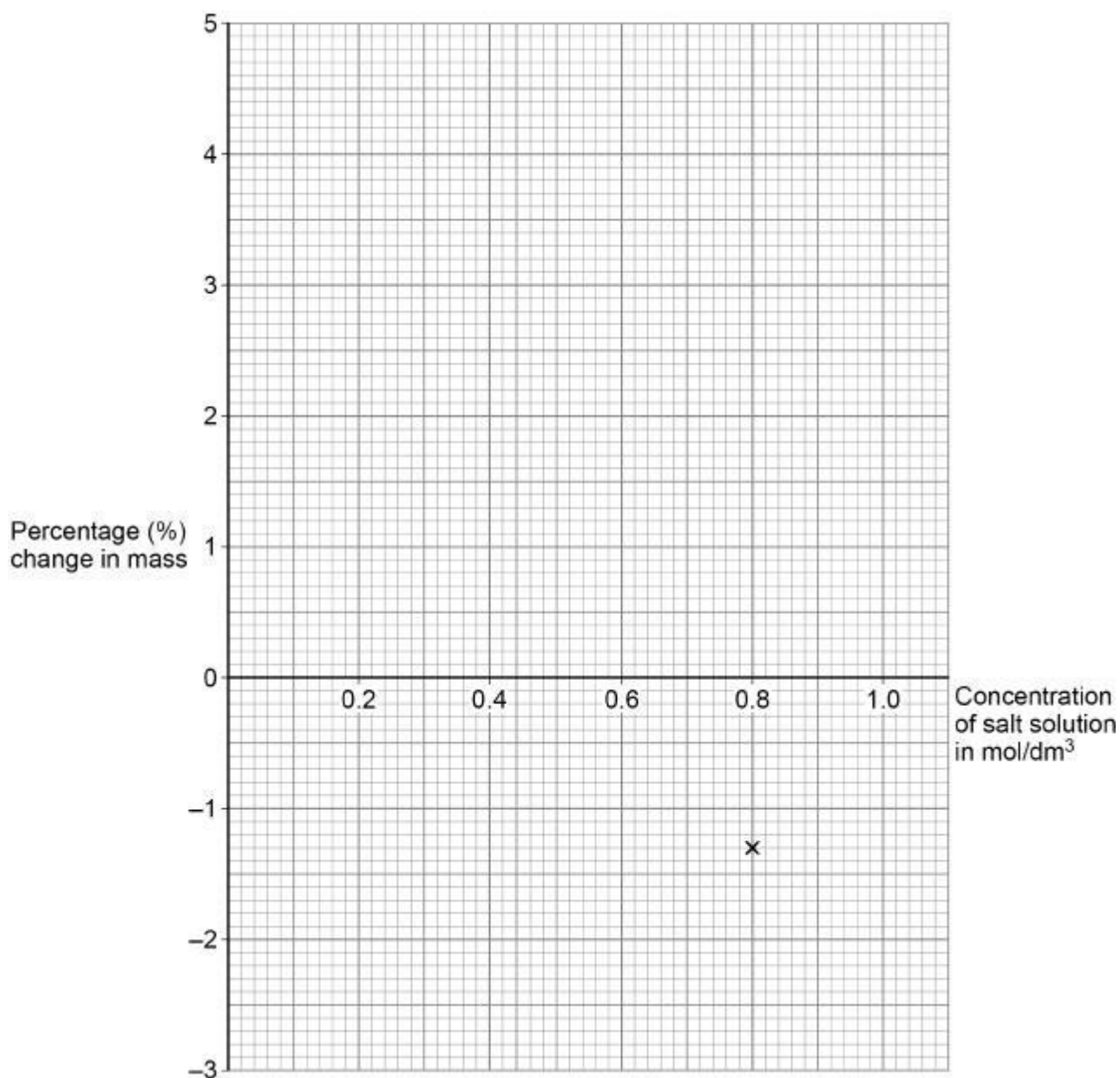
You should:

- plot the percentage change in mass from the table above for salt concentrations of **only** 0.2 mol/dm³ to 1.0 mol/dm³
- draw a line of best fit.

One of the results has been plotted for you.

(3)

Figure 2



(e) Determine the concentration of salt in solution **Z**.

Use **Figure 2**.

Concentration = _____ mol/dm³

(1)

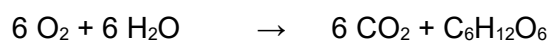
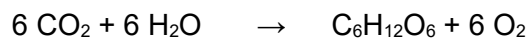
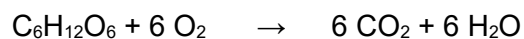
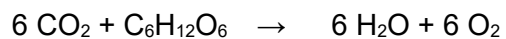
(Total 9 marks)

Q3.

This question is about photosynthesis.

(a) What is the symbol equation for photosynthesis?

Tick (✓) **one** box.



(1)

A student investigated the relationship between temperature and the rate of photosynthesis.

The student measured the volume of gas produced by an aquatic plant in 1 hour.

The student collected the gas in a measuring cylinder.

The table below shows the results.

Temperature in °C	Volume of gas produced in 1 hour in cm ³
10	1
15	2
20	4
25	8
30	16
35	16
40	2
45	0

(b) Describe the effect of increasing temperature on the **rate** of photosynthesis.

Use data from the table above.

(3)

(c) Explain why no gas was produced by the plant at 45 °C.

(2)

(d) How could the student increase the accuracy of the results?

Tick (✓) **one** box.

Repeat the investigation, collecting the gas for 24 hours.

Repeat the investigation, measuring the volume of gas to 0.5 cm³.

Repeat the investigation using a different aquatic plant.

Repeat the investigation, using temperatures of 5 °C and 50 °C.

(1)

A person grows tomatoes in a greenhouse.

- (e) The mean temperature of the greenhouse is 15 °C.

A heater would keep the temperature of the greenhouse at 25 °C.

Suggest **two** reasons **against** using a heater set at 25 °C in the greenhouse.

Do **not** refer to cost in your answer.

1 _____

2 _____

(2)

- (f) The person cut a stem from one of the tomato plants.

The cut stem was placed in soil to grow new roots.

Which tissue in the cut stem will differentiate into new root cells?

Tick (✓) **one** box.

Epidermis

Meristem

Mesophyll

Phloem

(1)

(Total 10 marks)

Q4.

This question is about microscopy.

- (a) **Figure 1** shows bacteria viewed using a microscope.

Figure 1



What type of microscope was used to view the bacteria in **Figure 1**?

Give a reason for your answer.

Type of microscope _____

Reason _____

(1)

- (b) Bacterial cells are prokaryotic cells.

Give **three** ways that a prokaryotic cell is different from a eukaryotic cell.

1 _____

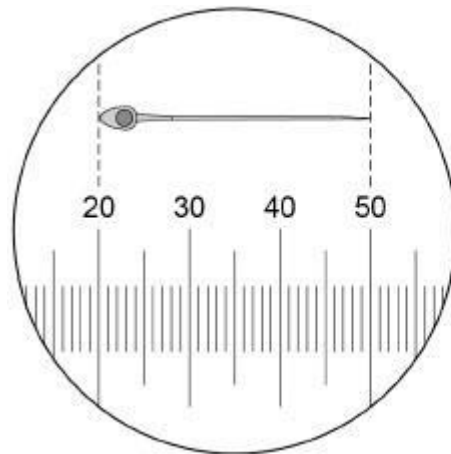
2 _____

3 _____

(3)

- (c) **Figure 2** shows a special slide used to determine the size of a cell viewed using a microscope.

Figure 2



Each small division
on the scale is 1.5 μm

Calculate the magnification of the cell shown in **Figure 2**.

Magnification = \times _____

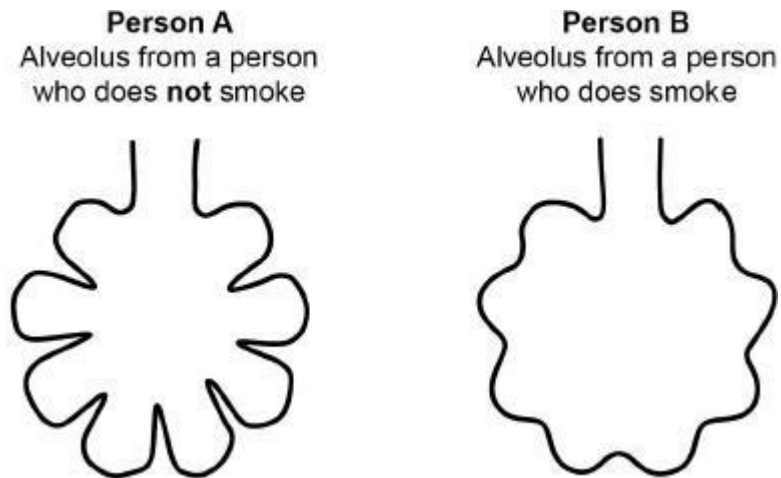
(5)

(Total 9 marks)

(c) Smoking can damage the lungs in different ways.

Figure 2 shows alveoli from the lungs of two people.

Figure 2



Person **A** and person **B** do the same exercise.

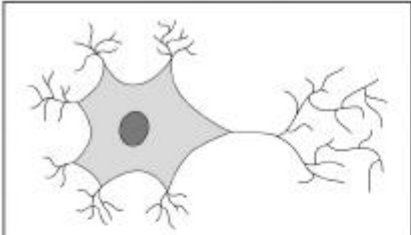


Explain why person **B** breathes much faster than person **A** during the exercise.

(4)
(Total 11 marks)

Q6.

The human body is made of different types of cell.

(a) Draw **one** line from each type of cell to the organ system where the cell is found.

Type of cell	Organ system
 <p data-bbox="501 707 619 741">Brain cell</p>	<p data-bbox="1067 584 1315 618">Circulatory system</p>
 <p data-bbox="469 1057 657 1090">Red blood cell</p>	<p data-bbox="1083 824 1299 857">Nervous system</p>
 <p data-bbox="491 1406 635 1440">Sperm cell</p>	<p data-bbox="1051 1064 1331 1097">Reproductive system</p>
	<p data-bbox="1062 1303 1319 1337">Respiratory system</p>

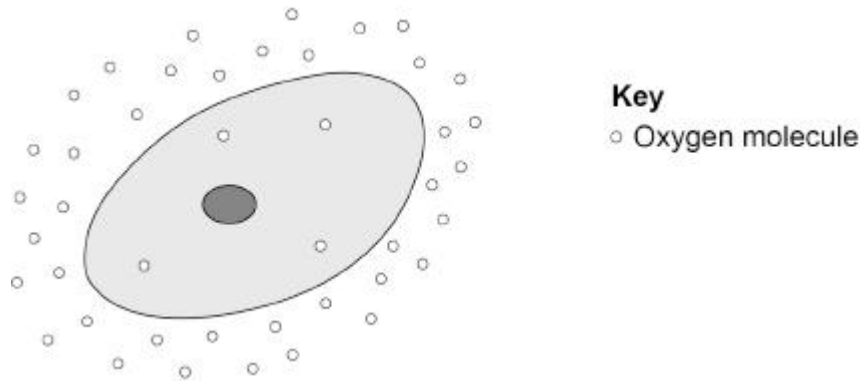
(3)

(b) Explain **one** way a sperm cell is adapted for its function.

(2)

The figure below shows a cell.

Oxygen molecules are shown inside and outside the cell.



(c) Give **one** way you can tell that the cell in the figure above is **not** a plant cell.

(1)

(d) Which part of a cell controls the movement of substances into and out of the cell?

Tick (✓) **one** box.

Cell membrane	<input type="checkbox"/>
Cytoplasm	<input type="checkbox"/>
Nucleus	<input type="checkbox"/>

(1)

(e) What is the name of the process that moves oxygen molecules into the cell in the figure above?

Give the reason for your answer.

Tick (✓) **one** box.

Active transport

Diffusion

Osmosis

Reason _____

(2)

(f) Name **two** substances that move **into** most cells in the body from the blood.

Do **not** refer to oxygen in your answer.

1 _____

2 _____

(2)

(Total 11 marks)

Mark schemes

Q1.

- (a) **A** - (cell) membrane 1
- B** - nucleus 1
- C** - cytoplasm 1
- (b) to control the activities of the whole cell 1
- (c) to release energy in respiration 1
- (d) stage 1
- must be in this order*
- eyepiece lens 1
- allow eyepiece*
ignore lens unqualified
- mirror 1
- objective lens 1
- allow objective*
ignore lens unqualified
- (e) *measurement*
36 (mm) 1
- allow in the range of 35 to 37 (mm)*
- conversion*
36 000 (μm) 1
- allow an answer using student's measurement $\times 1000$*
- substitution*
$$\frac{36\ 000}{40}$$
 1
- allow student's converted measurement divided by 40*
- magnification*
900 1
- do not accept if units given*

[13]

Q2.

- (a) concentration of salt solution 1
- (b) (water / solution on the tube / tubing) would affect / increase the mass
allow the results would not be valid 1
- (c) $\frac{0.96}{15.54} \times 100$ 1
- 6.17 (760618...)(%) 1
- 6.2 (%)
allow answer written in Table 1
allow correct conversion to one decimal place from students' incorrect percentage change calculation using figures from 0.0 Concentration of salt solution in mol/dm³ 1
- (d) all 4 points plotted correctly
allow a tolerance of $\pm \frac{1}{2}$ a small square
allow 1 mark for 3 points plotted correctly
ignore attempt to plot a point for 0 mol/dm³ 2
- line of best fit
ignore extrapolation 1
- (e) value from student's line of best fit
allow a tolerance of $\pm \frac{1}{2}$ a small square
if no line of best fit drawn allow 1 mark for an answer in the range 1

[9]**Q3.**

- (a) $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$ 1
- (b) (as temperature increases) the rate of photosynthesis increases **then**
(the rate of photosynthesis) decreases
ignore references to volume unqualified 1
- fastest rate between 30 °C **and** 35 °C
allow a fastest rate at a temperature above 30 °C and below 35 °C
allow reaches an optimum temperature between 30 °C and 35 °C 1

up to 30 °C the rate doubles every 5 °C increase

allow up to 30 °C the rate increases at an increasing rate

allow up to 30 °C the rate increases exponentially

1

(c) enzymes (in the plant / chloroplast) become destroyed

allow enzymes become denatured

*do **not** accept enzymes are killed*

*do **not** accept cells / plants are denatured*

1

(because) active site changes shape

OR

the active site changes shape (1)

(so) the substrate no longer fits / binds (1)

OR

enzymes (in the plant / chloroplast) become destroyed (1)

allow enzymes become denatured

*do **not** accept enzymes are killed*

*do **not** accept cells / plants are denatured*

(so) the substrate no longer fits / binds (1)

ignore the plant is killed / dead

1

(d) repeat the investigation, measuring the volume of gas to 0.5 cm³

1

(e) any **two** from:

- may have too many tomatoes to eat / sell

*allow the idea of a glut **or** all ripen at the same time*

- other factors could limit photosynthesis

allow other named limiting factor could limit photosynthesis

allow factors could limit tomato production

- the optimum temperature might be above / below 25 °C
- greenhouses are poorly insulated
- pollution from the heater

allow increase carbon dioxide emissions

allow increase global warming

- increase the rate of transpiration

allow increase the water loss from the plant

- increased spread of plant disease(s)

if no other mark awarded allow it is a fire hazard for 1 mark

2

(f) meristem

1

[10]

Q4.

(a) *microscope:*

electron (microscope)

and

reason:

(has a) high resolution / magnification

1

(b) any **three** from:
(prokaryotic cell):

allow converse for eukaryotic cell if clearly stated

- does not have a nucleus
or DNA is free in the cytoplasm
or genetic material is free in cytoplasm
ignore genetic information
- does not have mitochondria
if no other mark awarded, allow prokaryotic cell has no membrane-bound organelles
- has a single loop of DNA
or has a single strand of DNA
ignore genetic information
- (has) plasmids
allow (small) rings of DNA
- (is) smaller
allow bacteria have smaller ribosomes

3

(c) *measurement of cell*
36 (mm)

allow correct calculations in cm or mm
allow in the range of 35 to 37 (mm)
allow in the range 3.5 to 3.7 (cm)

1

conversion

$$36 \times 1000 = 36\,000 \text{ (}\mu\text{m)}$$

1

real size of cell

$$(30 \times 1.5) = 45 \text{ (}\mu\text{m)}$$

1

substitution

$$\text{magnification} = \frac{36\,000}{45}$$

1

800

do not accept if unit given

if no other mark awarded allow 1 mark for:

$$\text{magnification} = \frac{\text{image size}}{\text{real size}}$$

or correct rearrangement

1

[9]

Q5.

(a) DNA replicates

or

two copies of each chromosome form

allow a maximum of 3 marks if the stages are out of order

allow DNA duplicates / doubles

allow genetic material doubles

ignore genetic information replicates

*do **not** accept DNA reproduces*

1

one set of chromosomes is pulled to each end of the cell

allow one set of chromosomes is moved to each end of the cell

ignore half the chromosomes are moved to each end of the cell

1

nucleus divides

allow two (new) nuclei form

1

cytoplasm **or** cell membrane divides **and** two genetically identical cells form

*allow cytokinesis **and** two genetically identical cells form*

ignore names of phases of mitosis

if no other mark awarded allow 1 mark for mitosis

1

(b) uncontrolled cell division / growth

1

invade neighbouring tissues

1

(tumour) cells spread to different parts of the body / tissues in the blood / lymph

allow tumour metastasises

1

(c) (need to breathe faster / deeper) to get more oxygen

allow the converse if clearly stated

1

(because) smaller surface area

1

(so) less oxygen in the blood

allow (so) less oxygenation of haemoglobin

1

(so) less (oxygen for) respiration

allow (so) anaerobic respiration increases

allow (so) lactic acid is produced

allow (so) an oxygen debt is created

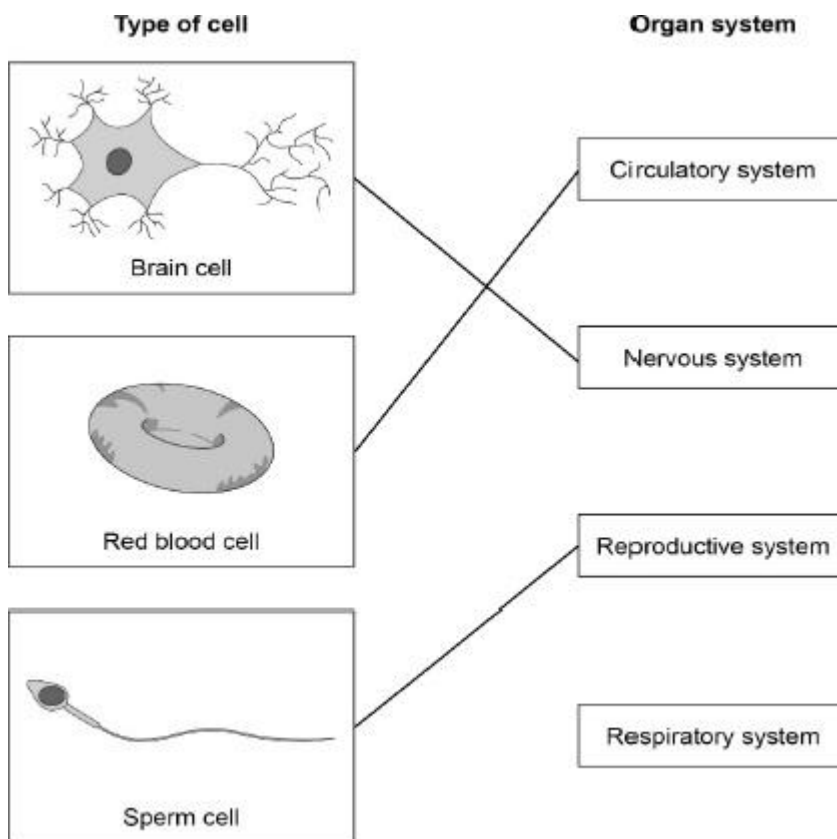
do not accept energy produced / made / created

1

[11]

Q6.

(a)



do not accept more than one line from a box on the left

3

(b) has a tail

allow has flagellum

1

(so) it can swim

allow so it can move / travel

OR

has (many) mitochondria (1)

to transfer / release / energy (for sperm to swim) (1)

allow for energy

do not accept energy is made / produced / created

OR

has enzyme(s) (1)

to penetrate into the egg (1)

OR

is streamlined (1)

to swim faster (1)

OR

has 23 chromosomes (1)

to produce 46 chromosomes in fertilised cell (1)

allow a correct adaptation (1)

and linked explanation (1)

1

(c) any **one** from:

(cell in the figure) does **not** have

- a (cell) wall
- a (large) vacuole
- chloroplasts

ignore chlorophyll

1

(d) cell membrane

1

(e) diffusion

1

Reason:

concentration (of oxygen) is greater outside the cell

or

concentration (of oxygen) is lower inside the cell

*allow (oxygen moves) from a high concentration
to a low concentration*

*allow there is more (oxygen) outside the cell
(than inside the cell)*

*allow there is less (oxygen) inside the cell (than
outside the cell)*

*ignore oxygen moves along a concentration
gradient*

1

(f) any **two** from:

ignore oxygen

- glucose / sugar
- water

allow H₂O

- amino acids
- fatty acids
- glycerol

- mineral ions
allow minerals / salts / vitamins / hormones
allow named ion / mineral / vitamin / hormone

ignore carbon dioxide
ignore urea

2

[11]