

Cell Biology part 13 AQA Combined Science

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Time: **72 minutes**

Marks: **72 marks**

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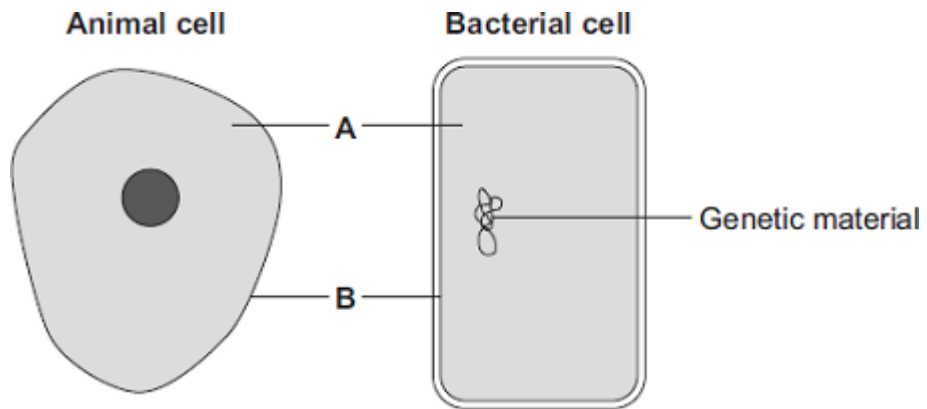
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Q1.

The diagrams show an animal cell and a bacterial cell.



- (a) (i) Structures **A** and **B** are found in both the animal cell and the bacterial cell.

Use words from the box to name structures **A** and **B**.

cell membrane	chloroplast	cytoplasm	vacuole
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A _____

B _____

(2)

- (ii) Both cells contain genetic material.

Name the structure in the animal cell that contains genetic material.

(1)

(b) **List A** gives three structures found in animal cells.

List B gives four functions of cell structures.

Draw **one** line from each structure in **List A** to its correct function in **List B**.

List A – Structure

Cell membrane

Mitochondrion

Ribosome

List B – Function

Controls what substances enter the cell

Photosynthesis

Protein synthesis

Respiration

(3)

(Total 6 marks)

Q2.

- (a) (i) Mitosis and meiosis are types of cell division.

For each feature in the table, tick (✓) **one** box to show if the feature occurs:

- only in mitosis
- only in meiosis.

Feature	Only in mitosis (✓)	Only in meiosis (✓)
Produces new cells during growth and repair		
Produces gametes (sex cells)		
Produces genetically identical cells		

(2)

- (ii) Name the organ that produces gametes (sex cells) in:

a man _____

a woman _____

(2)

- (b) **X** and **Y** chromosomes are the sex chromosomes. They determine a person's sex.

What sex chromosomes will be found in the body cells of:

(i) a man _____

(1)

(ii) a woman? _____

(1)

- (c) A man and a woman decide to have a child.

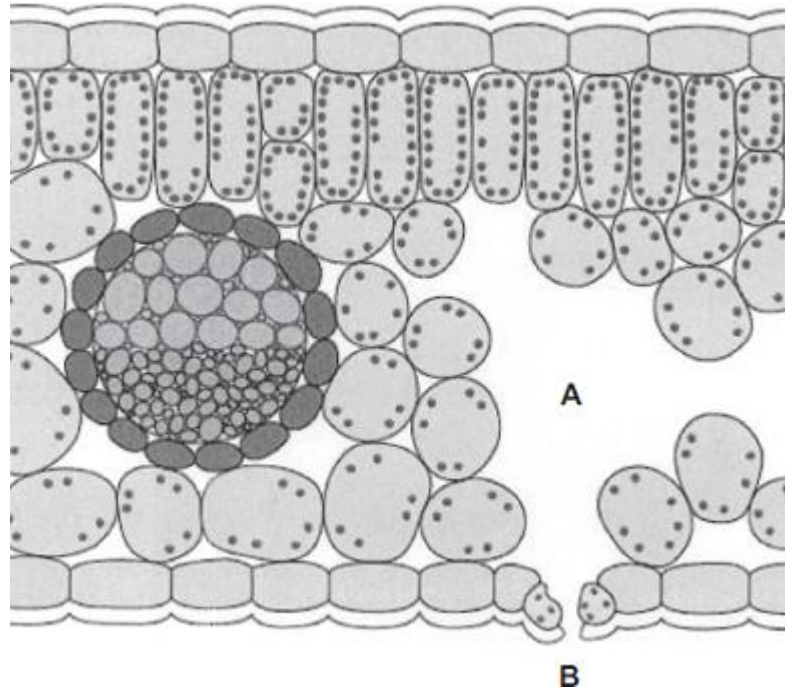
What is the chance that the child will be a boy? _____

(1)

(Total 7 marks)

Q3.

The diagram shows a section through a plant leaf.



- (a) Use words from the box to name **two** tissues in the leaf that transport substances around the plant.

epidermis	mesophyll	phloem	xylem
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_____ and _____

(1)

- (b) Gases *diffuse* between the leaf and the surrounding air.

- (i) What is *diffusion*?

(2)

- (ii) Name **one** gas that will diffuse from point **A** to point **B** on the diagram on a sunny day.

(1)

(Total 4 marks)

Q4.

The photographs show the flowers of two closely-related species of plant.

Species A



Species B



Images: © iStock/Thinkstock

The drawings show chromosomes from one cell in the root of each plant during cell division.

Species A



**One
chromosome**

Species B



**One
chromosome**

(a) The drawings show that each chromosome has two strands of genetic material.

(i) How does a chromosome become two strands?

(1)

(ii) Explain why each chromosome must become two strands before the cell divides.

(2)

(b) For sexual reproduction, the plants produce gametes.

(i) Name the type of cell division that produces gametes.

(1)

(ii) How many chromosomes would there be in a gamete from each of these two plant species?

Species A **Species B**

(1)

(iii) It is possible for gametes from **Species A** to combine with gametes from **Species B** to produce healthy offspring plants.

How many chromosomes would there be in each cell of one of the offspring plants?

(1)

(c) (i) Look back at the information at the start of the question and the information from part (b).

What evidence from these two pieces of information supports the belief that **Species A** and **Species B** evolved from a common ancestor?

(2)

- (ii) For successful gamete production to take place, chromosomes that contain the same genes must pair up.

The drawings showing the chromosomes of **Species A** and of **Species B** are repeated below.

Species A



Species B



The offspring plants cannot reproduce sexually.

Suggest an explanation for this.

(2)

(Total 10 marks)

Q5.

Plants exchange substances with the environment.

- (a) Plant roots absorb water mainly by osmosis.
Plant roots absorb ions mainly by active transport.

Explain why roots need to use the two different methods to absorb water and ions.

(4)

(b) What is meant by the *transpiration stream*?

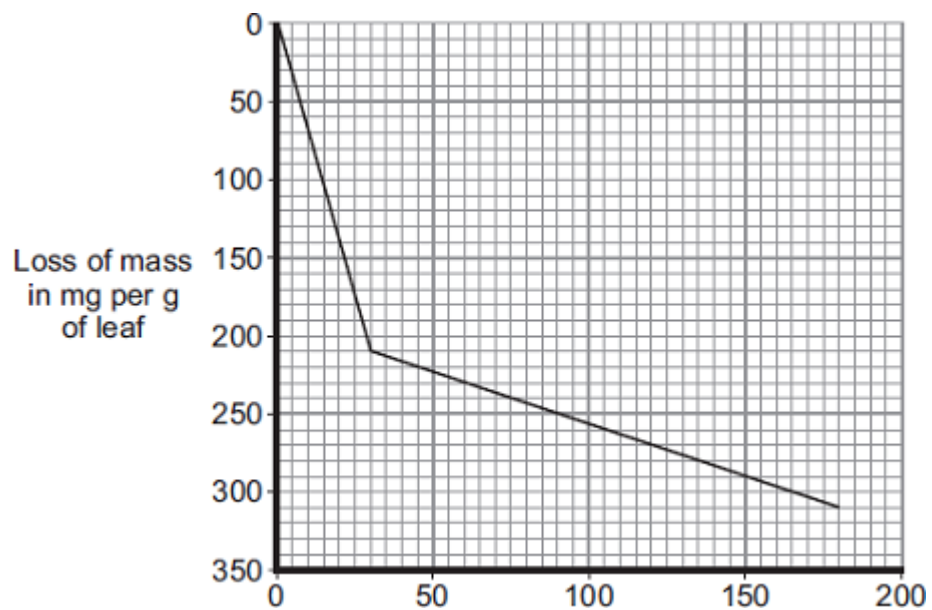
(3)

(c) Students investigated the loss of water vapour from leaves.

The students:

- cut some leaves off a plant
- measured the mass of these leaves every 30 minutes for 180 minutes.

The graph shows the students' results.



(i) The rate of mass loss in the first 30 minutes was 7 milligrams per gram of leaf per minute.

Calculate the rate of mass loss between 30 minutes and 180 minutes.

Rate of mass loss = _____ milligrams per gram of leaf per minute

(2)

- (ii) The rate of mass loss between 0 and 30 minutes was very different from the rate of mass loss between 30 and 180 minutes.

Suggest an explanation for the difference between the two rates.

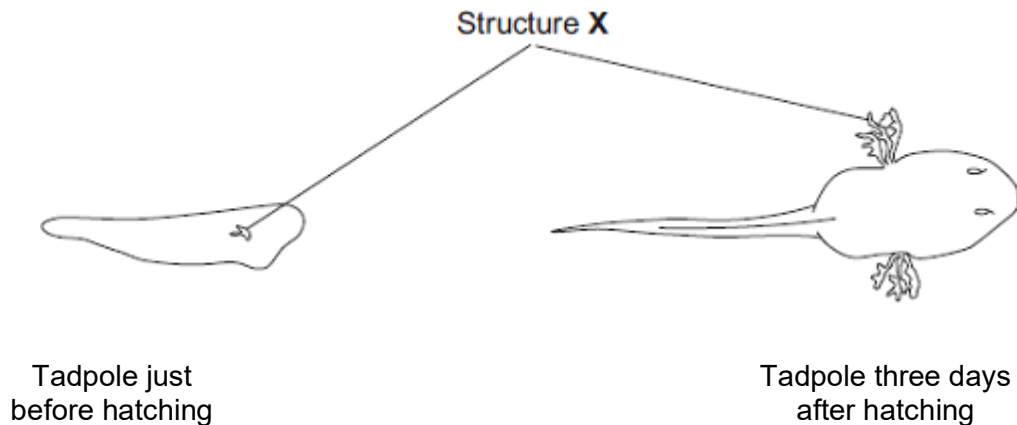
(2)
(Total 11 marks)

Q6.

The young stages of frogs are called tadpoles. The tadpoles live in fresh water.

The drawings show a tadpole just before hatching and three days after hatching.

Structure **X** helps in the exchange of substances between the tadpole and the water.



- (a) Name **one** substance, other than food, that the tadpole needs to exchange with the water in order to grow.

(1)

- (b) Suggest how the changes in the tadpole shown in the drawings help it to survive as it grows larger.

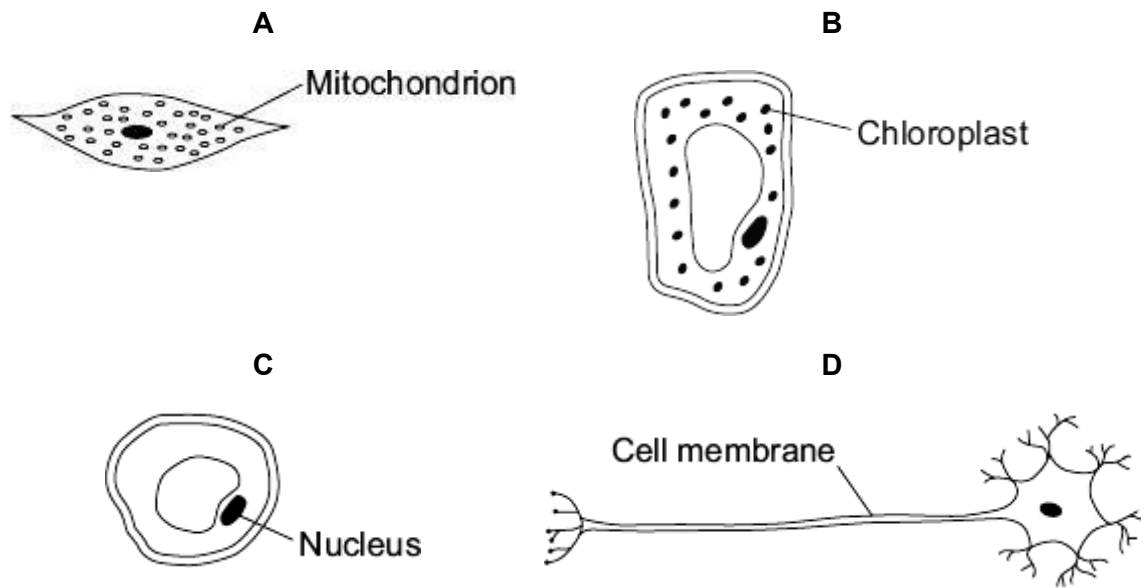
You should **not** refer to movement in your answer.
To gain full marks you should refer to structure **X**.

(4)

(Total 5 marks)

Q7.

The diagrams show four cells, **A**, **B**, **C** and **D**.



Use letters **A**, **B**, **C** or **D** to answer these questions.

(a) Which cell can photosynthesise?

(1)

(b) Which cell is adapted for receiving and sending information?

(1)

(c) Which cell is adapted to respire quickly?

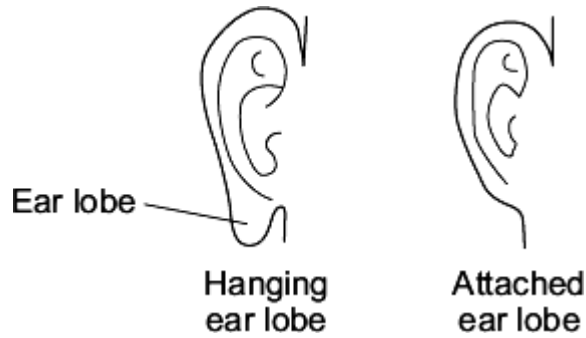
(1)

(Total 3 marks)

Q8.

People have different shaped ear lobes, either 'hanging' or 'attached'.

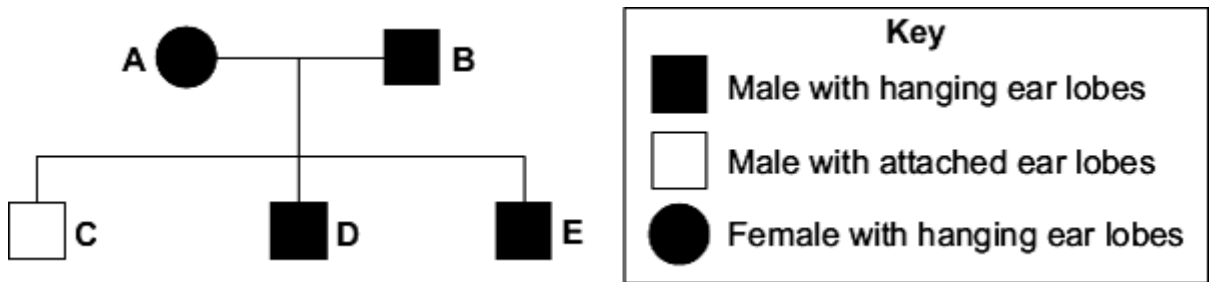
The diagrams show the two shapes of ear lobe.



A gene controls the shape of a person's ear lobes.

The diagram shows a family tree.

Parents **A** and **B** both have hanging ear lobes.



(a) The key does **not** show the symbol for a female with attached ear lobes.

Draw the symbol for the key to show a female with attached ear lobes.

Use information in the family tree and the key.

Symbol = _____

(1)

(b) Look at the family tree.

What does the information in the family tree tell you about the allele for hanging ear lobes?

Draw a ring around the correct word to complete the sentence.

The allele for hanging ear lobes is

- dominant.
- weak.
- recessive.

(1)

- (c) (i) Parents **A** and **B** have three children, **C**, **D** and **E**.
All three children are boys.

What are the chances that the next child of parents **A** and **B** will be a girl?

Draw a ring around **one** answer.

no chance (0 %) **a half (50 %)** **certain (100 %)**

(1)

- (ii) Which statement explains your answer to part (c)(i)?

Tick (✓) **one** box.

Some of **B**'s sperm cells have an X chromosome.

Some of **A**'s egg cells have a Y chromosome

All of **B**'s sperm cells have an X chromosome.

(1)

(Total 4 marks)

Q9.

Stem cells can be collected from human embryos and from adult bone marrow. Stem cells can develop into different types of cell.

The table gives information about using these two types of stem cell to treat patients.

Stem cells from human embryos	Stem cells from adult bone marrow
It costs £5000 to collect a few cells.	It costs £1000 to collect many cells.
There are ethical issues in using embryo stem cells.	Adults give permission for their own bone marrow to be collected.
The stem cells can develop into most other types of cell.	The stem cells can develop into only a few types of cell.
Each stem cell divides every 30 minutes.	Each stem cell divides every four hours.
There is a low chance of a patient's immune system rejecting the cells.	There is a high chance of a patient's immune system rejecting the cells.
More research is needed into the use of these stem cells.	Use of these stem cells is considered to be a safe procedure.

Scientists are planning a new way of treating a disease, using stem cells.

Use **only** the information above to answer these questions.

- (a) Give **three** advantages of using stem cells from embryos instead of from adult bone marrow.

1. _____
2. _____
3. _____

(3)

- (b) Give **three** advantages of using stem cells from adult bone marrow instead of from embryos.

1. _____
2. _____
3. _____

(3)

(Total 6 marks)

Q10.

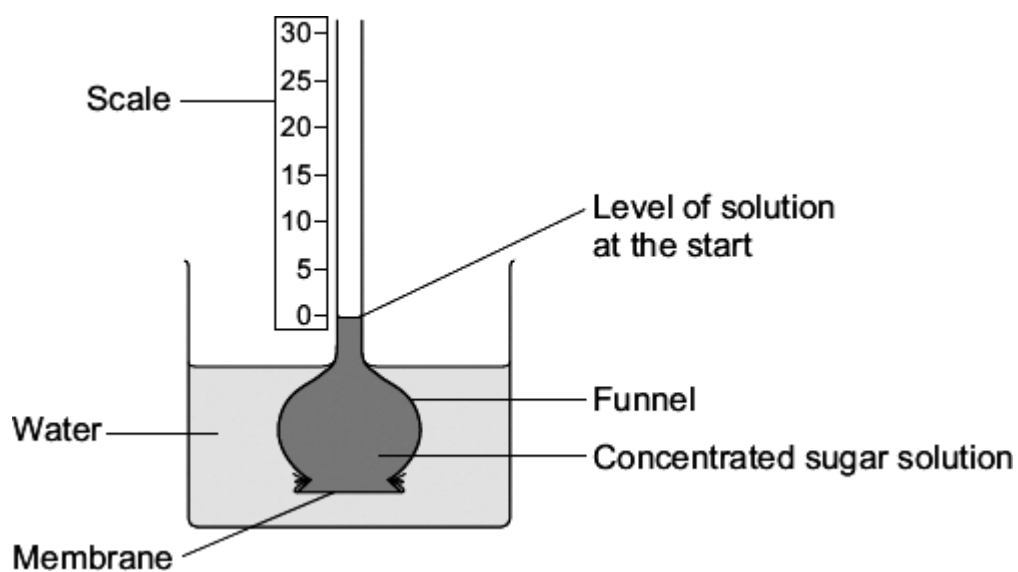
Some substances move through membranes.

A student set up an investigation.

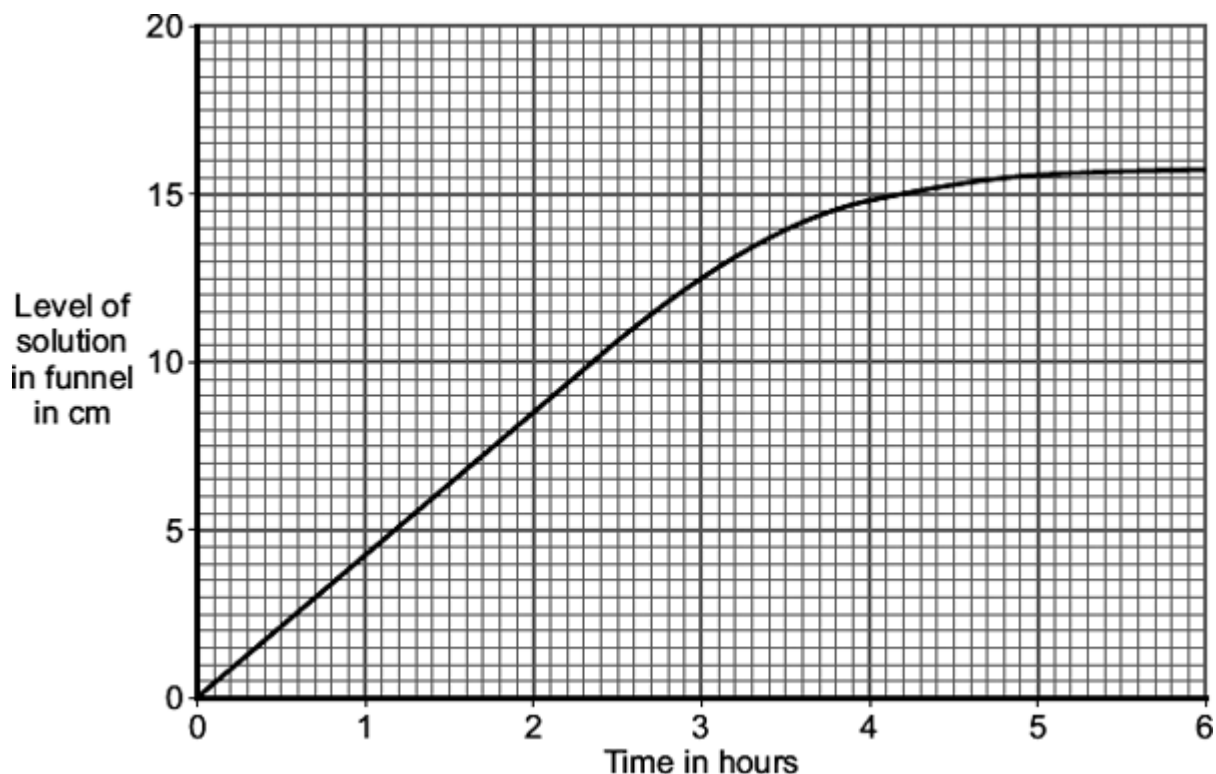
The student:

- tied a thin membrane across the end of a funnel
- put concentrated sugar solution in the funnel
- put the funnel in a beaker of water
- measured the level of the solution in the funnel every 30 minutes.

The diagram shows the apparatus.



The graph shows the results.



- (a) After 3 hours, the level of the solution in the funnel is different from the level at the start.

Explain why, as fully as you can.

(3)

- (b) The student repeated the investigation using dilute sugar solution instead of concentrated sugar solution.

In what way would you expect the results using dilute sugar solution to be different from the results using concentrated sugar solution?

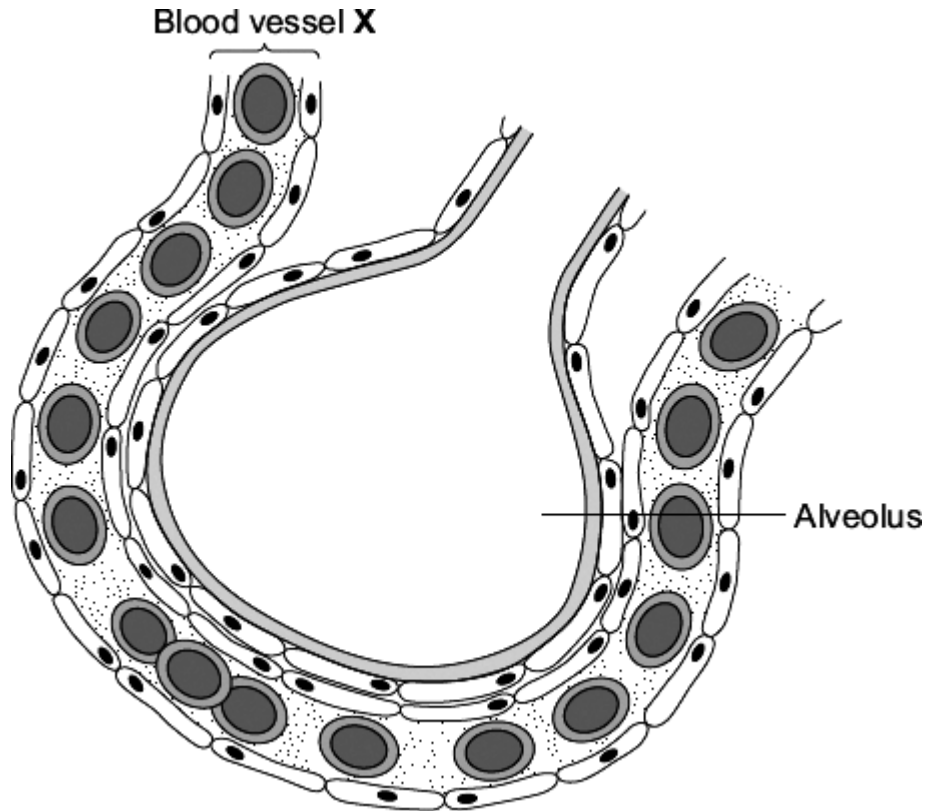
Give the reason for your answer.

(2)

(Total 5 marks)

Q12.

The diagram shows an alveolus and a blood vessel in the lung.



(a) Draw a ring around the correct answer to complete each sentence.

(i) Blood vessel X is

- an artery.
- a capillary.
- a vein.

(1)

(ii) Gases pass across the wall of the alveolus by

- diffusion.
- evaporation.
- fermentation.

(1)

- (iii) The table compares the concentrations of some gases in inhaled air and exhaled air.

Complete the table.

Write 'lower' or 'higher' in each box.

One line has been completed for you as an example.

Gas	Concentration	
	Inhaled air	Exhaled air
Water vapour	lower	higher
Carbon dioxide		
Oxygen		

(2)

- (b) Draw a ring around the correct answer to complete each sentence.

- (i) Oxygen is carried in the blood mainly in

blood plasma.
red blood cells.
white blood cells.

(1)

- (ii) In the blood, the oxygen combines with

carbon dioxide.
haemoglobin.
urea.

(1)

(Total 6 marks)

Mark schemes

Q1.

(a) (i) A = cytoplasm

1

B = (cell) membrane

1

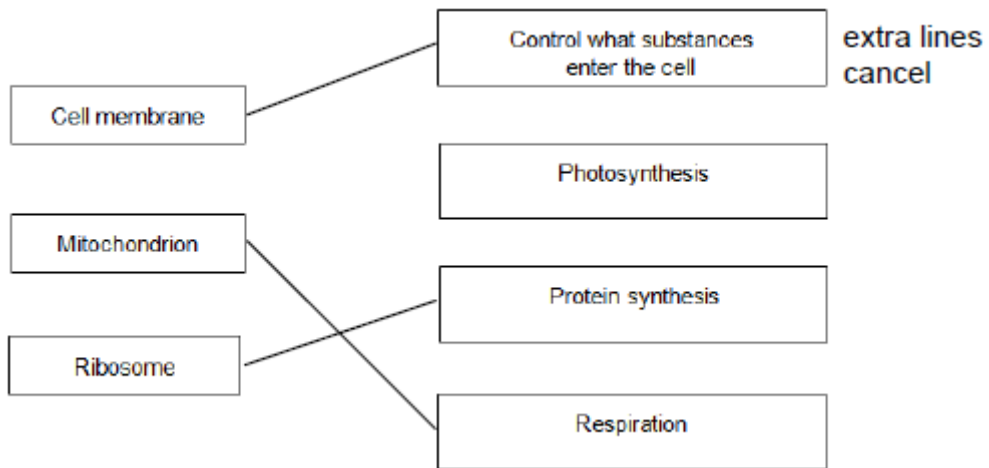
(ii) nucleus

accept chromosome / DNA / genes

accept phonetic

1

(b)



3

[6]

Q2.

(a) (i)

Feature	Mitosis only	Meiosis only
Produces new cells during growth and repair	✓	
Produces gametes (sex cells)		✓
Produces genetically identical cells	✓	

All 3 correct = **2** marks

2 correct = **1** mark

0 or 1 correct = **0** marks

2

- (ii) (a man) testis / testes
accept testicle(s) 1
- (a woman) ovary / ovaries
do not accept 'ova' / ovule 1
- (b) (i) XY / YX
or
X and Y 1
- (ii) XX
or
X and X or 2 X's
accept X 1
- (c) $\frac{1}{2}$ / 0.5 / 50% / 1:1 / 1 in 2
do not accept 1:2 / 50/50
allow 50:50
allow 2 in 4 1
- [7]

Q3.

- (a) xylem **and** phloem
either order
allow words ringed in box
allow mis-spelling if unambiguous 1
- (b) (i) movement / spreading out of particles / molecules / ions / atoms
ignore names of substances / 'gases' 1
- from high to low concentration
accept down concentration gradient
ignore 'along' / 'across' gradient
ignore 'with' gradient 1
- (ii) oxygen / water (vapour)
allow O₂ / O2
ignore O² / O
allow H₂O / H2O
ignore H²O 1
- [4]

Q4.

- (a) (i) DNA replication / copies of genetic material were made
'it' = a chromosome
allow chromosomes replicate / duplicate / are copied
ignore chromosomes divide / split / double 1
- (ii) one copy of each (chromosome / chromatid / strand) to each offspring cell
ignore ref. to gametes and fertilisation 1
- each offspring cell receives a complete set of / the same genetic material
allow 'so offspring (cells) are identical' 1
- (b) (i) meiosis
allow mieosis as the only alternative spelling 1
- (ii) Species A = 4 **and** Species B = 8 1
- (iii) sum of A + B from (b)(ii) e.g. 12 1
- (c) (i) similarities between chromosomes
or
similarities between flowers described
e.g. shape of petals / pattern on petals / colour / stamens 1
- can breed / can sexually reproduce
allow can reproduce with each other / they can produce offspring 1
- (ii) any **two** from:
- offspring contain 3 copies of each gene / of each chromosome / odd number of each of the chromosomes
 - some chromosomes unable to pair (in meiosis)
 - (viable) gametes not formed / some gametes with extra / too many genes / chromosomes
- or**
some gametes with missing genes / chromosomes 2
- [10]
- Q5.**
- (a) solution in soil is more dilute (than in root cells)
concentration of water higher in the soil (than in root cells) 1

so water moves from the dilute to the more concentrated region
*so water moves down (its) concentration gradient **or** water moves from a high concentration of water to a lower concentration*

1

concentration of ions in soil less (than that in root cells)

1

so energy needed to move ions

or

ions are moved against concentration gradient

the direction of the concentration gradient must be expressed clearly

accept correct reference to water potential or to concentrations of water

1

(b) any **three** from:

- movement of water from roots / root hairs (up stem)
- via xylem
- to the leaves
- (water) evaporates
- via stomata

3

(c) (i) 0.67/0.7

accept 0.66, 0.666666... or $\frac{2}{3}$ or 0.6

correct answer gains 2 marks with or without working

*if answer incorrect allow evidence of $\frac{100}{150}$ for 1 mark
do **not** accept 0.6 or 0.70*

2

(ii) during the first 30 minutes

any **one** from:

- it was warmer
- it was windier
- it was less humid
- there was more water (vapour) in the leaves

1

so there was more evaporation

ignore 'water loss'

or

stomata open during first 30 minutes **or** closed after 30 minutes (1)

so faster (rate of) evaporation in first 30 min **or** reducing (rate of) evaporation after 30 min (1)

1

[11]

Q6.

(a) oxygen / O₂

allow O₂

do not accept O²

or

carbon dioxide / CO₂

allow CO₂

do not accept CO²

1

(b) any **four** from:

ignore references to tail used for locomotion

ignore reference to nostrils

- because structure X / gills has threads / filaments **or** is thin **or** tadpole has longer tail
- there is an increased surface area
- there is a shorter diffusion pathway
- therefore an increase in exchange
ignore food
- eyes (now visible in older tadpole)
- so that food / danger etc can be seen
accept reference to a good blood supply
accept increased water flow over gills / tail will increase diffusion of gases

4

[5]

Q7.

(a) B

1

(b) D

1

(c) A

1

[3]

Q8.



*the shape must be (roughly) circular **and** not shaded, for the mark*

accept the shape drawn in the key if it is not contradictory

1

(b) dominant

1

(c) (i) a half (50%)

1

(ii) Some of B's sperm cells have an X chromosome

1

[4]

Q9.

(a) *comparisons are **not** required but should be credited
accept a clear indication of the statement even if incomplete*

can develop into most other types of cell

1

each cell divides every 30 minutes

1

low chance of rejection by the patient's immune system

1

(b) any **three** from:

- cheaper / only costs £1000
*this **must** be comparative
ignore costs £1000*
- can collect many (stem) cells
- adults give permission for their own bone marrow to be collected
comparisons are not required but should be credited
- safe

3

[6]

Q10.

(a) water enters (funnel / sugar solution) **or** water diffuses in (to the funnel)
*do **not** accept if diffusion of sugar*

1

membrane partially / selectively / semi permeable **or** by osmosis
allow description

1

because concentration (of sugar) greater
inside funnel than outside / water / in beaker

*assume 'concentration' refers to sugar unless candidate
indicates otherwise
the position of the solutions may be implied*

1

(b) (level / it) rises more slowly **or** levels out earlier **or** does not rise as much

accept inference of less steep gradient (of graph)

*allow less / slower osmosis / diffusion / less water passes
through or less water enters funnel*

allow water enters / passes through slower

1

less difference in concentration (between solution / funnel and water / beaker)

*accept due to lower diffusion / concentration gradient /
described*

1

[5]

Q11.

Marks should **not** be awarded for simply copying the information provided

A mark may be awarded for a comparison between treatments if the answer only involves copied information

any **four** from:

*For all 4 marks to be awarded, there must be at least 1 pro
and 1 con*

embryo stem cells – examples of

pros

- can treat a wide variety / lots of diseases / problems
- many available / plentiful
- using them better than wasting them
- painless

cons

- (possible) harm / death to embryo
- (relatively) untested / unreliable / may not work
*allow long term effects not known
or may be more risky*
- embryo can't be 'asked' / 'embryo rights' idea

adult bone marrow stem cells – examples of

pros

- no ethical issues (in collection) **or** permission given
- quick recovery
- (relatively) safe
allow does not kill (donor) / low risk
- well tried / tested / know they work

cons

- operation hazards eg infection
- few types of cell / tissue produced **or** few diseases / problems treated
- painful so may deter donors

4

Conclusion to evaluation:

A reasoned conclusion from the evidence

1

[5]

Q12.

(a) (i) capillary

1

(ii) diffusion

1

(iii)

Carbon dioxide	low(er)	high(er)
----------------	---------	----------

1

Oxygen	high(er)	low(er)
--------	----------	---------

1 mark for each correct row

1

(b) (i) red blood cells

1

(ii) haemoglobin

1

[6]