Organisation part 6

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Name: _____

Class: _____

Date: _____

Time: **84 minutes**

Marks: **77 marks**

Comments:

Q1.

Being overweight can affect the health and life expectancy of a person.

(a) Give **one** disease related to being overweight.

_____

(1)

(b) Body mass index (BMI) helps to show if a person has a healthy body mass for their height.

BMI is calculated using the equation:

$$\text{BMI} = \frac{\text{body mass in kg}}{(\text{height in m})^2}$$

A woman has a BMI of 27 and a body mass of 68.1 kg

Calculate the woman's height in metres.

_____

_____

_____

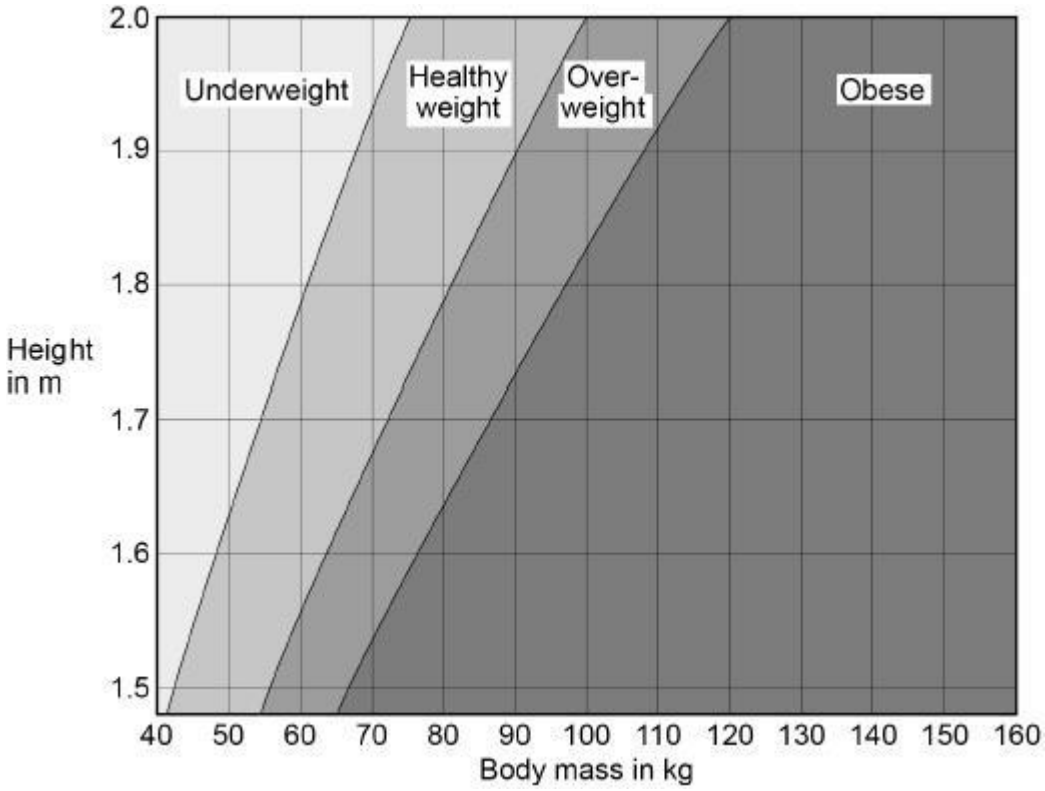
_____

_____

Height = _____ m

(3)

(c) The graph below shows a height-body mass chart for adults.



Which weight category describes the woman in part (b)?

Tick (✓) **one** box.

Underweight ☐

Healthy weight ☐

Overweight ☐

Obese ☐

(1)

(d) People are encouraged to control their body mass with diet and exercise.

Describe how the balance between the mass of food eaten and the amount of exercise a person does controls body mass.

(3)

(e) During long periods of vigorous exercise the body respires anaerobically.

Explain the changes that happen in the body during **and** after vigorous exercise.

(6)

(Total 14 marks)

Q2.

Mineral ions are important chemicals in an ecosystem.

(a) Plants take in nitrate ions dissolved in water.

Which part of a plant takes in nitrate ions?

_____

(1)

(b) Name **two** chemicals that are cycled between plants, the soil and the air.

Do **not** refer to nitrogen or nitrates in your answer.

1. _____

2. _____

(2)

(c) All the chemicals in a plant are recycled when the plant dies.

Describe how:
- microorganisms recycle chemicals
- the chemicals are used again by new plants.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(6)

(Total 9 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 ☐

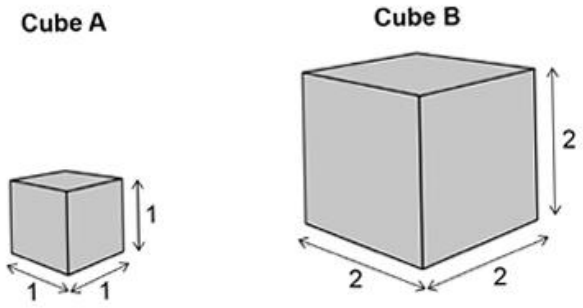
Osmosis ☐

(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 = _____

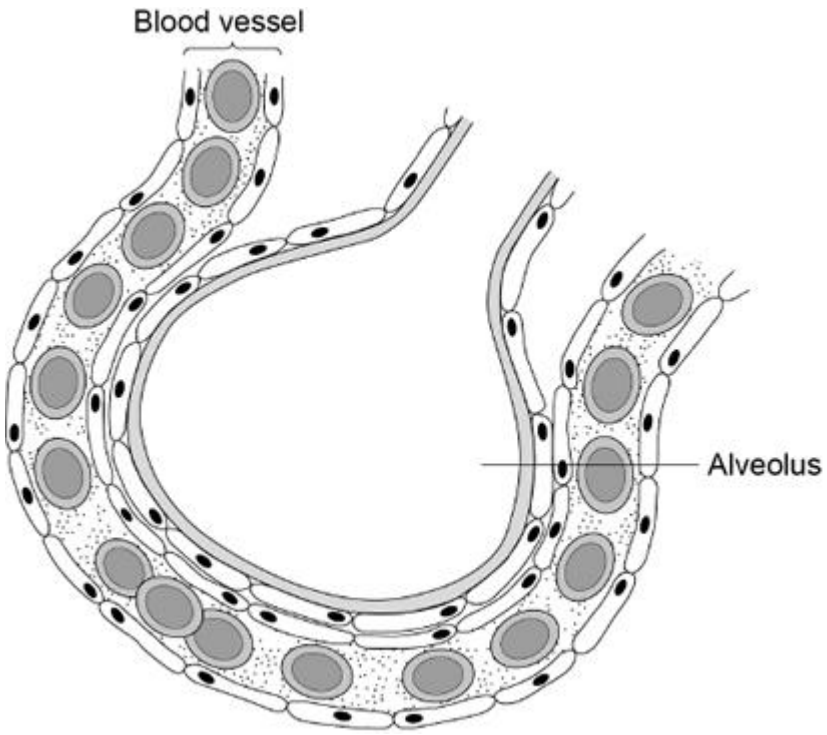
Surface area to volume ratio = _____ : _____

(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 ☐

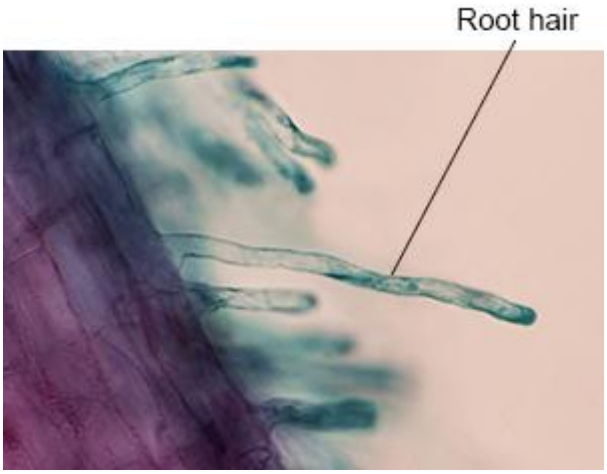
Phloem ☐

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.

_____

_____

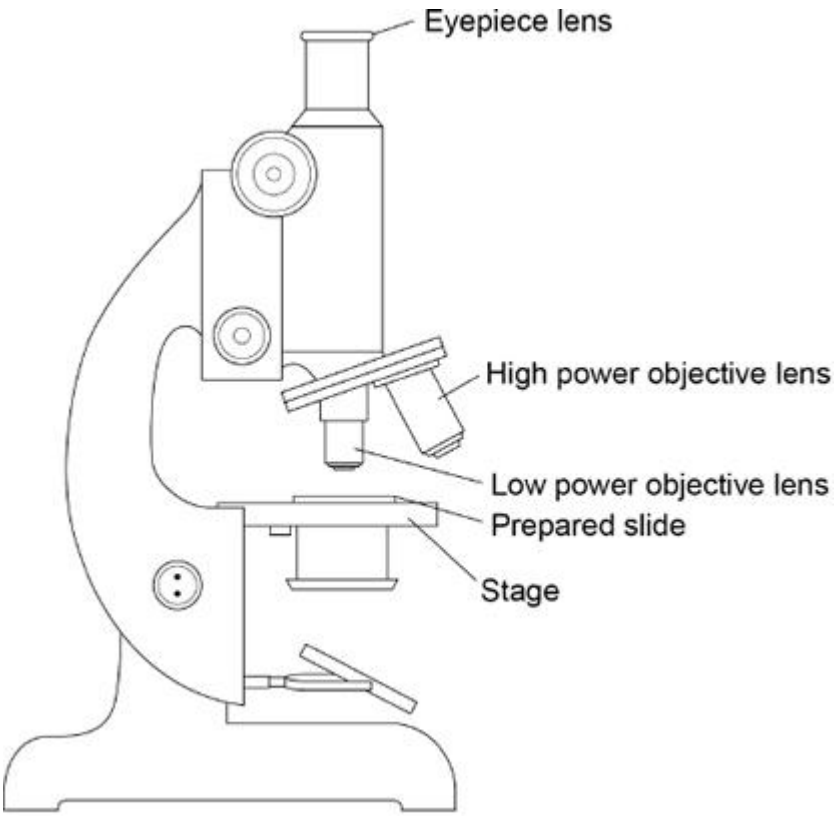
_____

_____

(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 ☐

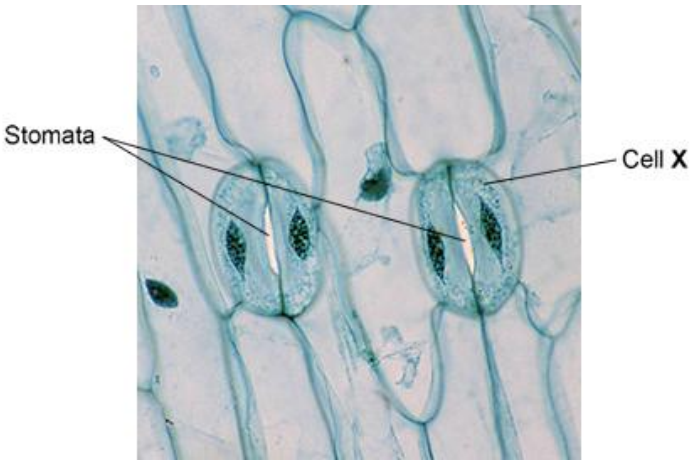
Photosynthesis ☐

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:

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

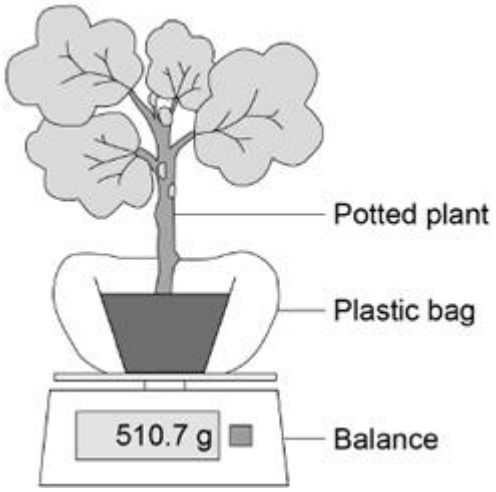
Real length of cell **X** = _____ μm

(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 _____

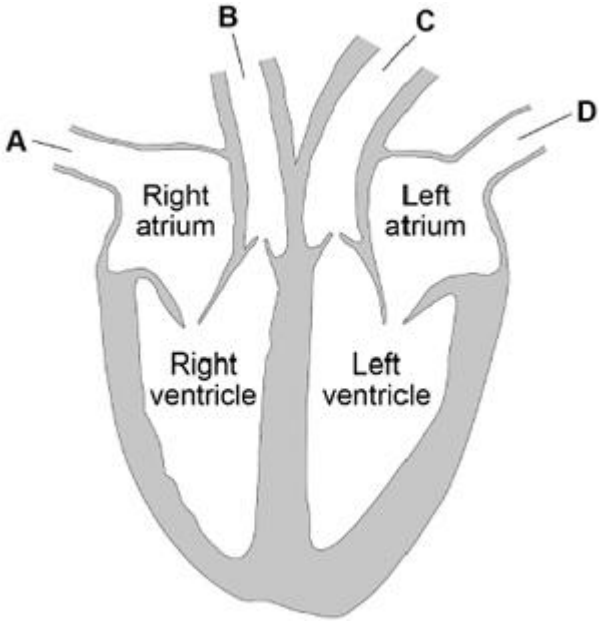
2 _____

(2)

(Total 12 marks)

Q6.

The diagram shows a human heart.



(a) Which blood vessel carries deoxygenated blood away from the heart to the lungs?

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

(1)

(b) The natural resting heart rate is controlled by a group of cells that act as a pacemaker.

Where in the heart are 'pacemaker cells' found?

Tick (✓) **one** box.

- Left atrium ☐
- Left ventricle ☐
- Right atrium ☐
- Right ventricle ☐

(1)

Some people may be treated with a drug to slow their heart rate.

(c) Digitalis is a drug that slows the heart rate.

Where does the drug digitalis originate from?

Tick (✓) **one** box.

- Bacteria ☐
- Foxgloves ☐
- Mould ☐
- Willow ☐

(1)

Beta blockers are another type of drug that slows the heart rate.

The table shows information for people who do not take beta blockers and for people who do take beta blockers.

- Stroke volume is the volume of blood pumped out of the heart each time it beats.
- Cardiac output is the total volume of blood pumped out of the heart each minute.

	No beta blockers taken		**Taking beta blockers**	
	At rest	**During exercise**	**At rest**	**During exercise**
Heart rate in beats per minute	68	150	52	88
Stroke volume in cm^3	80	120	**X**	98
Cardiac output in cm^3 per minute	5440	18 000	2800	8624

(d) Calculate stroke volume **X** in the table above.

Use the equation:

cardiac output = stroke volume × heart rate

Give your answer to 2 significant figures.

Stroke volume **X** = _____ cm^3

(3)

(e) Some people who take beta blockers get out of breath when they exercise.

Explain why beta blockers can have this effect during exercise.

You should refer to information given in the table in part (d).

(6)

(Total 12 marks)

Q7.

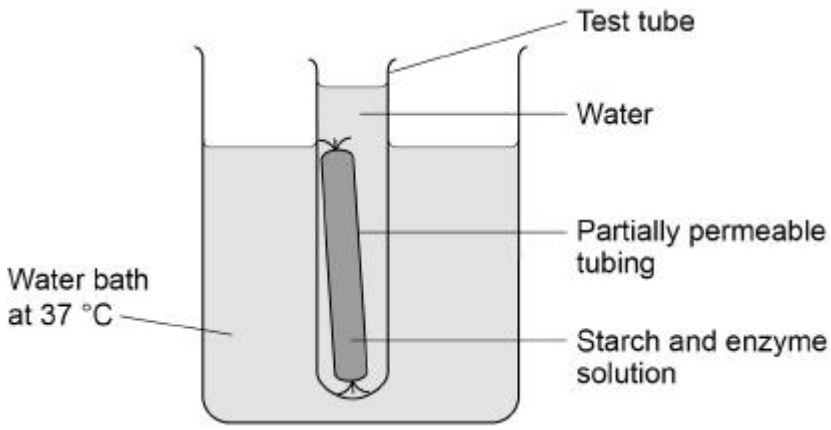
This question is about digestion.

(a) Name the enzyme that digests starch in the human digestive system.

(1)

A student set up a model to represent the digestion and absorption of food molecules in the digestive system.

The diagram shows the student's model.



This is the method used.

1. Fill a test tube with water at 37 °C
2. Test the water for starch and for sugar.
3. Mix together starch and enzyme solution and immediately test it for starch and for sugar.
4. Fill some partially permeable tubing with the starch and enzyme mixture.
5. Seal the tubing and place it in the test tube of water.
6. Place the test tube in a water bath at 37 °C
7. After 30 minutes, test the mixture inside the partially permeable tubing and test the water in the test tube for starch and for sugar.

(b) Suggest which parts of the body the partially permeable tubing and the water in the test tube represent.

Partially permeable tubing _____

Water in the test tube _____

(2)

The table below shows the results.

Test	Description of liquid	Result of starch test	Result of sugar test
1	Mixture inside tubing at start	✓	✗
2	Water in the test tube at start	✗	✗
3	Mixture inside tubing after 30 minutes	✓	✓
4	Water in the test tube after 30 minutes	✗	✓

Key
✓ = Present
✗ = Not present

(c) Name the reagents used to test for starch and for sugar.

Starch _____

Sugar _____

(2)

(d) Why was there no sugar present in test **1**?

_____

_____

(1)

(e) Explain the results for test **3**.

_____

_____

_____

_____

_____

(2)

(f) Explain the results for test **4**.

_____

_____

_____

_____

_____

_____

(2)

(Total 10 marks)

Q1.

(a) any **one** from:

- (Type 2) diabetes

  ignore obesity

  *do **not** accept Type 1 diabetes allow cardiovascular disease ignore heart attack / failure*
- (coronary / ischaemic) heart disease / CHD
- high blood pressure
- cancer
- depression

  allow (osteo)arthritis

1

(b)

$27 = \frac{68.1}{\text{height}^2}$

1

$\text{height}^2 = 68.1 \div 27$

or

$\text{height}^2 = 2.522(\text{r}) / 2.52 / 2.5$

allow height = $\sqrt{\frac{68.1}{27}}$

or

allow height = $\sqrt{2.522(\text{r})}$

1

height = 1.59 (m) allow height =

allow a correctly rounded value

if 2.5 is given in step 2 allow an answer of 1.58 (m)

1

(c) overweight

*answer must be consistent with height calculated in **(b)***

1

(d) any **three** from:

*max **2** marks if refer to energy being made / used / produced / created*
allow reference to calories / joules for energy

- increased energy intake if more food eaten

  allow increased energy intake if more fat / carbohydrate eaten
  allow converse

allow energy taken in when you eat

- if exercise more, more energy is transferred / released
  *allow if exercise more, respiration / metabolism increases **or** is faster*
  allow converse
  allow energy is transferred during exercise
  *do **not** accept energy is burnt during exercise*

- if more energy is taken in than is transferred body mass increases
  or
  if less energy is taken in than is transferred body mass decreases
  allow if less energy is transferred than is taken in body mass increases
  or
  if more energy is transferred than is taken in body mass decreases

- if energy intake = energy transferred body mass stays the same
  *if no marks are awarded allow **1** mark for food eaten can increase body mass **and** exercise can decrease body mass*
  or
  *allow **1** mark for if a lot of food is eaten **and** little exercise is done body mass increases*
  allow converse

3

(e) **Level 3:** Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.

5–6

Level 2: Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.

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
During exercise:
- increased breathing rate
- increased breath volume
- (to) take in more oxygen for (aerobic) respiration
- (and) exhale more carbon dioxide
- increased heart rate
- (so) increased blood flow (to muscles)
- (to) transport oxygen / glucose to respiring cells faster
- (and) increase rate of carbon dioxide removal
- glycogen converted to glucose

- insufficient oxygen supplied (during prolonged vigorous exercise)
- (so) lactic acid is formed (during anaerobic respiration)
- (and) an oxygen debt is created

- (lactic acid causes) muscles become fatigued / tired **or** (causes) muscles to stop contracting efficiently
- allow reference to sweating **or** increased body temperature **or** vasodilation (during or after exercise)

After exercise:
- heart rate remains high **or** heart rate slowly decreases
- continue to breathe rapidly **or** breathing rate slowly decreases
- (to) pay back oxygen debt
- oxygen debt is the amount of oxygen needed to break down lactic acid
- (and to) provide more oxygen to react with the lactic acid and remove it from cells
- (some) lactic acid transported to liver
- (lactic acid) is converted back into glucose

For Level 3 need reference to:
- changes during **and** after exercise
- lactic acid **and** its removal.

[14]

Q2.

(a) root (hairs)

1

(b) carbon

in either order

allow carbon dioxide

1

water

if no other mark awarded allow oxygen for 1 mark

1

(c) **Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.

4–6

Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.

1–3

No relevant content

0

Indicative content

- microorganisms decay (the dead plant)
- microorganisms respire
- using carbon compounds / glucose
- releasing carbon dioxide
- into the atmosphere
- new plants take in carbon dioxide
- (carbon dioxide) for photosynthesis
- making glucose
- converted into correctly named cell materials

(when plants are decayed)

Nitrate / mineral ions
- are released into soil
- to be taken up by new growing plants

Water
- plants dehydrate or water evaporates when they die
- recycled as rain needed by growing plants

[9]

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) **B**

1

(b) right atrium

1

(c) foxgloves

1

(d) **X** = 2800 / 52

1

53.846153

1

54 (cm^3)

an answer of 54 (cm^3) scores 3 marks
allow correct rounding of an incorrectly calculated value of stroke volume

1

(e) **Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.

5–6

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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

effect of exercise
- during exercise body needs to transfer (more) energy
- energy transferred during respiration
- rate of respiration increases during exercise
- (so) more oxygen is needed

effect of beta blockers
- beta blockers reduce (the increase in) heart rate (during exercise)
- beta blockers reduce stroke volume (or described)
- beta blockers reduce cardiac output
- (so) heart cannot supply oxygen fast enough / in sufficient quantity to

muscle cells

effect on breathing rate
- breathing rate increases to increase rate / amount of oxygen absorbed
- breathing rate increases to increase rate / amount of carbon dioxide removed from body
- (but) increased breathing rate cannot fully compensate for changes in heart function

A level 3 response should make links between all three sections of indicative content

A level 2 response should attempt to link effect of exercise with oxygen / energy requirement **and** beta blockers to effect on heart function.

[12]

Q7.

(a) amylase

allow phonetic spelling

allow carbohydrase

ignore references to source of enzyme e.g. salivary / pancreatic

*do **not** accept amylose*

1

(b) (partially permeable tubing) small intestine

allow stomach

ignore intestine unqualified

*do **not** accept large intestine*

1

(water in test tube) blood

allow plasma

1

(c) (Starch): Iodine (solution)

ignore iodide unqualified

1

(Sugar): Benedict's (solution)

all allow phonetic spelling

1

(d) enzyme had not started to work
or
none of the starch had been digested / broken down

1

(e) (enzyme) digested / broke down starch to form sugar

1

(however) not all the starch was digested / broken down

1

(f) sugar molecules formed are small enough to pass through tubing

1

(but) starch molecules too large (to pass through tubing)

1

[10]