Cell Biology part 12 AQA Combined Science

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Name: _____

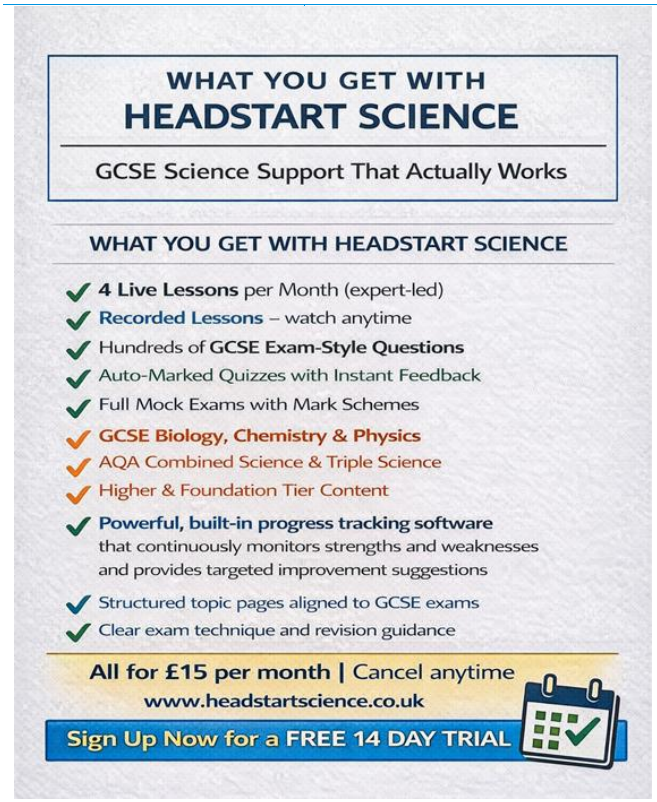
Class: _____

Date: _____

Time: **76 minutes**

Marks: **76 marks**

Comments:



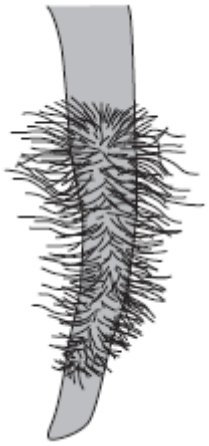
Q1.

Plant roots absorb water from the soil by osmosis.

(a) What is osmosis?

(3)

(b) The image below shows part of a plant root.



The plant root is adapted for absorbing water from the soil.

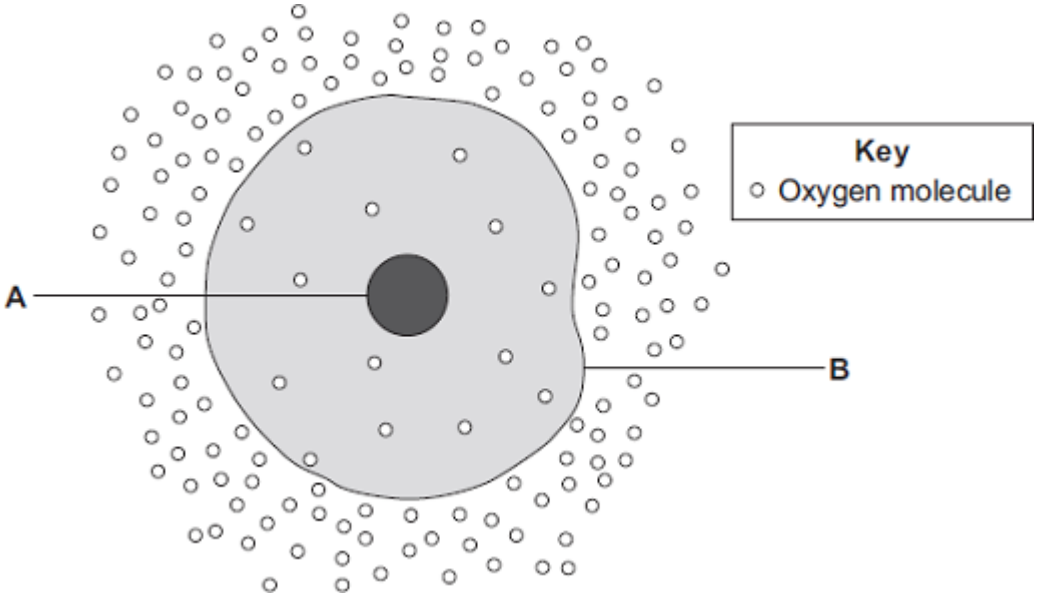
Use information from the diagram to explain how this plant root is adapted for absorbing water.

(3)

(Total 6 marks)

Q2.

The diagram shows a cell.



(a) (i) Use words from the box to name the structures labelled **A** and **B** .

cell membrane	chloroplast	cytoplasm	nucleus

A _____

B _____

(2)

(ii) The cell in the diagram is an animal cell.

How can you tell it is an animal cell and **not** a plant cell?

Give **two** reasons.

1. _____

_____

2. _____

_____

(2)

(b) Oxygen will diffuse into the cell in the diagram.

Why?

Use information from the diagram.

_____

_____

(1)

(c) The cell shown in the diagram is usually found with similar cells.

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

Scientists call a group of similar cells

an organ.
a system.
a tissue.

(1)

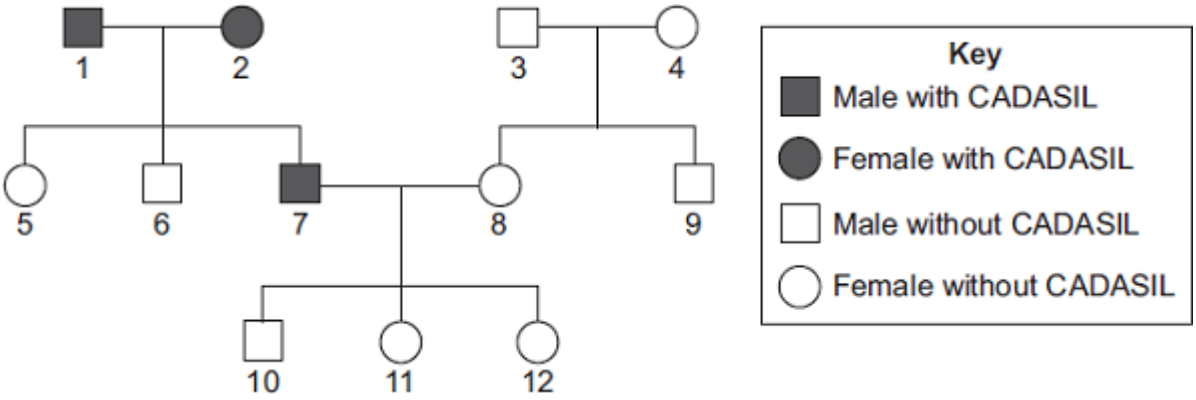
(Total 6 marks)

Q3.

CADASIL is an inherited disorder caused by a dominant allele.

CADASIL leads to weakening of blood vessels in the brain.

The diagram shows the inheritance of CADASIL in one family.



(a) CADASIL is caused by a *dominant allele*.

(i) What is a *dominant allele*?

_____

_____

(1)

(ii) What is the evidence in the diagram that CADASIL is caused by a dominant allele?

_____

_____

(1)

(iii) Person **7** has CADASIL.

Is person **7** homozygous or heterozygous for the CADASIL allele?

Give evidence for your answer from the diagram.

_____

_____

(1)

(b) Persons **7** and **8** are planning to have another baby.
Use a genetic diagram to find the probability that the new baby will develop into a person with CADASIL.

Use the following symbols to represent alleles.

D = allele for CADASIL
d = allele for not having CADASIL

Probability = _____

(4)

(c) Scientists are trying to develop a treatment for CADASIL using stem cells.

Specially treated stem cells would be injected into the damaged part of the brain.

(i) Why do the scientists use stem cells?

_____

_____

_____

_____

(2)

(ii) Embryonic stem cells can be obtained by removing a few cells from a human embryo. In 2006, scientists in Japan discovered how to change adult skin cells into stem cells. Suggest **one** advantage of using stem cells from adult skin cells.

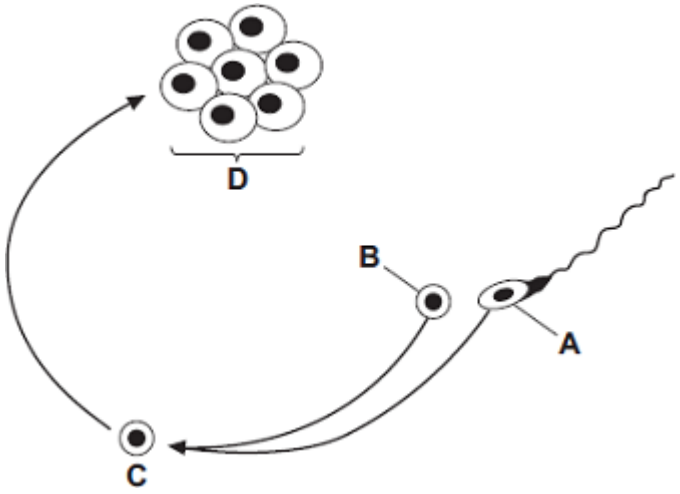
_____

_____

(1)
(Total 10 marks)

Q4.

The diagram shows some of the stages in IVF (in vitro fertilisation).



(a) Use words from the box to name structures **A**, **B**, **C** and **D**.

egg	embryo	fertilised egg	ovary	sperm

Structure **A** _____

Structure **B** _____

Structure **C** _____

Structure **D** _____

(4)

(b) What do doctors do next with structure **D**?

_____

_____

_____

_____

(2)

(c) The table gives statistics for an IVF clinic.

	Age of women treated			
	Below 35 years	**35 – 37 years**	**38 – 39 years**	**40 – 42 years**
Number of women treated	414	207	106	53
Number of women who produced one baby	90	43	17	1
Number of women who produced twins	24	8	4	1

Number of women who produced triplets	1	0	0	0

(i) About what proportion of the treated women aged 35 – 37 years produced one or more babies?

Draw a ring around your answer.

one quarter **one third** **half**

(1)

(ii) This clinic does **not** give IVF treatment to women over 42 years of age.

Use data from the table to explain why.

_____

_____

_____

_____

(2)

(iii) The committee which regulates IVF treatment now advises that only one embryo is used in each treatment.

Suggest **one** reason for this.

_____

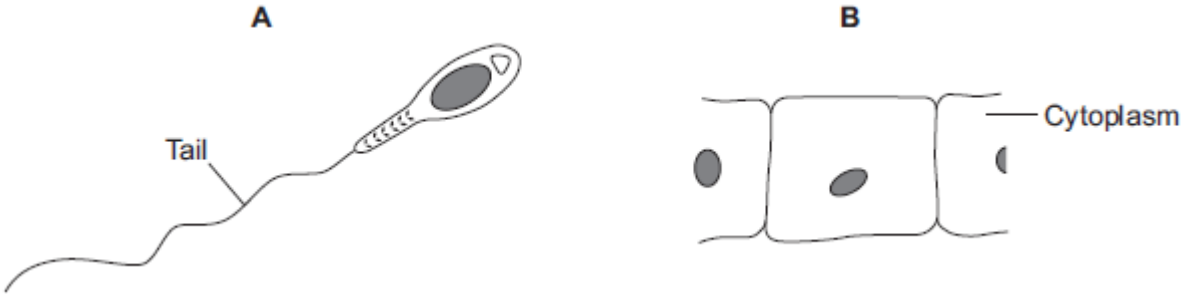
_____

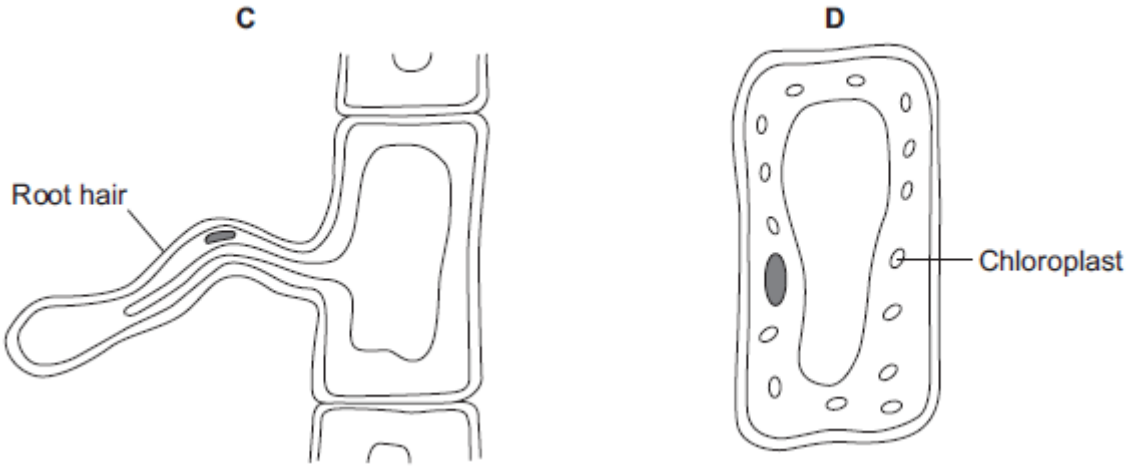
(1)

(Total 10 marks)

Q5.

The diagrams show four types of cell, **A**, **B**, **C** and **D**.
Two of the cells are plant cells and two are animal cells.





(a) (i) Which **two** of the cells are plant cells?

Tick (✓) **one** box.

A and **B** ☐

A and **D** ☐

C and **D** ☐

(1)

(ii) Give **one** reason for your answer.

_____

_____

(1)

(b) (i) Which cell, **A**, **B**, **C** or **D**, is adapted for swimming? ☐

(1)

(ii) Which cell, **A**, **B**, **C** or **D**, can produce glucose by photosynthesis? ☐

(1)

(c) Cells **A**, **B**, **C** and **D** all use oxygen.

For what process do cells use oxygen?

Draw a ring around **one** answer.

osmosis **photosynthesis** **respiration**

(1)

(Total 5 marks)

Q6.

Substances can move into and out of cells.

(a) (i) How does oxygen move into and out of cells?

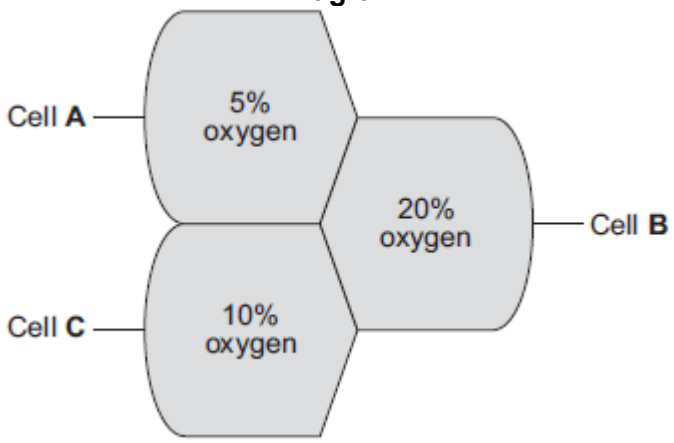
Draw a ring around **one** answer.

diffusion **digestion** **photosynthesis**

(1)

(ii) **Diagram 1** shows the percentage concentration of oxygen in three cells, **A**, **B** and **C**.

Diagram 1



Oxygen can move from cell to cell.

Into which cell, **A**, **B** or **C**, will oxygen move the fastest?

(1)

(b) (i) How does water move into and out of cells?

Draw a ring around **one** answer.

breathing **osmosis** **respiration**

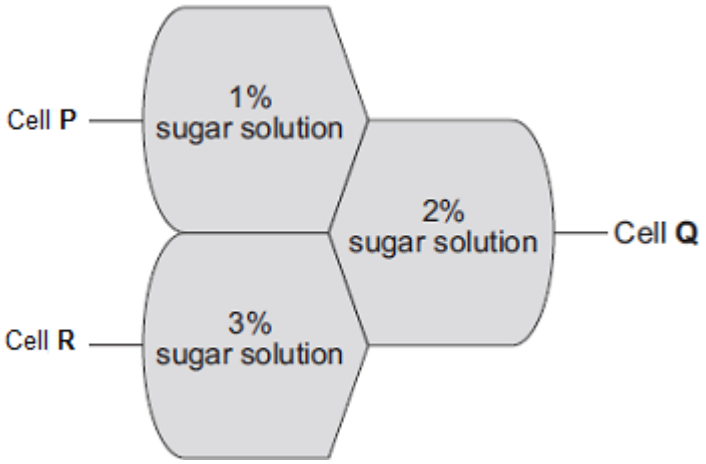
(1)

(ii) Differences in the concentration of sugars in cells cause water to move into or out of cells at different rates.

Diagram 2 shows three different cells, **P**, **Q** and **R**.

The information shows the percentage concentration of sugar solution in cells **P**, **Q** and **R**.

Diagram 2



Water can move from cell to cell.

Into which cell, **P**, **Q** or **R**, will water move the fastest? ☐

(1)

(Total 4 marks)

Q7.

(a) Mr and Mrs Smith both have a history of cystic fibrosis in their families.
Neither of them has cystic fibrosis.
Mr and Mrs Smith are concerned that they may have a child with cystic fibrosis.

Use a genetic diagram to show how they could have a child with cystic fibrosis.

Use the symbol **A** for the dominant allele and the symbol **a** for the recessive allele.

(3)

(b) Mr and Mrs Smith decided to visit a genetic counsellor who discussed embryo screening.

Read the information which they received from the genetic counsellor.

- Five eggs will be removed from Mrs Smith's ovary while she is under an anaesthetic.
- The eggs will be fertilised in a dish using Mr Smith's sperm cells.
- The embryos will be grown in the dish until each embryo has about thirty cells.
- One cell will be removed from each embryo and tested for cystic fibrosis.
- A suitable embryo will be placed into Mrs Smith's uterus and she may become pregnant.
- Any unsuitable embryos will be destroyed.

(i) Suggest why it is helpful to take five eggs from the ovary and not just one egg.

_____

_____

(1)

(ii) Evaluate the use of embryo screening in this case.

Remember to give a conclusion to your evaluation.

_____

_____

_____

_____

_____

_____

_____

_____

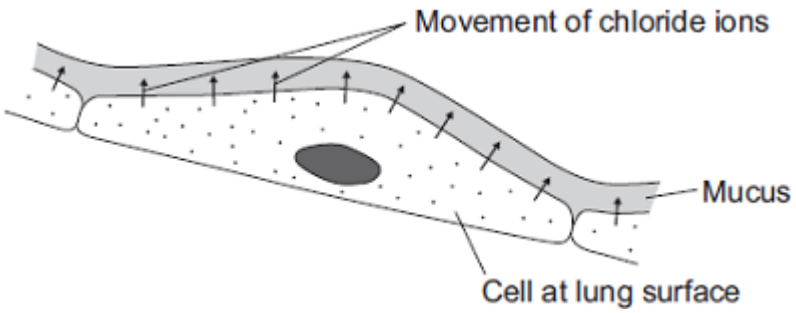
_____

_____

(4)

(c) In someone who has cystic fibrosis the person's mucus becomes thick.

The diagram shows how, in a healthy person, cells at the lung surface move chloride ions into the mucus surrounding the air passages.



The movement of chloride ions causes water to pass out of the cells into the mucus.

Explain why.

_____

_____

_____

_____

_____

_____

_____

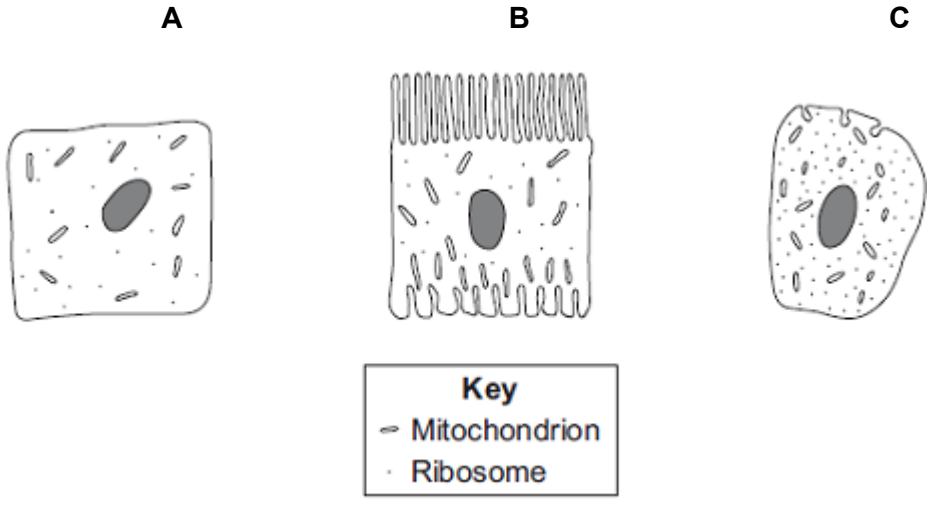
_____

(3)

(Total 11 marks)

Q8.

Diagrams **A**, **B** and **C** show cells from different parts of the human body, all drawn to the same scale.



(a) Which cell, **A**, **B** or **C**, appears to be best adapted to increase diffusion into or out of the cell? ☐

Give **one** reason for your choice.

_____

_____

(1)

(b) (i) Cell **C** is found in the salivary glands.

Name the enzyme produced by the salivary glands.

_____

(1)

(ii) Use information from the diagram to explain how cell **C** is adapted for producing this enzyme.

_____

_____

_____

_____

(2)

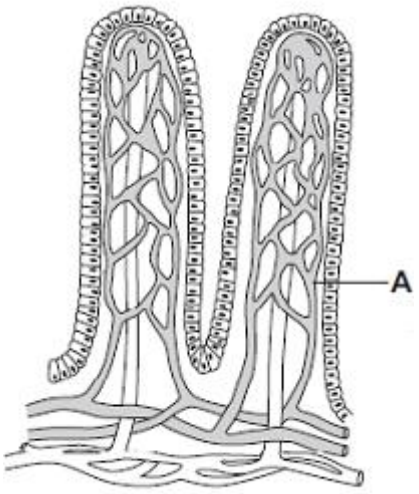
(Total 4 marks)

Q9.

Villi are found in some parts of the digestive system.

Diagram 1 shows two villi.

Diagram 1



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

(i) Structure **A** is a

muscle.
nerve.

capillary.

(1)

(ii) The villi absorb the products of digestion by

dialysis.

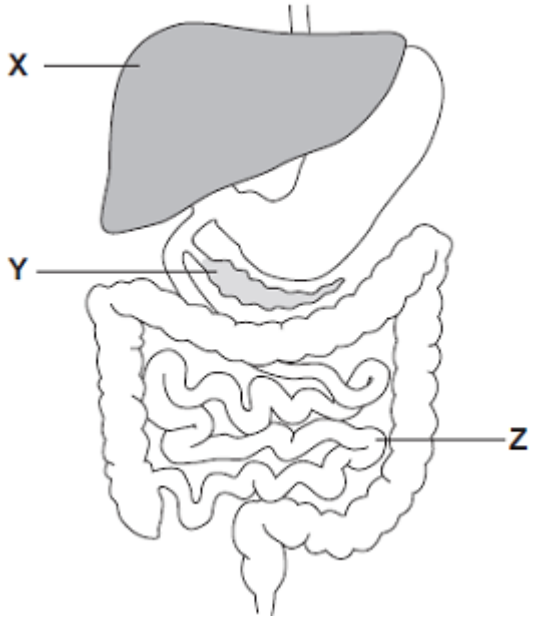
diffusion.

osmosis.

(1)

(b) **Diagram 2** shows the digestive system.

Diagram 2



(i) In which part of the digestive system, **X**, **Y** or **Z**, are most villi found? ☐

(1)

(ii) There are about 2000 villi in each cm^2 of this part of the digestive system.

Why is it helpful to have lots of villi?

_____

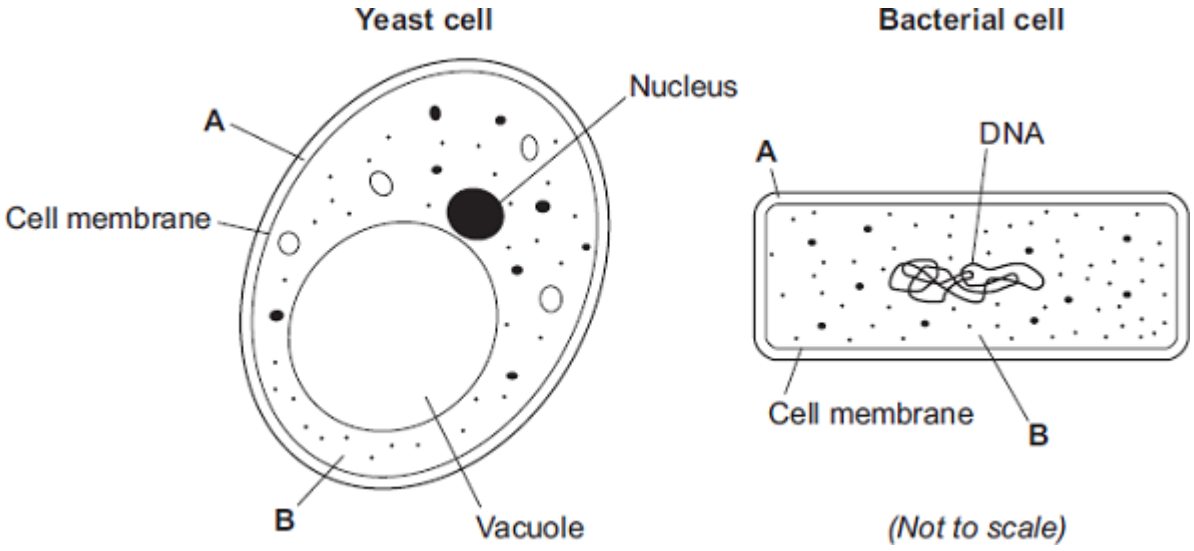
_____

(1)

(Total 4 marks)

Q10.

(a) The diagrams show the structures of a yeast cell and a bacterial cell.



(i) Both the yeast cell and the bacterial cell have structures **A** and **B**.

Name structures **A** and **B**.

A _____

B _____

(2)

(ii) The yeast cell and the bacterial cell have different shapes and sizes.

Give **one** other way in which the structure of the bacterial cell is different from the structure of the yeast cell.

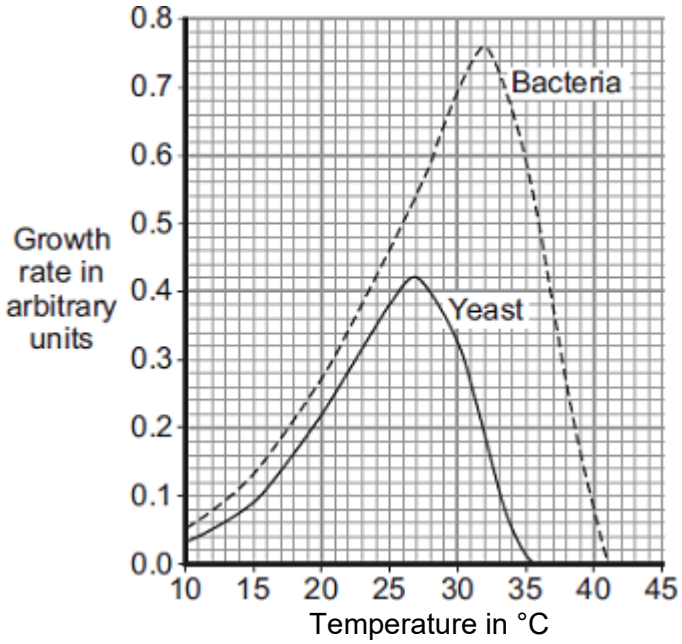
_____

_____

(1)

(b) Sourdough bread is light in texture and tastes slightly sour. The bread is made using two types of microorganism, a yeast and a bacterium. The bacterium can make acids such as lactic acid. The acid makes the bread taste sour.

The graph shows how the growth rates of the yeast and the bacteria change with temperature.



(i) Sourdough bread rises fastest at 27°C.

Use information from the graph to explain why.

_____

_____

_____

_____

(2)

(ii) The bread tastes most sour if it rises at 32°C.

Use information from the graph to explain why.

_____

_____

_____

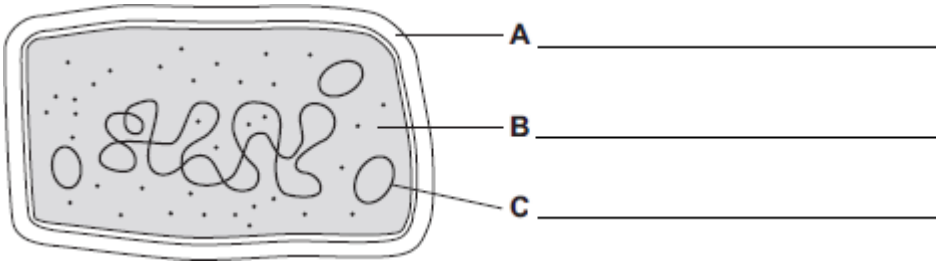
_____

(2)

(Total 7 marks)

Q11.

(a) The diagram shows the structure of a bacterial cell.



(i) On the diagram use words from the box to label structures **A**, **B** and **C**.

cell membrane	**cell wall**	**chloroplast**	**cytoplasm**	**plasmid**

(3)

(ii) Give **one** difference between the structure of the bacterial cell and an animal cell.

_____

(1)

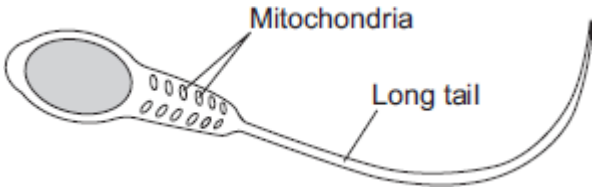
(iii) Name **one** structure that is found in a plant cell but is **not** found in a bacterial or an animal cell.

_____

(1)

(b) Cells can be specialised for a particular job.

The diagram shows the structure of a human sperm cell.



Describe how the long tail and the mitochondria help the sperm to do its job.

Long tail _____

_____

_____

Mitochondria _____

_____

_____

(4)

(Total 9 marks)

Q1.

(a) any **three** from:

- (water through a) partially permeable
  accept 'semi permeable' / selectively permeable
- membrane
- from dilute to (more) concentrated solution
  allow 'from a high concentration of water to a lower concentration (of water)'
  allow 'from high water potential to low water potential'
  allow 'down a concentration gradient of water'
  *do **not** accept 'along a concentration gradient of water'*
- (it's a) passive (process)
  allow requires no energy

3

(b) (there are) many <u>hairs</u> **or** thin <u>hairs</u> **or** <u>hairs</u> are one cell thick

1

(which gives) large / increased surface area **or** short diffusion pathway

1

(so there is) more diffusion / osmosis (of water into the root)
ignore absorption

1

[6]

Q2.

(a) (i) A = nucleus

1

B = (cell) membrane

1

(ii) any **two** from:
ignore shape

- no (cell) wall
- no (large / permanent) vacuole
- no chloroplasts / chlorophyll

2

(b) because high to low oxygen / concentration **or** down gradient
allow 'more / a lot of oxygen molecules <u>outside</u>'
ignore along / across gradient

1

(c) a tissue

1

[6]

Q3.

(a) (i) allele expressed even when other allele present **or** expressed if just one copy of allele is present **or** expressed if heterozygous

if present other allele not expressed

1

(ii) 2 affected parents have unaffected child **or 1** and **2** → **5** / **6**

or if recessive all of **1** and **2**'s children would have CADASIL

1

(iii) heterozygous – has unaffected children **or** because if homozygous all children would have CADASIL

1

(b) genetic diagram including:

accept alternative symbols, if defined

1

correct gametes:

D and **d**
and d (and **d**)

ignore 7 / 8 or male / female

1

derivation of offspring genotypes:

Dd Dd dd dd

*allow just **Dd dd** if ½-diagram*
allow ecf if correct for student's gametes

1

identification **of Dd** as CADASIL
or dd as unaffected

allow ecf if correct for student's gametes

1

correct probability: 0.5 / ½ / 1 in 2 / 50% / 1 : 1

1

(c) (i) stem cells can differentiate **or** are undifferentiated / unspecialised

1

can form blood vessel cells / brain cells

or

stem cells can divide

1

(ii) ethical argument - eg no risk of damage to embryo or adult can give consent for removal of cells **or** adult can re-grow skin

more ethical qualified

ignore religion unqualified

or
if from a relative then less chance of rejection **or** if from self then no

chance of rejection
or
skin cells more accessible

1

[10]

Q4.

(a) **A** sperm

1

B egg

1

C fertilised egg

1

D embryo

1

(b) insert into mother

ignore fertilise / check fertilisation / check viability

1

womb / uterus

1

(c) (i) one quarter

1

(ii) no / little chance of success over 42

1

reference to table of only two women in the age bracket 40-42 years became pregnant

*the statement 'only 2 out of 53 40-42 year old women became pregnant / had babies' gains **2** marks*

1

(iii) so fewer twins / multiple births
or
multiple births more dangerous

1

[10]

Q5.

(a) (i) **C** and **D**

no mark if more than one box is ticked

1

(ii) any **one** from:

*do **not** allow if other cell parts are given in a list*

- (have) cell wall(s)
- (have) vacuole(s)

1

(b) (i) **A**

apply list principle

1

(ii) **D**

apply list principle

1

(c) respiration

apply list principle

1

[5]

Q6.

(a) (i) diffusion

apply list principle

1

(ii) **A**

apply list principle

1

(b) (i) osmosis

apply list principle

1

(ii) **R**

apply list principle

1

[4]

Q7.

(a) both parents **Aa**

*accept other upper and lower case letter without key **or** symbols with a key*

allow as gametes shown in Punnett square

1

aa in offspring correctly derived from parents
or
aa correctly derived from the parents given

ignore other offspring / gametes

for this mark parents do not have to be correct

1

offspring **aa** identified as having cystic fibrosis

*may be the only offspring shown **or** circled / highlighted / described*

1

(b) (i) any **one** from:

accept converse if clear, eg if you (only) took one it might have cystic fibrosis / might not be fertilised

- (more) sure / greater chance of healthy / non-cystic fibrosis egg / embryo / child

  accept some may have the allele

  reference to 'suitable / good embryo' is insufficient

- greater chance of fertilisation

1

(ii) **advantages**

to gain 3 marks both advantage(s) <u>and</u> disadvantage(s) must be given

max 3

any **two** from:

ignore references to abortion unless qualified by later screening

- greater / certain chance of having child / embryo without cystic fibrosis / healthy
- child with cystic fibrosis difficult / expensive to bring up
- cystic fibrosis (gene / allele) not passed on to future generations

disadvantages

any **two** from:

- operation dangers / named eg infection

  ignore risk unqualified

- ethical or religious issues linked with killing embryos

  accept wrong / cruel to embryos accept right to life argument

  ignore embryos are destroyed

- (high) cost of procedure
- possible damage to embryo (during testing for cystic fibrosis / operation)

plus

conclusion

a statement that implies a qualified value judgement
eg it is right because the child will (probably) not have cystic fibrosis even though it is expensive
or
eg it is wrong because embryos are killed despite a greater chance of having a healthy baby

***note**: the conclusion mark cannot be given unless a reasonable attempt to give both an advantage and a disadvantage is made*

*do **not** award the mark if the conclusion only states that advantages outweigh the disadvantages*

1

(c) any **three** from:

- osmosis / diffusion
  *do **not** accept movement of ions / solution by osmosis / diffusion*
- more concentrated solution outside cell / in mucus
  assume concentration is concentration of solute unless answer indicates otherwise or accept correct description of 'water concentration'
- water moves from dilute to more concentrated solution
  allow correct references to movement of water in relation to concentration gradient
- partially permeable membrane (of cell)
  allow semi / selectively permeable

3

[11]

Q8.

(a) **B**

*no mark for "B" alone, the mark is for B **and** the explanation.*

large(r) surface / area **or** large(r) membrane

accept reference to microvilli

ignore villi / hairs / cilia

accept reasonable descriptions of the surface eg folded membrane / surface

*do **not** accept wall / cell wall*

1

(b) (i) any **one** from:

- (salivary) amylase
- carbohydrase

1

(ii) <u>many</u> ribosomes

*do **not** mix routes. If both routes given award marks for the greater.*

1

ribosomes produce <u>protein</u>

accept amylase / enzyme / carbohydrase is made of protein

or

(allow)

<u>many</u> mitochondria (1)

mitochondria provide energy to build / make <u>protein</u> (1)

accept ATP instead of energy

1

[4]

Q9.

(a) (i) capillary

1

(ii) diffusion

1

(b) (i) Z

ignore any names

1

(ii) large / increased surface / area

allow all food absorbed

or to absorb more food
or improved diffusion

1

[4]

Q10.

(a) (i) A = (cell) wall

ignore cellulose

1

B = cytoplasm

1

(ii) any **one** from:

accept has DNA instead of a nucleus, but not just has DNA

- bacterial cell / it has no nucleus

allow no mitochondria

- DNA free in cytoplasm

ignore size

- has no vacuole / no vesicles

ignore strands of DNA

1

(b) (i) yeast grows best / better / well **or** optimum temperature for yeast / more yeast present

allow yeast works best / better / well

1

(yeast) makes CO_2 **or** respires / respiration

allow fermentation

1

(ii) bacterium grows best / better / well / more bacteria present **or** optimum temperature for bacterium

ignore microorganisms / microbes

allow works / respires best / better / well

1

(bacterium) makes (lactic) acid

*do **not** allow wrong acid*

1

[7]

Q11.

(a) (i) **A** − (cell) wall

1

B − cytoplasm

1

C − plasmid

1

(ii) bacterium cell has cell wall / no nucleus / no mitochondria / plasmids present

accept its DNA / genetic material is not enclosed / it has no nuclear membrane

it = bacterium cell

accept converse for animal cell

ignore flagella

1

(iii) any **one** from:

- chloroplast

ignore chlorophyll

- (permanent) vacuole

1

(b) (Long tail) moves the sperm / allows the sperm to swim

1

towards the egg

allow correct reference to other named parts of the female reproductive system

1

(Mitochondria) release <u>energy</u> (for movement / swimming)

allow supply / produce / provide

1

in respiration

1

[9]