Cell Biology part 5 AQA Combined Science

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Name: _____

Class: _____

Date: _____

Time: **81 minutes**

Marks: **75 marks**

Comments:

Q1.

Starch is digested to form sugar molecules in the digestive system.

(a) What is the name of the enzyme that digests starch?

_____

(1)

(b) Where are most food molecules absorbed?

Tick (✓) **one** box.

Large intestine ☐

Liver ☐

Small intestine ☐

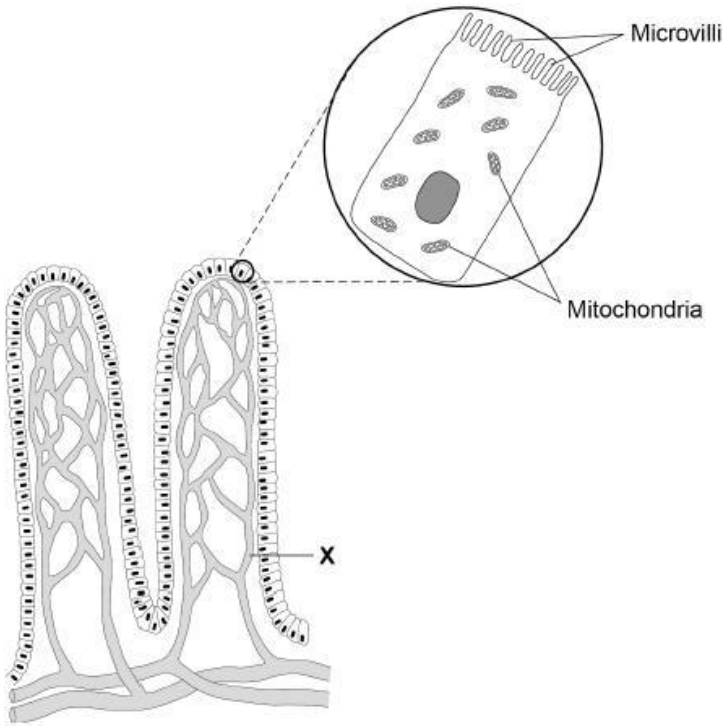
Stomach ☐

(1)

Figure 1 shows two villi.

Figure 1 also shows one cell on the surface of a villus as seen using an electron microscope.

Figure 1



(c) Give **one** advantage of using an electron microscope compared with using a light microscope.

_____

_____

(1)

(d) What type of blood vessel is labelled **X**?

Tick (✓) **one** box.

Artery ☐

Capillary ☐

Vein ☐

(1)

(e) The real length of one villus is 0.8 mm

Calculate the image length if the villus is viewed at a magnification of ×20

Use the equation:

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

_____

_____

_____

_____

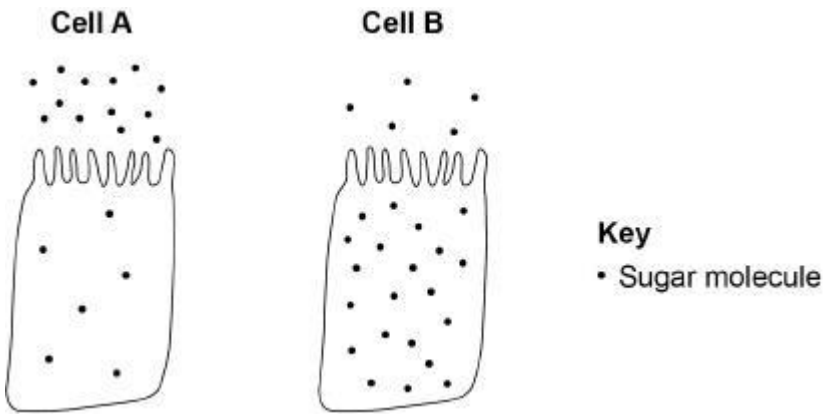
Image length = _____ mm

(3)

Figure 2 shows two cells from the surface of a villus.

There are sugar molecules inside and next to each cell.

Figure 2



(f) Name the process by which sugar moves into cell **A**.

_____

(1)

(g) Name the process by which sugar moves into cell **B**.

_____

(1)

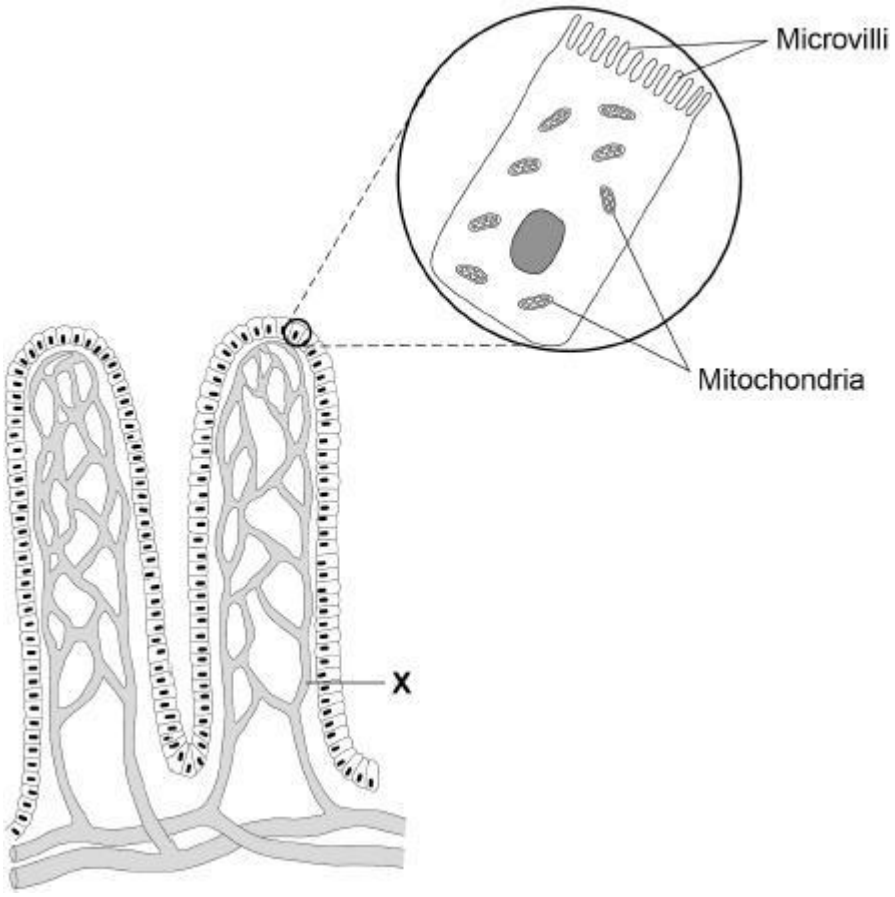
(h) Give **one** use of sugar in the body.

_____

(1)

(i) **Figure 1** is repeated below.

Figure 1



Explain how villi are adapted for efficient absorption of sugar molecules.

(4)

(Total 14 marks)

Q2.

Cells are the basic units of all forms of life.

(a) Describe **four** differences between a bacterial cell and a plant cell.

1. _____

_____

2. _____

_____

3. _____

_____

4. _____

_____

(4)

(b) Gonorrhoea is a bacterial disease.

A new vaccine is being developed against gonorrhoea.

Describe how a vaccine would work to prevent gonorrhoea.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

Another disease caused by bacteria is salmonella food poisoning.

In the UK, chickens are vaccinated against *Salmonella* bacteria to reduce the number of cases of food poisoning in humans.

(c) Explain how vaccinating chickens reduces the number of cases of salmonella food poisoning.

_____

_____

_____

_____

(2)

(d) Give **one** way that the spread of salmonella food poisoning from one human to another is controlled.

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

_____

_____

(1)

(e) The number of cases of salmonella food poisoning is usually higher in summer than in winter.

Suggest **one** reason why.

_____

_____

(1)

(Total 12 marks)

Q3.

A single-celled organism has a large surface area to volume ratio.

(a) How does oxygen enter a single-celled organism?

Tick (✓) **one** box.

Active transport ☐

Diffusion ☐

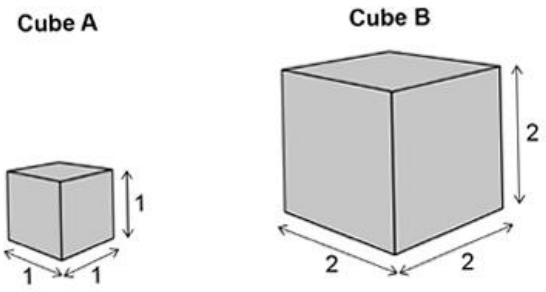
Osmosis ☐

(1)

Figure 1 shows two cubes.

The surface area to volume ratio for cube **A** is 6:1

Figure 1



(b) Calculate the surface area to volume ratio of cube **B**.

Surface area of one face of cube **B** _____

_____

Surface area of one face = _____

Total surface area of cube **B** _____

_____

Total surface area = _____

Volume of cube **B** _____

_____

Volume = _____

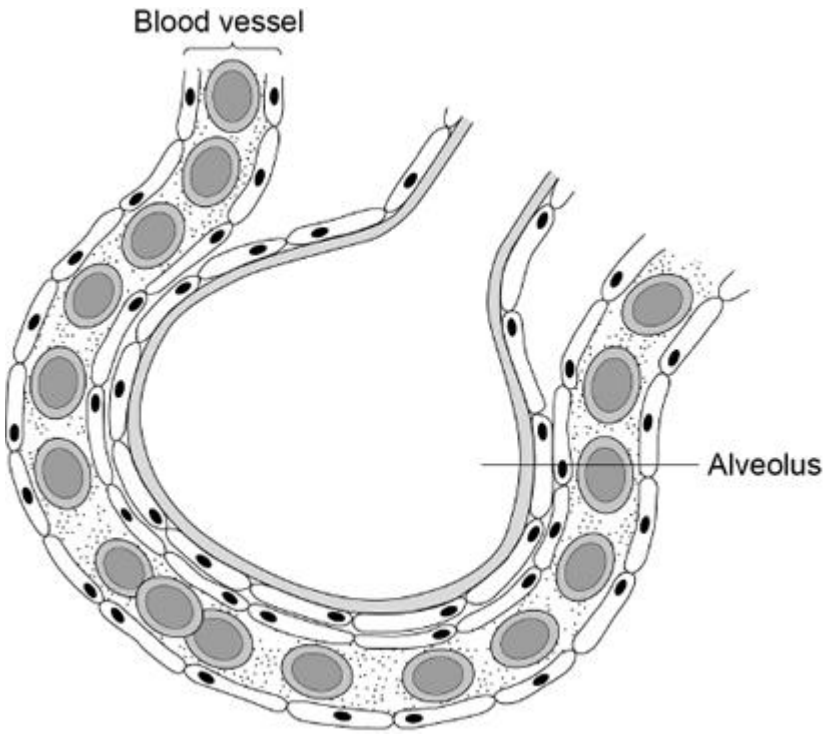
Surface area to volume ratio = _____ : _____

(4)

Multicellular organisms have exchange surfaces to absorb substances.

Figure 2 shows part of the exchange surface in the lungs.

Figure 2



(c) Oxygen passes from the alveolus into the blood.

Name the part of the blood that carries the most oxygen.

_____

(1)

(d) Name the gas that passes out of the blood into the alveolus.

_____

(1)

(e) Alveoli provide a large surface area for gas exchange.

Give **two** other ways the lungs are adapted for efficient gas exchange.

1 _____

_____

2 _____

_____

(2)

(Total 9 marks)

Q4.

This question is about organisation in living organisms.

(a) Write the biological structures from the box in the correct size order.

cell	nucleus	organ	tissue

Smallest

↓

Largest

_____

_____

_____

_____

(3)

(b) Name **one** animal organ.

_____

(1)

(c) Which is a plant tissue?

Tick (✓) **one** box.

Flower ☐

Leaf ☐

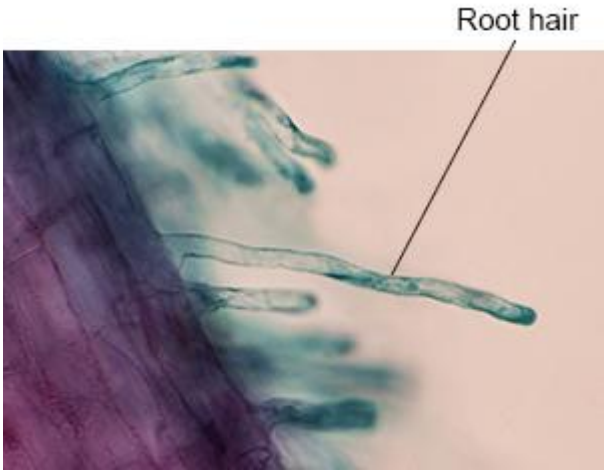
Phloem ☐

Root ☐

(1)

Figure 1 shows part of a root viewed using a microscope.

Figure 1



(d) Explain how a root hair cell is specialised for its function.

_____

_____

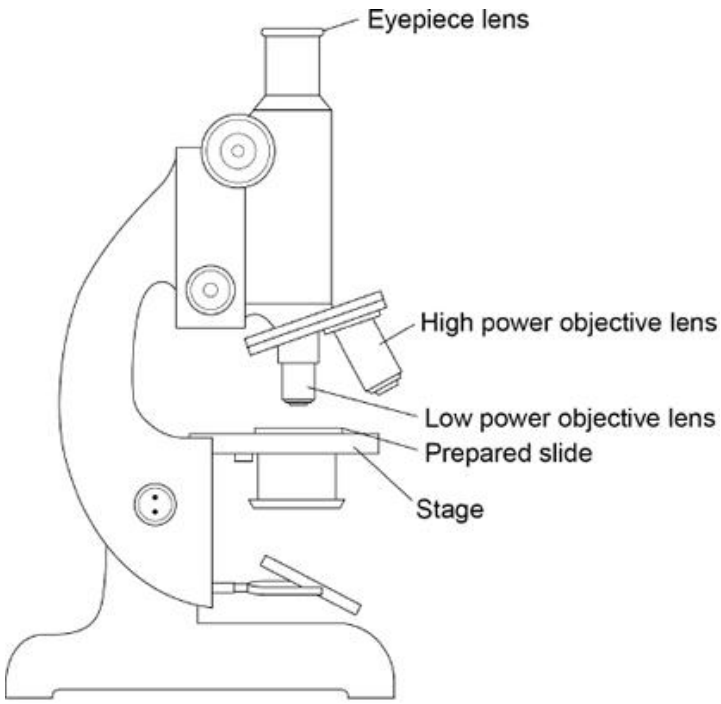
_____

_____

(2)

Figure 2 shows a microscope.

Figure 2



(e) It is easier to view the cells using the low power objective lens first.

Give **one** reason why.

_____

_____

(1)

(f) To focus the image the objective lens should be moved away from the stage.

Give **one** reason why the objective lens should **not** be moved towards the stage.

_____

_____

(1)

(g) The image of the prepared slide in **Figure 2** is viewed with the ×10 objective lens.

The total magnification is ×50

What was the power of the eyepiece lens used?

_____

_____

Power of eyepiece lens = × _____

(1)

(h) Root hair cells do **not** contain chloroplasts.

Suggest **one** reason why.

_____

_____

(1)

(Total 11 marks)

Q5.

Water is lost from the leaves of a plant through stomata.

(a) What is the process by which water is lost from the leaves of a plant?

Tick (✓) **one** box.

Osmosis ☐

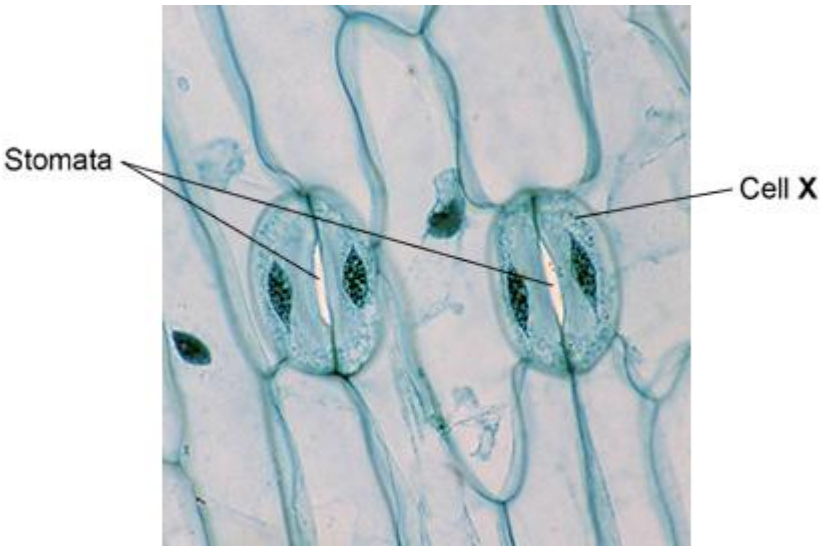
Photosynthesis ☐

Transpiration ☐

(1)

Figure 1 shows stomata on the lower surface of a leaf.

Figure 1



(b) What is the name of cell **X**?

Tick (✓) **one** box.

Epidermal cell ☐

Guard cell ☐

Palisade cell ☐

Xylem cell ☐

(1)

(c) The length of cell **X** is 25 mm when viewed at a magnification of ×800

Calculate the real length of cell **X**.

Give your answer in micrometres (μm).

1 mm = 1000 μm

Use the equation:

$$\text{real length of cell} = \frac{\text{size of image}}{\text{magnification}}$$

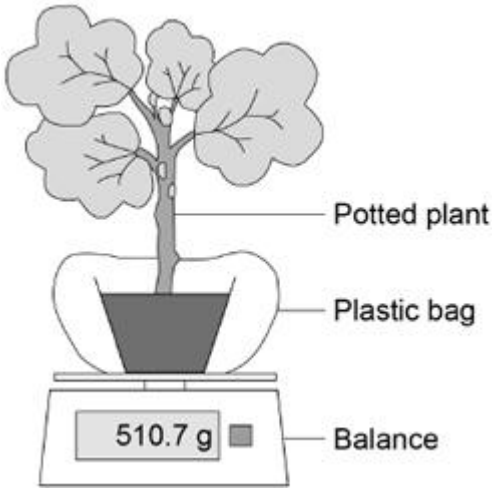
Real length of cell **X** = _____ μm

(3)

A student measured the mass of water lost from some similar plants.
The plants were at different temperatures.

Figure 2 shows the apparatus used.

Figure 2



This is the method used.

1. Seal a plastic bag around the pot of a potted plant.
2. Place the potted plant with the bag on a balance in a room at 20 °C
3. Record the mass.
4. After 3 hours record the mass again.
5. Calculate the mass of water lost from the plant.
6. Repeat steps 1–5 at 25 °C and at 30 °C with other similar plants.

(d) What was the independent variable in this investigation?

Tick (✓) **one** box.

- Initial mass of the plant ☐
- Length of time the plant was left ☐
- Mass of water lost ☐
- Temperature of the room ☐

(1)

(e) Suggest why the student sealed a plastic bag around the pot.

_____

_____

(1)

The table shows the student's results.

Temperature in °C	Mass at the start in g	Mass after 3 hours in g	Mass of water lost in 3 hours in g
20	510.7	508.6	2.1
25	510.4	507.1	3.3
30	**X**	506.3	4.9

(f) What is the resolution of the balance used in this investigation?

Tick **one** box.

0.1 g ☐ 1.0 g ☐ 100 g ☐ 500 g ☐

(1)

(g) Calculate value **X** in the table above.

_____

_____

X = _____ g

(1)

(h) Give **one** conclusion that can be made from the results in the table above.

_____

_____

(1)

(i) Give **two** factors that might affect the rate of water loss from the leaves.

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

1 _____

2 _____

(2)

(Total 12 marks)

Q6.

Pathogens are microorganisms that cause infectious diseases.

(a) What type of pathogen causes malaria?

Tick (✓) **one** box.

Bacterium ☐

Fungus ☐

Protist ☐

Virus ☐

(1)

(b) Give **two** methods used to prevent people catching malaria.

Give a reason why each method works.

Method 1 _____

_____

Reason _____

_____

Method 2 _____

_____

Reason _____

_____

(4)

(c) Describe **two** differences between a bacterial cell and a eukaryotic cell.

1 _____

_____

2 _____

_____

(2)

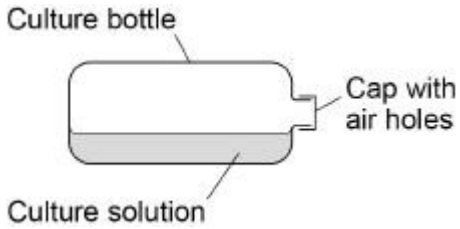
A scientist investigated the population growth of bacteria in a culture solution.

At the start of the investigation the culture solution contained all the nutrients the bacteria needed.

The scientist determined the number of living bacterial cells in the solution every hour over two days.

Figure 1 shows the apparatus used.

Figure 1



(d) Describe why there are air holes in the cap of the culture bottle.

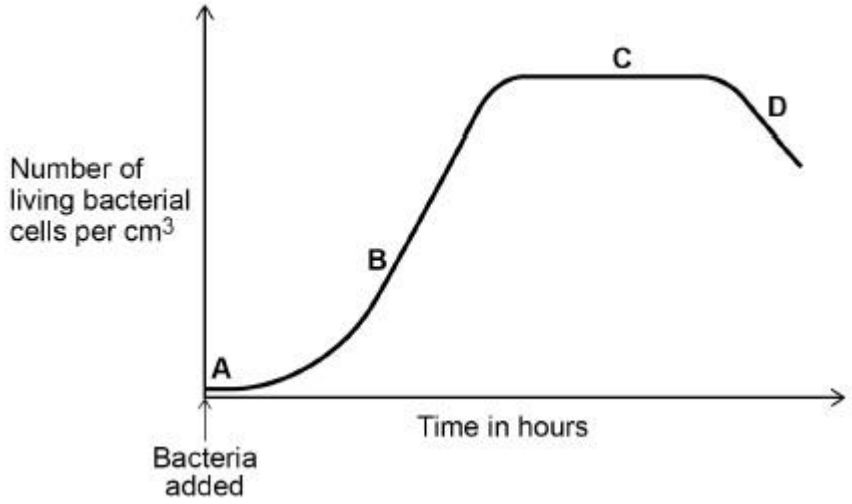
_____

_____

(1)

Figure 2 shows the scientist's results.

Figure 2



(e) Give **one** reason for what is happening to the number of bacteria at each of the stages.

Stage **A** _____

_____

_____

Stage **B** _____

_____

_____

Stage **C** _____

_____

_____

Stage **D** _____

_____

_____

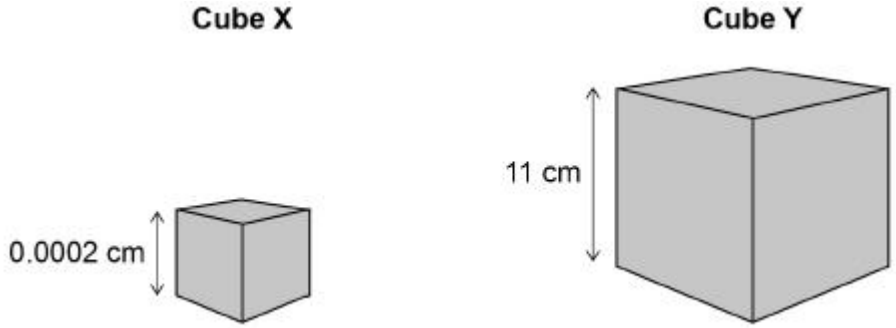
(4)

(f) **Figure 3** shows two cubes.

Cube **X** represents a bacterial cell.

Cube **Y** represents a small multicellular organism.

Figure 3



A bacterial cell can absorb all the nutrients it needs by diffusion through its outer surface.

Explain why a multicellular organism **cannot** absorb all the nutrients it needs by diffusion through its outer surface.

You **must** include calculations in your answer.

Use **Figure 3**.

(5)

(Total 17 marks)

Q1.

(a) amylase

allow phonetic spelling
allow carbohydrase
*do **not** accept amylose*

1

(b) small intestine

1

(c) any **one** from:
- greater magnification
- higher resolving power

allow can see (smaller) sub-cellular structures / parts

allow can see more detail (inside cells)

allow reference to 3-D images

1

(d) capillary

1

(e)

$$20 = \frac{\text{image length}}{0.8}$$

1

image length = 0.8 x 20

1

image length = 16 (mm)

1

(f) diffusion

1

(g) active transport

allow active uptake

1

(h) any **one** from:
- respiration

allow as an energy source

*do **not** accept to make / use / create / produce energy*

- to form glycogen
- to make amino acids / proteins

allow to make lipid / fat

1

(i) **Level 2:** Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.

3–4

Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.

1–2

No relevant content

0

Indicative content

- have (many) microvilli
- (to) increase surface area

- wall of villus only one cell thick **or** is thin
- capillaries are close to surface
- (so) short pathway

- good blood supply
- (to) transport food molecules away **or** to the body
- (and) maintain a diffusion gradient

- cells have many mitochondria
- (where) respiration takes place
- (where) energy is transferred
- (as) active transport requires energy
- energy is needed to absorb sugar / food / molecules

For Level 2 must make links between structure and it's function

[14]

Q2.

(a) any **four** from:

- bacterial cell is smaller (than a plant cell)

  allow converse statements 'it' refers to bacteria

- bacterial cell does **not** have chloroplasts (plant cell does)

  ignore chlorophyll

- bacterial cell does **not** have its DNA / genetic material inside a nucleus (plant cell does)

  *allow bacterial cell does **not** have a nucleus (plant cell does)*

  allow bacterial cell has DNA / genetic material in a ring / loop (plant cell does not)

  allow bacterial cell has DNA / genetic material free in cytoplasm

- bacterial cell (may) have plasmids (plant cell does not)

- bacterial cell does **not** have mitochondria (plant cell does)

- cell wall in bacterial cells is **not** made of cellulose (cell wall in plant cells is)

- bacterial cell does **not** have a large / permanent vacuole (plant cell does)

- bacterial cell has smaller ribosomes (than plant cells)

  *do **not** accept idea that bacterial cells do not have ribosomes*

  allow bacterial cell (may) have a flagellum (plant cells do not)

  allow bacterial cell (may) have a slime capsule (plant cell does not)

4

(b) any **four** from:

- dead / inactive / weakened form of pathogen / bacterium / microorganism is introduced / injected

  allow introduce / inject antigen(s) from the pathogen

  allow dead / inactive / weakened form of Gonorrhoea (bacteria) introduced / injected

  *do **not** accept inject Gonorrhoea disease*

- white blood cells stimulated to produce antibodies

  *do **not** accept incorrect white blood cell, eg phagocyte*

- reference to memory cells made or remain

- on re-exposure specific / correct antibodies are made (very) quickly

  allow on re-exposure specific / correct antibodies are produced in large quantities

- bacteria / pathogens / microorganisms killed and do not produce a large enough population to cause the disease

  allow bacteria / pathogens / microorganisms killed and do not produce a large enough population to produce toxins

4

(c) fewer bacteria / pathogens in chicken / eggs / food

ignore references to immunity unqualified

allow fewer chickens / eggs will carry the bacteria / pathogens ignore chickens do not get disease / infected

1

(so) fewer bacteria are ingested (by humans)

allow idea of fewer bacteria being passed on to humans in food

or

fewer bacteria / pathogens ingested (by humans) (1)

(so) fewer toxins produced (1)

allow idea of fewer bacteria being passed on to humans in food (1)

1

(d) wash hands before preparing food

ignore wash hands unqualified

allow good food hygiene

wash hands after using the toilet

allow clean areas where a person has been ill

allow do not shake hands (with someone who has food poisoning)

1

(e) warmer weather so bacteria reproduce / increase faster

ignore bacteria are killed at low temperatures

allow food not cooked properly on barbeques

1

[12]

Q3.

(a) diffusion

1

(b) (SA of one face = 2 × 2) =4

ignore units

1

(Total SA = 4 × 6) = 24

allow correct calculation using their calculated SA of 1 face × 6

1

(Volume = 2 × 2 × 2) =8

(SA:volume ratio =) 24:8 **or** 3:1

ratio must be consistent with their figures

1

(c) red (blood) cell(s)

allow erythrocyte(s)

1

(d) carbon dioxide

name takes precedence

allow CO_2

gnore CO^2 / CO2

ignore water (vapour)

1

(e)

ignore large surface area

ignore many alveoli

ignore moist lining

any **two** from:

- wall of alveolus (only) one cell thick
- wall of capillary (only) one cell thick
- cells of alveolus / capillary wall are flattened / thin

- good blood supply

  if none of these mentioned
  *allow **1** mark for idea of short distance between (air in) alveolus and blood*
- (well) ventilated

2

[9]

Q4.

(a) nucleus
cell
tissue
organ

all in correct order

*allow **1** mark for each consecutive pair of structures*

3

(b) any **one** from:
- bladder
- brain
- heart
- (small **or** large) intestine
- kidney
- liver
- lung
- pancreas
- skin
- stomach

allow any organ found in an animal
ignore blood

1

(c) phloem

1

(d) large surface area

allow long

(so) it can absorb (a lot of) water / minerals / (mineral) ions

allow long

1

*allow **1** mark for (many) mitochondria*
*allow for **2** marks (many) mitochondria for active transport*

1

(e) any **one** from:

- biggest / widest field of view
- easier to focus

1

(f) to avoid damage to lens / slide

ignore references to focussing

1

(g) (×)5

allow are underground

1

(h) any **one** from:
(root hair cells)
- are not exposed to light
- do not photosynthesise

allow are underground

1

[11]

Q5.

(a) transpiration

1

(b) guard cell

1

(c) (real length of cell =) $\frac{25}{800}$

an answer of 31.25 (μm) scores 3 marks

allow 2 marks for $\frac{25\,000}{800}$

1

0.03125

1

31.25 (μm)

allow 31 or 31.3
allow correct unit conversion of incorrect answer

1

(d) temperature of the room

1

(e) any water / mass lost was from the leaves / plant

allow so no water was lost (directly) from the soil

1

(f) 0.1 g

1

(g)

View with the table in the question

511.2 (g)

answer line takes precedence

1

(h) the higher the temperature the more water lost

cause and effect must be the correct way round

1

(i) any **two** from:

- humidity
- air movement

  allow wind
- light (intensity)

  allow time of day
- water availability
- rate of photosynthesis

allow number / size of leaves /

allow number of stomata on plant

ignore type of plant

ignore time plant left for

2

[12]

Q6.

(a) protist

1

(b) any **two** methods with reason from:

1 mark for method and 1 mark for a correctly linked reason

- Method: insecticides
  Reason: to kill mosquitos / vector

  ignore kill insects unqualified

- Method: (mosquito) nets
  Reason: to avoid being bitten

  allow long clothing

  ignore acts as a physical barrier

- Method: insect repellents
  Reason: less likely to be bitten

  allow DEET or named insect repellent

- Method: vaccination
  Reason: so people are immune (to malaria)

- Method: anti-malaria tablets

  allow named anti-malarial e.g. Larium / Malarone

  allow antibiotics

- Reason: kills the pathogen / protist

  allow ecf from part (a)

  ignore kills malaria

  allow

  Method: drain swampy ground
  or
  remove pots of water
  or

put oil on water / pond

Reason: fewer breeding grounds for mosquitos

allow

Method: release GM / sterile mosquitos

Reason: prevent / reduce reproduction

*if no other marks awarded allow **1** mark for kill mosquitos*

4

(c) any **two** from:
(bacterial cell):

does not have a nucleus

allow DNA is free in cytoplasm

allow has a single loop of DNA

allow has a single strand of DNA

has plasmids

allow description, e.g. (small) ring(s) of DNA

is smaller

allow bacterial cells do not have mitochondria or do not have membrane bound organelles

allow bacteria have smaller ribosomes

ignore bacterial cells do not have chloroplasts

2

(d) to allow air / oxygen in for bacteria to respire

allow to allow carbon dioxide produced in respiration to escape

or

so bacteria can respire aerobically

1

(e) (A)
(no change in population size) because no / limited cell division / reproduction

allow (no change in population size) because bacteria / cells adjusting to environment / culture conditions

ignore reference to growth unqualified

1

(B)
(rapid increase in population size) as cells dividing rapidly as (plentiful) supply of nutrients / food

allow rapid binary fission as (plentiful) supply of nutrients / food

1

(C)
(population size stays the same) as rate of cell death equals rate of cell division

1

(D)
(population size decreasing) as cells dying due to nutrients running out
or
(population size decreasing) as cells dying due to toxins / carbon dioxide / cell wastes building up (in solution)

1

(f)

*a ratio of 30 000:1 for **X** and 0.55:1 for **Y** scores **3** marks*

(SA: vol ratio of **X** =)

$2.4 \times 10\text{-}7 : 8 \times 10^{-12}$

1

or

0.000 000 24 : 0.000 000 000 008

(SA: vol ratio of **Y** =) 726:1331

conversion to same scale: 30 000:1 **and** 0.55:1

if no other calculation marks awarded allow 1 mark for calculation of SA for X and Y
or
*calculation of volume for **X** and **Y***

1

or
*calculation of SA and volume for one **or** both cubes if not given as a ratio*

1

(so) diffusion distance is longer in multicellular organism

allow converse

or
(so) volume supplied by each unit of surface area is greater in multicellular organism

allow converse
allow idea that some cells will have no surfaces exposed to outside in multicellular organism

1

(so) diffusion rate per unit volume is slower in a multicellular organism

allow converse

1

[17]