Name: _____

Class: _____

Date: _____

Organisation part 4 AQA Triple Biology

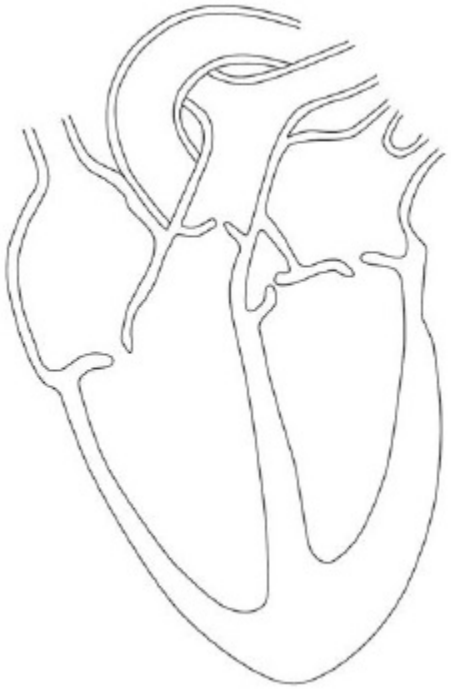
Time: **91 minutes**

Marks: **85 marks**

Comments:

1. **Figure 1** shows the internal structure of the human heart.

Figure 1



(a) Which organ system is the heart a part of?

_____

(1)

(b) Draw a ring around **one** valve on **Figure 1**.

(1)

(c) What is the function of the valves in the heart?

_____

_____

(1)

(d) Valves are also found inside some blood vessels.

Which type of blood vessel contains valves?

_____

(1)

Sometimes a valve in the heart can begin to leak.

A leaking heart valve may be replaced with either:

- a mechanical valve
- a biological valve from a pig.

Table 1 shows information about the replacement valves.

Table 1

Mechanical valve	Biological valve from a pig
Made of plastic or metal	Made from living tissue
Can cause the blood to clot around the valve	No risk of blood clotting around the valve
No need for another replacement valve after 5 years	Sometimes another replacement valve is needed after 5 years

(e) Suggest **two** reasons why a patient may choose a mechanical valve and **not** a biological valve from a pig.

1 _____

_____

2 _____

_____

(2)

(f) Suggest **one** reason why a patient may choose a biological valve from a pig and not a mechanical valve.

_____

_____

(1)

(g) A person may develop other medical conditions.

Draw **one** line from each medical condition to the correct treatment.

Medical condition	Treatment
High blood cholesterol	Antibiotics
	Artificial pacemaker
Irregular heart rate	Insulin
	Statins

(2)

(Total 9 marks)

2. This question is about leaves.

(a) Complete the sentences.

Choose answers from the box.

epidermis **phloem** **palisade mesophyll** **waxy cuticle** **xylem**

The layer of cells lining the upper surface and lower surface of a leaf is the _____.

The part of the leaf where most photosynthesis occurs is the _____.

Water is transported to the leaf in the _____.

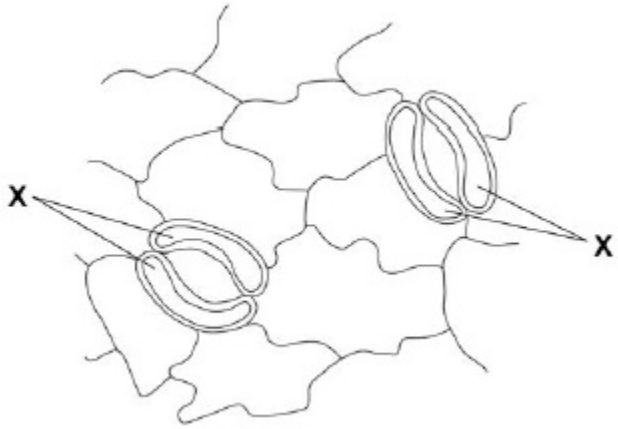
(3)

Water is lost through small openings on the lower surface of plant leaves.

These small openings are called stomata.

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

Figure 1



(b) The cells labelled **X** control the width of the stomata.

What are the cells labelled **X**?

Tick (✓) **one** box.

Guard cells ☐

Mesophyll cells ☐

Root hair cells ☐

Stem cells ☐

(1)

(c) What is the function of the stomata?

Tick (✓) **one** box.

To allow light into the leaf ☐

To let carbon dioxide into the leaf ☐

To let sugars out of the leaf ☐

To protect the leaf from pathogens ☐

(1)

(d) How is water lost from a leaf?

Tick (✓) **one** box.

By evaporation ☐

By respiration ☐

By translocation ☐

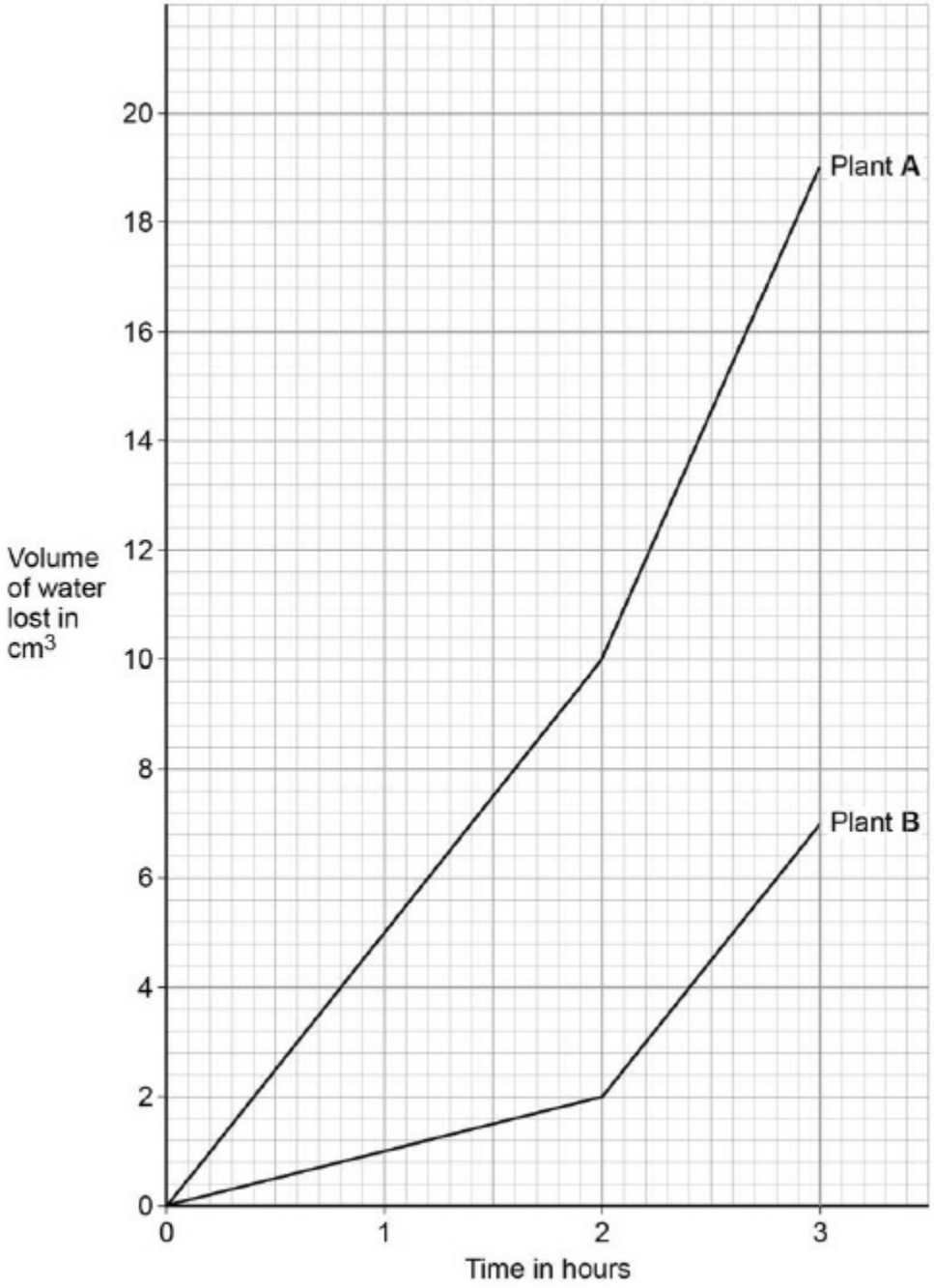
(1)

A student investigated the volume of water lost from two plants.

The plants were different species.

Figure 2 shows the student's results.

Figure 2



(e) Calculate the difference in the volume of water lost by plant **A** compared to plant **B** in the first hour.

_____

_____

Difference in volume = _____ cm^3

(2)

(f) What could cause plant **A** to lose water at a faster rate than plant **B**?

Tick (✓) **one** box.

Plant **A** has fewer stomata per leaf. ☐

Plant **A** is smaller. ☐

Plant **A** has more leaves. ☐

Plant **A** has smaller leaves. ☐

(1)

(g) After the first 2 hours, both plants were moved to a new room.

Suggest **one** reason why both plants lost water at a faster rate in the new room.

_____

_____

(1)

(h) Some plants have adaptations to stop them from being eaten by animals.

Figure 3 shows part of a holly plant.

Figure 3

Describe **one** way the holly plant is adapted to stop it being eaten by animals.

_____

_____

(1)

(Total 11 marks)

3. Water moves from a plant to the atmosphere through the leaves.

(a) How is the volume of water lost from the leaves controlled?

_____

_____

(1)

(b) Describe the transport of water through a plant from the roots to the atmosphere.

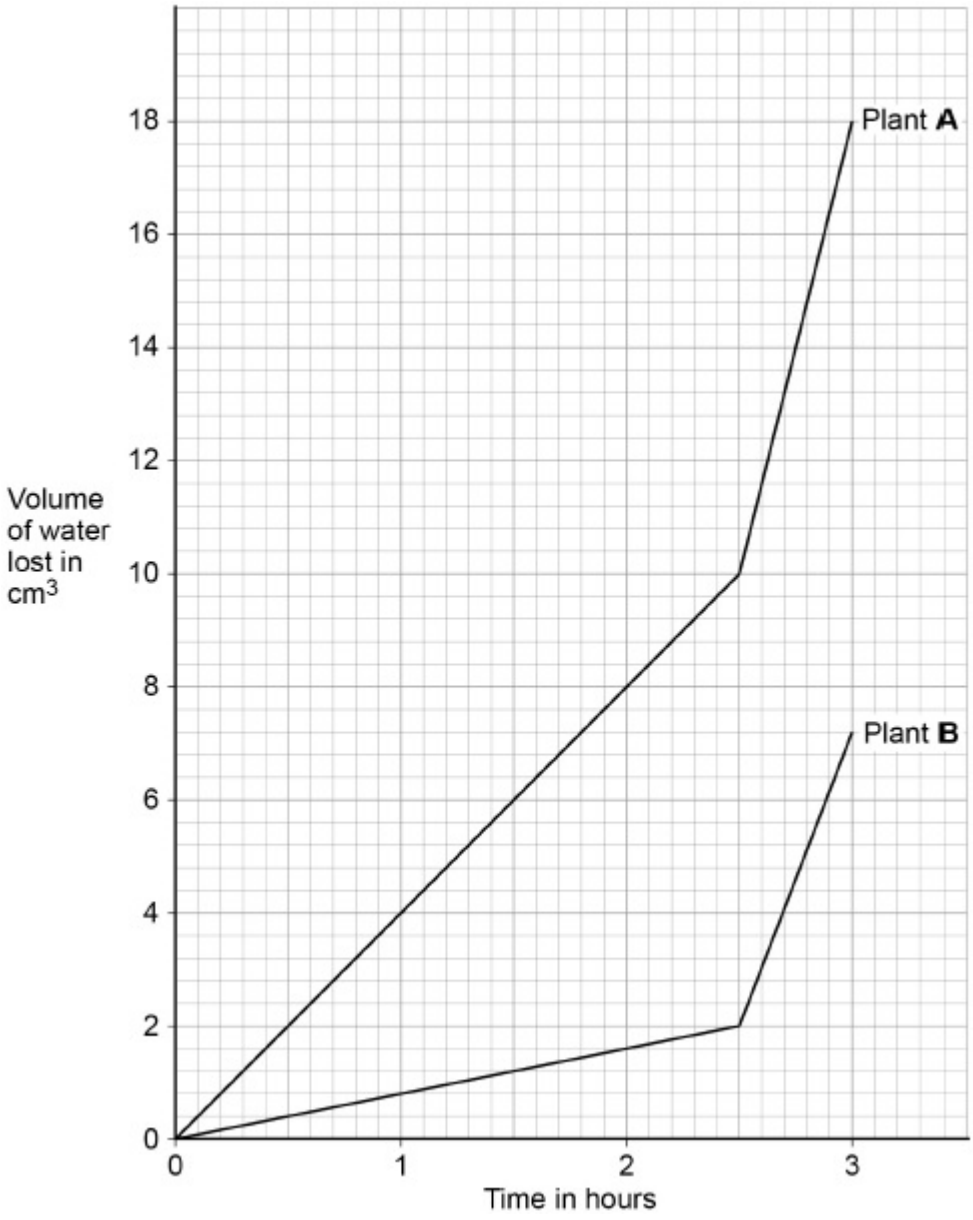
(3)

A student investigated the volume of water lost from two plants of different species.

Both plants were kept together.

Figure 1 shows the student's results.

Figure 1



(c) Suggest **one** reason for the difference in the rate of water loss from the two plants in the first 2.5 hours.

_____

_____

(1)

Both plants were moved to a different place at 2.5 hours.

(d) Calculate the rate of water loss per hour in plant **B** from 2.5 hours to 3 hours.

Give your answer to **2** significant figures.

_____

_____

_____

_____

_____

_____

Rate of water loss = _____ cm^3/hour

(3)

(e) Suggest **two** reasons why the rate of water loss in both plants changed after 2.5 hours.

_____

_____

_____

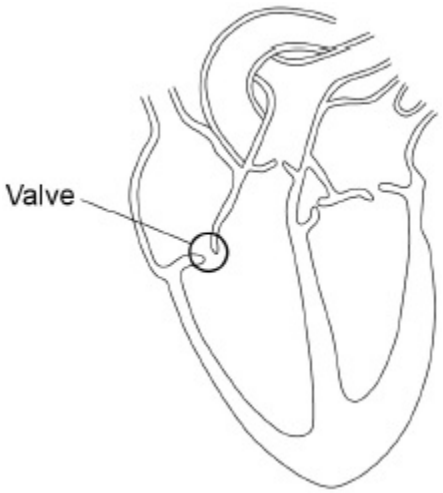
_____

(2)

(Total 10 marks)

4. The figure below shows the internal structure of the human heart.

One of the heart valves is labelled.



Sometimes a valve in the heart can start to leak.

(a) Explain why a person with a leaking heart valve has difficulty exercising.

(4)

A patient with a leaking heart valve may have the valve replaced.

A study compared two different types of replacement heart valve:

- mechanical valves
- biological valves from pigs.

The data used in the study was collected from female patients aged 50–69.

The following table shows the data.

	Type of replacement heart valve	
	Mechanical	**Biological**
Number of patients given the valve	2852	1754
Number of patients who died from heart-related problems after valve replacement	180	178
Percentage of patients alive after 5 years	91	89
Percentage of patients needing a second valve replacement within 6 years	2.2	5.2
Percentage of patients who had a blood clot on the brain after surgery	5.8	0.1

(b) Give **one** conclusion about the death of patients from heart-related problems after a valve replacement.

Include calculations to support your answer.

(3)

(c) One risk of mechanical valves is that blood clots can form on the surface of the valve.

Name the component of the blood that starts the process of blood clotting.

(1)

(d) Evaluate the use of mechanical replacement heart valves and biological replacement heart valves.

Use information from the table above and your own knowledge.

(6)

(Total 14 marks)

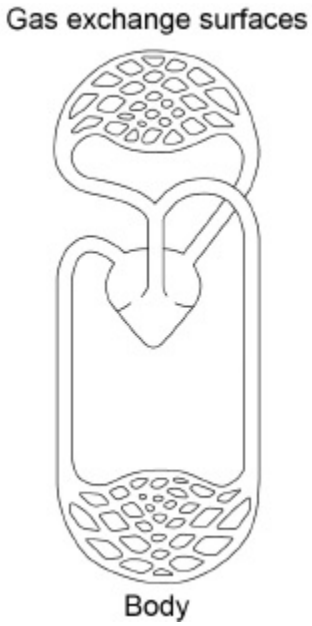
5. A small animal called an axolotl lives in water. The axolotl has a double circulatory system.

(a) Define the term double circulatory system.

(1)

Figure 1 shows the double circulatory system of the axolotl.

Figure 1



(b) The heart of the axolotl has only one ventricle.

Label the ventricle on **Figure 1**.

(1)

(c) Explain why having only one ventricle makes the circulatory system less efficient than having two ventricles.

_____

_____

_____

_____

(2)

Figure 2 shows an axolotl.

Figure 2

(d) Explain why an axolotl may die in water with a low concentration of oxygen.

(4)

If a gill of an axolotl is removed, a new gill will grow in its place.

Scientists hope to use information on how axolotls grow new gills to help with regenerating human tissue.

(e) Name the type of cell that divides when a new gill grows.

(1)

(f) Name **one** condition that could be treated using regenerated human tissue.

_____

(1)

(g) Suggest **one** reason why an axolotl is a suitable animal for research in the laboratory.

_____

_____

(1)

(h) An axolotl may **not** be a suitable animal to study when researching regeneration in human tissue.

Suggest **one** reason why.

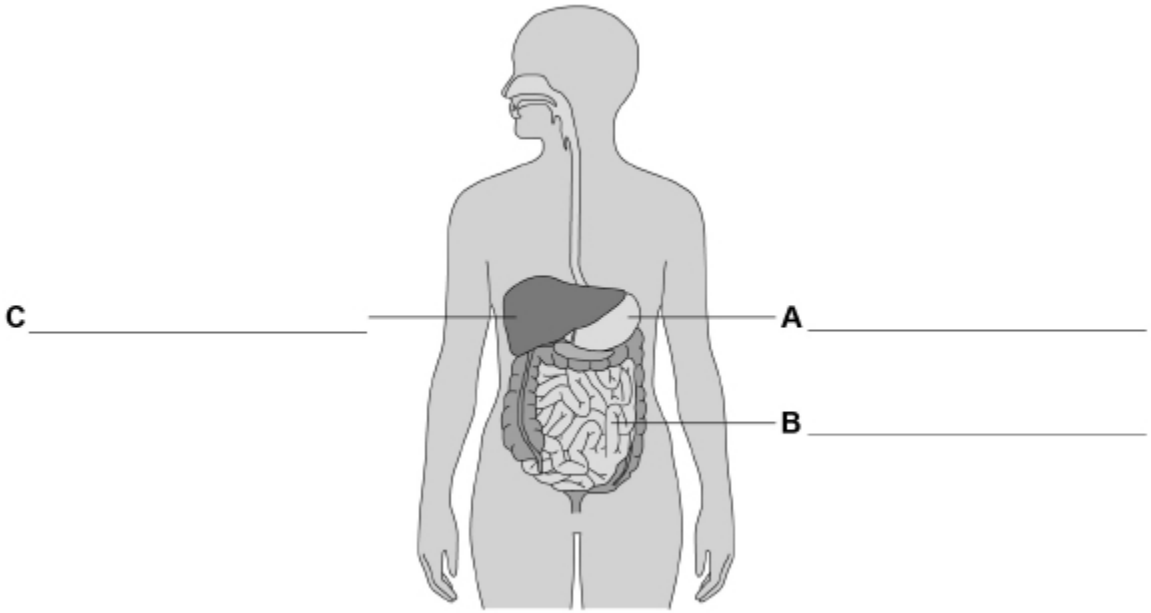
_____

_____

(1)

(Total 12 marks)

6. The diagram below shows the human digestive system.



(a) Label organs **A**, **B** and **C**.

(3)

(b) Complete the sentences.

Choose the answers from the box.

catalyse	**denatured**	**digest**	**energise**
excreted	**ingested**	**insoluble**	**soluble**

Digestion is the process of breaking down large food molecules into smaller molecules that are _____ .

Enzymes help to break down food because they _____ chemical reactions.

If the temperature of an enzyme gets too high, the enzyme is _____ .

(3)

(c) Protease is an enzyme.

Protease breaks down protein.

What is protein broken down into?

Tick **one** box.

- Amino acids ☐
- Fatty acids ☐
- Glucose ☐
- Glycerol ☐

(1)

(d) Why is protein needed by the body?

_____

_____

(1)

(e) Which organ in the human digestive system produces protease?

Tick **one** box.

Gall bladder ☐

Large intestine ☐

Liver ☐

Stomach ☐

(1)

(f) Describe how you would test a sample of food to show it contains protein.

Give the reason for any safety precautions you would take.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(g) Complete the sentence.

Choose the answer from the box.

fat	**fibre**	**minerals**	**vitamins**

Obesity can be caused by a diet high in _____ .

(1)

(h) Complete the sentence.

Choose the answer from the box.

skin cancer	type 1 diabetes	type 2 diabetes

Obesity is a risk factor for _____ .

(1)

(Total 15 marks)

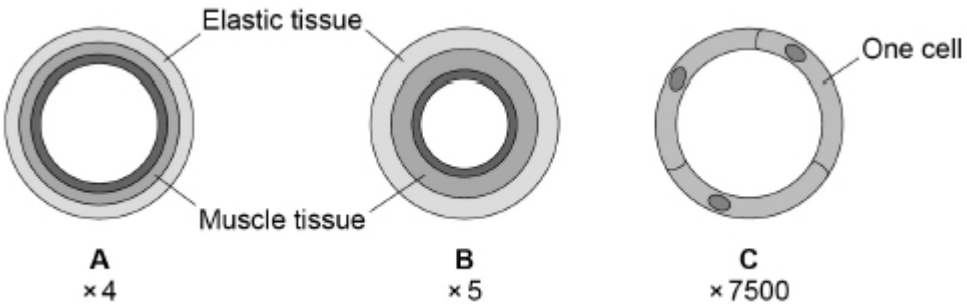
7. This question is about the circulatory system.

(a) Draw **one** line from each blood component to its function.

Blood Component	Function
	Destroys microorganisms
Platelet	Helps the blood to clot
Red blood cell	Transports glucose around the body
White blood cell	Transports oxygen around the body
	Transports urea

(3)

(b) The diagram below shows cross sections of the three main types of blood vessel found in the human body. Each blood vessel is drawn to the scale shown.



Which blood vessel has the smallest diameter?

Tick **one** box.

A		B		C	

(1)

(c) Which blood vessel in the figure above is an artery?

Give **one** reason for your answer.

Blood vessel: _____

Reason: _____

_____

(2)

Table 1 gives information about the blood flow in two people.

Table 1

Person	**Blood flow through the coronary arteries in cm^3 / minute**
A – does **not** have coronary heart disease	250
B – has coronary heart disease	155

(d) Calculate the difference in blood flow between person **A** and person **B**.

_____

_____

Difference = _____ cm^3 / minute

(1)

(e) Suggest why blood flow through the coronary arteries is lower in people with coronary heart disease.

_____

_____

(1)

(f) Calculate the volume of blood flowing through the coronary arteries of person **A** in 1 hour.

Give your answer in dm^3.

_____

_____

_____

_____

_____

Volume of blood in 1 hour = _____ dm^3

(2)

Coronary heart disease can be treated by:

- inserting a stent
- using a Coronary Artery Bypass Graft (CABG).

Table 2 gives information about each method.

Table 2

	Stent	CABG
Procedure	The patient is awake during the procedure. A small cut is made in the skin. A wire mesh is inserted into the coronary artery via a blood vessel in the arm or leg.	The patient is not awake during the procedure. The chest is cut open. A section of blood vessel from the arm or leg is removed. It is used to create a new channel for blood to bypass the blockage in the coronary artery.
When procedure is recommended	When only one blockage is present	When multiple blockages are present
Time spent in hospital after procedure	2-3 hours	at least 7 days
Recovery time after procedure	7 days	12 weeks
Risk of heart attack during procedure	1%	2%
Chance of failure within one year	40%	5%

(g) Give **two** advantages of using a stent instead of CABG.

1. _____

_____

2. _____

_____

(2)

(h) Give **two** advantages of using CABG instead of a stent.

1. _____

_____

2. _____

_____

(2)

(Total 14 marks)

1.

(a) circulatory / circulation (system)

allow cardiovascular (system)

ignore blood (system)

ignore cardiorespiratory system

1

(b) any valve ringed

allow more than one valve separately ringed

1

(c) prevent backflow (of blood)

allow correct description of backflow

or

ensure one-way flow

allow maintains (correct) direction of blood

1

(d) vein

allow correctly named veins

1

(e) any **two** from:

(referring to mechanical valves)

- long lasting
  or
  durable
  or
  does not break / tear
  or
  does not wear out

  allow reliable

  allow less likely to need a replacement (after 5 years)

  ignore no need for a replacement
- do not need to go into hospital / surgery again
- no ethical issues (surrounding use of living / animal tissue)
- no risk of rejection
- no need for anti-rejection / immunosuppressant drugs
- no risk of transmission of disease

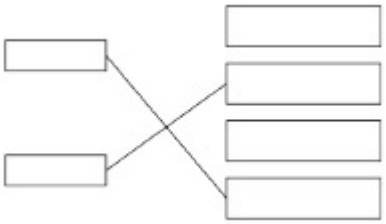
2

(f) no need to take anti-clotting medication

allow can't hear a pig valve
allow can get a better fit with a pig valve
allow less leaky with a pig valve
allow less likely to get a heart attack / stroke
ignore will not get blood clots (around the valve)

1

(g)



an additional line from a medical condition negates the mark

2

[9]

2. (a) epidermis

palisade mesophyll

allow palisade / mesophyll

xylem

3

(b) guard cells

1

(c) to let carbon dioxide into the leaf

1

(d) by evaporation

1

(e)

*an answer of 4 (cm^3) scores **2** marks*

evidence of correct graph readings (5 and 1)

allow in range 4.8 to 5.2 and 0.8 to 1.2

1

4 (cm^3)

allow correct subtraction from their graph readings
allow their calculated value from readings in the range 4.6 to 5.4 and 0.6 to 1.4

1

(f) plant **A** has more leaves

1

(g) any **one** from:
(the new room was)
- windier
- warmer
- drier / less humid
- brighter

answers must be comparative
allow sunnier
ignore more sun

1

(h) any **one** from:
- spikes / points / thorns / sharp
- poisonous / toxic
- brightly coloured berries
- leaves are tough / leathery
  or
  leaves are hard to chew

ignore reference to predators eating holly
allow unpleasant taste

1

[11]

3. (a) (by the guard cells) opening **and** closing the stomata

ignore ref to guard cells being plasmolysed / turgid

1

(b) (water is) transported in xylem

ignore mechanism of water entering the roots
*do **not** accept translocation*

1

water evaporates (from leaves)

allow loss of water vapour

1

through the stomata

allow between the guard cells
*if no other marks awarded allow **1** mark for reference to transpiration*

1

(c) any **one** from:

*allow converse for plant **B***

- plant **A** has more stomata

  allow (the plants) have different numbers of stomata
- plant **A** has more leaves

  allow (the plants) have different numbers of leaves
- plant **A** has bigger leaves

  allow (the plants) have different sized leaves
- plant **A** has a greater total surface area of leaves

  allow (the plants) have different total surface area of leaves

  *allow plant **A** has less (waxy) cuticle*

  or

  (the plants) have different amounts of (waxy) cuticle

  *allow plant **A** has fewer hairs on leaves*

  or

  (the plants) have different number of hairs on the leaves

1

(d)

*an answer of 10 scores **3** marks*

5.2

allow in range 4.8 to 5.6

1

(5.2 × 2 =) 10.4

or

$\left(\frac{5.2}{0.5} =\right) 10.4$

allow their calculated value in the range 8.8 to 12.0

1

10 (cm^3/hour)

allow their calculated value in the range 8.8 to 12.0
correct to 2 significant figures

1

(e) (rate increased because)

any **two** from:

answers must be comparative

- (it was) warmer
- light intensity was higher
- (it was) less humid

  allow greater water vapour gradient between leaves and environment
- (it was) windier

2

[10]

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

3–4

Level 1: Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.

1–2

No relevant content

0

Indicative content:

- backflow can occur **or** some blood flows backwards
- less blood leaves the heart **or** less blood is pumped around the body **or** some blood stays in the heart (instead of being pumped out) **or** reduced blood pressure **or** reduced flow rate
- less oxygen supplied to muscles / cells
- (so) less aerobic respiration
- (so) less energy released
- (so) less (efficient) muscle contraction
- anaerobic respiration takes place
- less (efficient) removal of lactic acid **or** lactic acid builds up **or** oxygen debt occurs
- (lactic acid building up) causes muscle fatigue
- less (efficient) removal of carbon dioxide (from blood)

a **level 2** response should refer to both respiration **and** the effects on exercise

(b)

ignore raw numbers from the table

(deaths mechanical valve =) 6% / 6.31136%

allow correctly rounded value

1

(deaths biological valve =) 10% / 10.14823%

allow correctly rounded value

1

(therefore a) higher proportion / percentage of patients die with biological valve
or
patients are more likely to die with biological valve

*do **not** accept more patients die with a biological valve*

*allow **2** marks for ratio mechanical : biological = 1:1.6 **or** 1:1.7 **or** correctly calculated value*

*allow **3** marks for deaths with biological valves = 4% / 3.83687% higher **or** correctly rounded value*
or
patients are 1.6 / 1.7 times more likely to die with biological valves

*if **no** other marks awarded, allow for **1** mark chance of death after a valve replacement is 8% / 7.77247% **or** correctly rounded value*

1

(c) platelets

allow thrombocytes

1

(d) **Level 3:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.

5–6

Level 2: Some logically linked reasons are given. There may also be a simple judgement.

3–4

Level 1: Relevant points are made. They are not logically linked.

1–2

No relevant content

0

Indicative content:

mechanical valves

- longer lasting **or** more durable **or** don't wear out as easily **or** less likely to need replacing (within 6 years)
- blood clots (on the brain) are more likely (after surgery)
- patient has to take anti-clotting medication (for the rest of their lives)
- if medication not taken (correctly), clots can lead to blood clots on brain / heart attack
- medication can lead to excessive bleeding (after injury)
- some patients say they can hear the valves opening and closing
- survival rate at 5 years is slightly higher for mechanical valve
- lower percentage of deaths due to heart-related problems

biological valves

- no additional medication required
- ethical issues surrounding use of animal tissue
- valve may harden
- more likely to need further operation **or** another new valve
- more likely to be rejected
- more likely to need (immuno-suppressant) medication

both valves

- both are readily available
- little wait time

a **level 2** response should contain comparisons of both valves **and** some reference to own knowledge

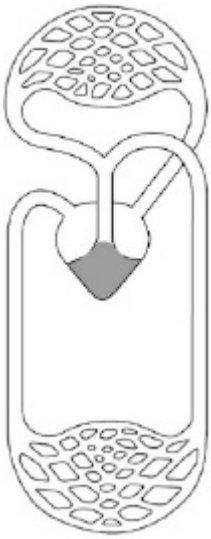
[14]

5. (a) blood is pumped to the lungs by one / right side of the heart
and
blood is pumped to the body by the other / left side of the heart

allow blood enters the heart twice for every (one) circuit around the body

1

(b) ventricle correctly identified as any part of grey area below:



1

(c) oxygenated and deoxygenated blood mixes

allow some deoxygenated blood is sent to the body / tissues / cells

1

(so) less oxygen reaches the body / tissues / cells

allow named tissues / organs

1

(d) concentration gradient (of oxygen) is shallow(er) / less steep

1

(therefore) less oxygen diffuses into blood / cells / gills

1

allow idea that concentration gradient is negative (i.e. out of axolotl) (1)
so oxygen diffuses out of axolotl's blood / cells / gills (1)

(so) less (aerobic) respiration occurs so less energy is released / available

or

(so more) anaerobic respiration occurs so less energy is released / available

*do **not** accept no respiration occurs*

*do **not** accept energy production*

1

(so) less metabolism

ignore reduced living processes unqualified

*allow reduction of building larger molecules **or** movement / muscle contraction **or** keeping warm **or** urea formation **or** chemical reactions*

or

(so when) anaerobic respiration occurs, lactic acid is produced (and is toxic)

1

(e) stem (cells)

*do **not** accept embryonic stem cell*

1

(f) any **one** from:

- paralysis
- diabetes

allow other examples such as Parkinson's / heart disease / stroke / cystic fibrosis / cancer / burns

*do **not** accept infectious diseases*

1

(g) any **one** from:

- easy to breed

allow reproduce quickly

- easy / cheap to keep / rear (as are small)
- don't take up much space

allow reference to not being dangerous (to the scientist)
allow they are not endangered
allow removal of gill will not kill the axolotl

1

(h) any **one** from:

- it's not a mammal **or** it is an amphibian
- regeneration in gills may be different to that in other organs
- metabolism / body processes are too different to humans

allow humans do not have gills

*allow it's an endangered species **or** species need to be protected from extinction*

*ignore reference to genetic differences **or** ethics*

1

[12]

6. (a) (A) stomach

1

(B) small intestine

allow ileum
ignore intestine unqualified

1

(C) liver

1

(b) soluble

1

catalyse

1

denatured

1

this order only

(c) amino acids

1

(d) any **one** from:

- for growth

  allow for enzymes / hormones / antibodies
- for repair / replacement (of cells / tissues / organs)

  allow to strengthen bones

  ignore for energy

1

(e) stomach

1

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

3–4

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

1–2

No relevant content

0

Indicative content

- grinding up the food
- add Biuret reagent (allow $CuSO_4$ and NaOH) to food (sample)
- protein turns solution (from blue) to purple / lilac
- wear goggles to protect eyes
- clean up spills immediately
- Biuret / NaOH is an irritant / corrosive / poisonous

for **level 2** a reference to Biuret, a positive result and reason for a safety precaution is required

(g) fat

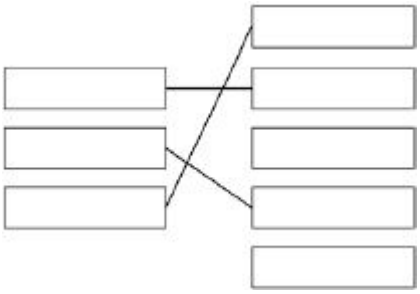
1

(h) type 2 diabetes

1

[15]

7. (a)



additional line from a blood component negates the mark for that component

1
1
1

(b) C

1

(c) (vessel) B

thick walls **or** thick muscle / elastic tissue

*do **not** accept ref to 'cell walls'*

1

or
lumen is small / narrow

allow description of 'lumen'

1

(d) 95

1

(e) (because coronary) arteries / they are narrower

allow (because the coronary) arteries are blocked / clogged (with fat)

1

(f) 250 × 60 (= 15 000)

or
15 000

allow 0.25 × 60

1

15

$$\text{allow } \frac{\text{answer to marking point 1}}{1000}$$

an incorrect conversion to dm^3 in calculation does not negate marking point 1

1

*an answer of 15 scores **2** marks*

(g) any **two** from:

- no need to stay as long in hospital (after procedure) **or** can go home sooner / same day

  allow only need to stay 2–3 hours in hospital (after procedure)
  allow less scarring
  allow less chance of infection
  allow only a small cut needed

- not as / less invasive **or** no need for a major operation **or** no need for general anaesthetic
- shorter recovery time **or** can get back to normal lifestyle quicker **or** less time needed off work

  allow only 7 days recovery

- lower risk of a heart attack (during procedure)

  ignore reference to cost
  ignore idea that it takes less time overall

2

(h) lower chance of failure (within one year)

allow only a 5% chance of failure

1

only need one operation to treat multiple blockages **or** can treat multiple blockages at one time

ignore ref to anaesthetic or CABG being a long-term treatment

1

[14]