

Section 6 – Organisms (Animals)

Answer Key

6.1	What is a tissue?	A group of specialised cells working together.
6.2	What is an organ?	A group of tissues working together.
6.3	What is a system?	A group of organs working together
6.4	What is an enzyme?	A biological catalyst (which is a protein)
6.5	Name 2 environmental conditions that cause an enzymes active site to change.	Temperature increase Increase of decrease of PH
6.6	Name 3 digestive enzymes and what they break down.	Lipase – breaks down lipids/fats Amylase – breaks down starch Protease – breaks down protein Carbohydrase - breaks down carbohydrates
6.7	What are the products when protein, fats and starch is broken down?	Protein – Amino Acids Fats – Fatty acids and glycerol Starch - Glucose
6.8	State 2 functions of bile.	Emulsify fat Neutralise stomach acid before food moves into the small intestine
6.9	What is the lock and key model?	The shape of the active site is complementary to the substrate molecules. This makes enzymes highly specific
6.10	What does denatured mean?	When the shape of the enzymes active site changes shape and the substrate no longer fits.
6.11	Where is the bile produced and where is it stored?	Produced in the liver Stored in the gall bladder.

Section 7 – Circulatory and Respiratory System

Answer Key

1.	What substance transports substances round the body?	The blood
2.	Name the 4 components that you mentioned in 7.1.	Red blood cells, white blood cells, plasma and platelets
3.	Name the upper and lower chambers of the heart.	Upper – Atria Lower – Ventricles
4.	What is the function of coronary arteries?	To provide heart tissue with oxygen for respiration, which releases energy for the heart muscle to contract.
5.	State an adaption of each blood vessel.	Capillary – 1 cell thick, Artery – Elastic walls Veins – contain valves to prevent back flow, large lumen
6.	State the pathway of air from the atmosphere to the blood.	Nose/mouth, trachea, bronchi, bronchioles, alveoli, blood
7.	What are the structures called where gas exchange happens?	Alveoli
8.	State the red pigment that blood cells contain?	Haemoglobin
9.	What is the function of the red pigment in the blood?	Bind with oxygen and transport it to the respiring cells.
10.	Name the substances that are exchanged in gas exchange at the alveoli.	Oxygen diffuses into the blood stream and carbon dioxide diffuses into the alveoli.
11.	State the risks associated with surgical intervention in the treatment of heart disease.	Death, rejection of organ transplant, clotting problems, thrombosis, infection

Section 8 – Organisation (Plants)

Answer Key

8.1	What is the function of the waxy cuticle?	To cover, protect and provide a waterproof layer.
8.2	What is the function of the mesophyll layer?	Where the majority of photosynthesis takes place.
8.3	What is the function of the spongy mesophyll layer?	Where the majority of gas exchange takes place.
8.4	What is the role of guard cells?	To control the opening and closing of the stomata, which control water loss and gas exchange.
8.5	How are palisade cells adapted for their function?	Large, tall cells to absorb more light. Lots of chloroplast
8.6	What is the role of the xylem?	Carry water from the roots around the plants.
8.6	How is the xylem adapted to the its function?	Hollow tubes strengthened by lignin.
8.7	What is transpiration?	The movement of water from the roots to the leaves, eventually leaving the leaves via evaporation.
8.9	What is the role of phloem?	To carry sugars from the leaves around the plant.
8.10	How is the phloem adapted?	Elongated cells with pores in the end cell walls to aid the movement of dissolved sugars.
8.11	What is translocation?	The movement of sugars from the leaves to the rest of the plant.
8.12	How are leaves in plant adapted for gas exchange?	The structure of the leaf is adapted for gas exchange. The cells in the spongy mesophyll (lower layer) are loosely packed and covered by a thin film of water. There are tiny pores, calls stomata in the surface of the leaf.

Foundation Tier

Q1.

Carbohydrates are needed as part of a balanced diet.

(a) Which formula shows glucose?

Tick (✓) **one** box.

$C_6H_{12}O_6$

☐

CO_2

☐

H_2O

☐

O_2

☐

(1)

(b) Which type of enzyme breaks down starch?

Tick (✓) **one** box.

Carbohydrase

☐

Lipase

☐

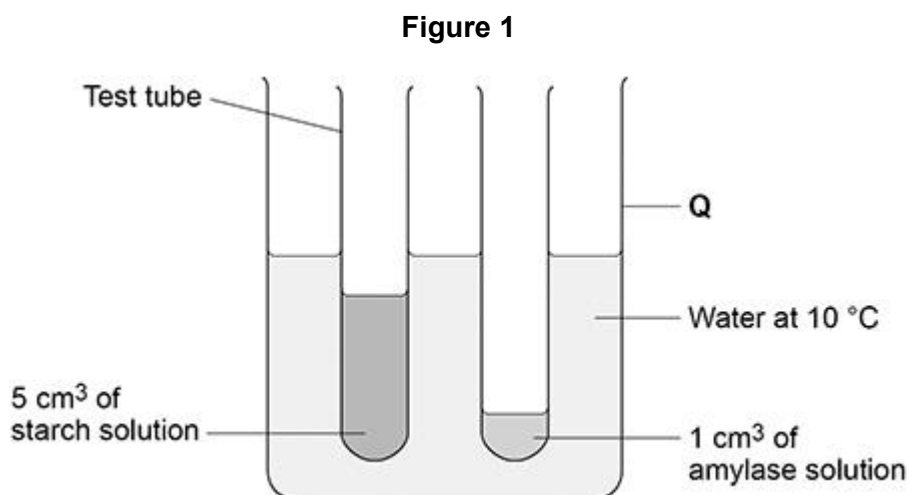
Protease

☐

(1)

A student investigated the effect of temperature on the activity of the enzyme amylase.

Figure 1 shows the apparatus used.



This is the method used.

1. Set up the apparatus as shown in **Figure 1**.
2. After 5 minutes, pour the starch solution into the amylase solution and mix.
3. Remove one drop of the amylase-starch solution mixture and place onto a spotting tile.
4. Immediately add two drops of iodine solution to the amylase-starch solution mixture on the spotting tile.
5. Record the colour of the iodine solution added to the amylase-starch solution mixture.
6. Repeat steps 3 to 5 every minute until the iodine solution is yellow-brown.

(c) Name apparatus **Q** in **Figure 1**.

(1)

(d) Why were the starch solution and the amylase solution left for five minutes before mixing them together?

Tick (✓) **one** box.

So that both solutions could reach 10 °C

☐

So that the student could calculate a mean

☐

So that the student could repeat the investigation

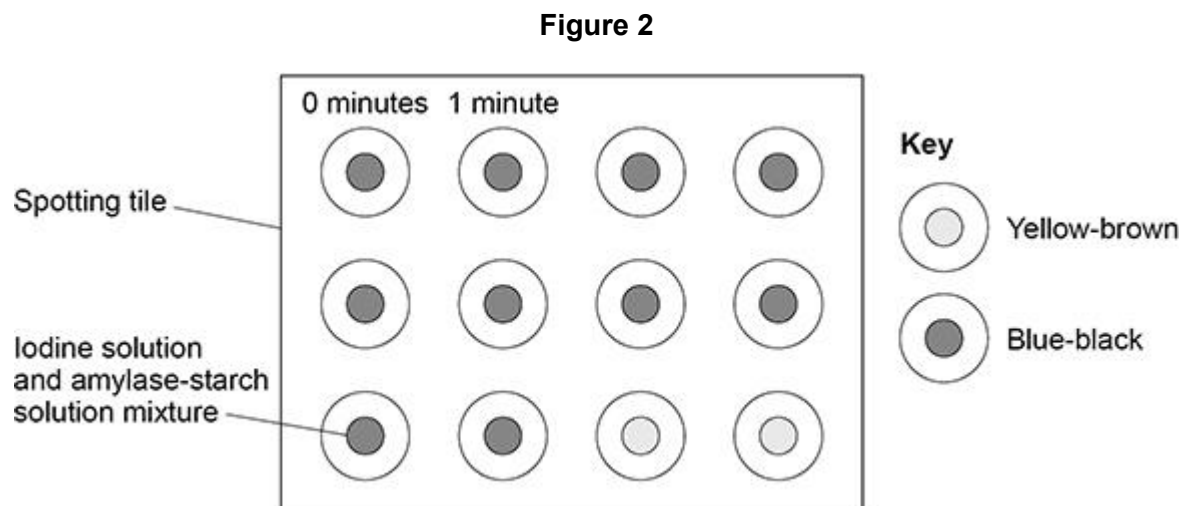
☐

So that the student had time to draw a table of results

☐

(1)

Figure 2 shows the results.



- (e) How many minutes did it take until the iodine solution and amylase-starch solution mixture was yellow-brown?

Use **Figure 2**.

_____ minutes

(1)

- (f) How could a more accurate time be obtained?

Tick (✓) **one** box.

Add more iodine solution to the spotting tile.

☐

Test the mixture with iodine solution every 30 seconds.

☐

Test the mixture with iodine solution for more time.

☐

Use two drops of amylase-starch solution mixture in each test.

☐

(1)

The student repeated the investigation at five different temperatures.

The table below shows the results.

Temperature in °C	Time taken until iodine solution and mixture was yellow-brown in minutes
20	5
35	2
50	7
65	12
80	Remained blue-black

(g) Which temperature did the enzyme work quickest at?

Tick (✓) **one** box.

20 °C

☐

35 °C

☐

50 °C

☐

65 °C

☐

(1)

(h) Explain why the iodine solution remained blue-black in the investigation at 80 °C.

(2)

(Total 9 marks)

Q2.

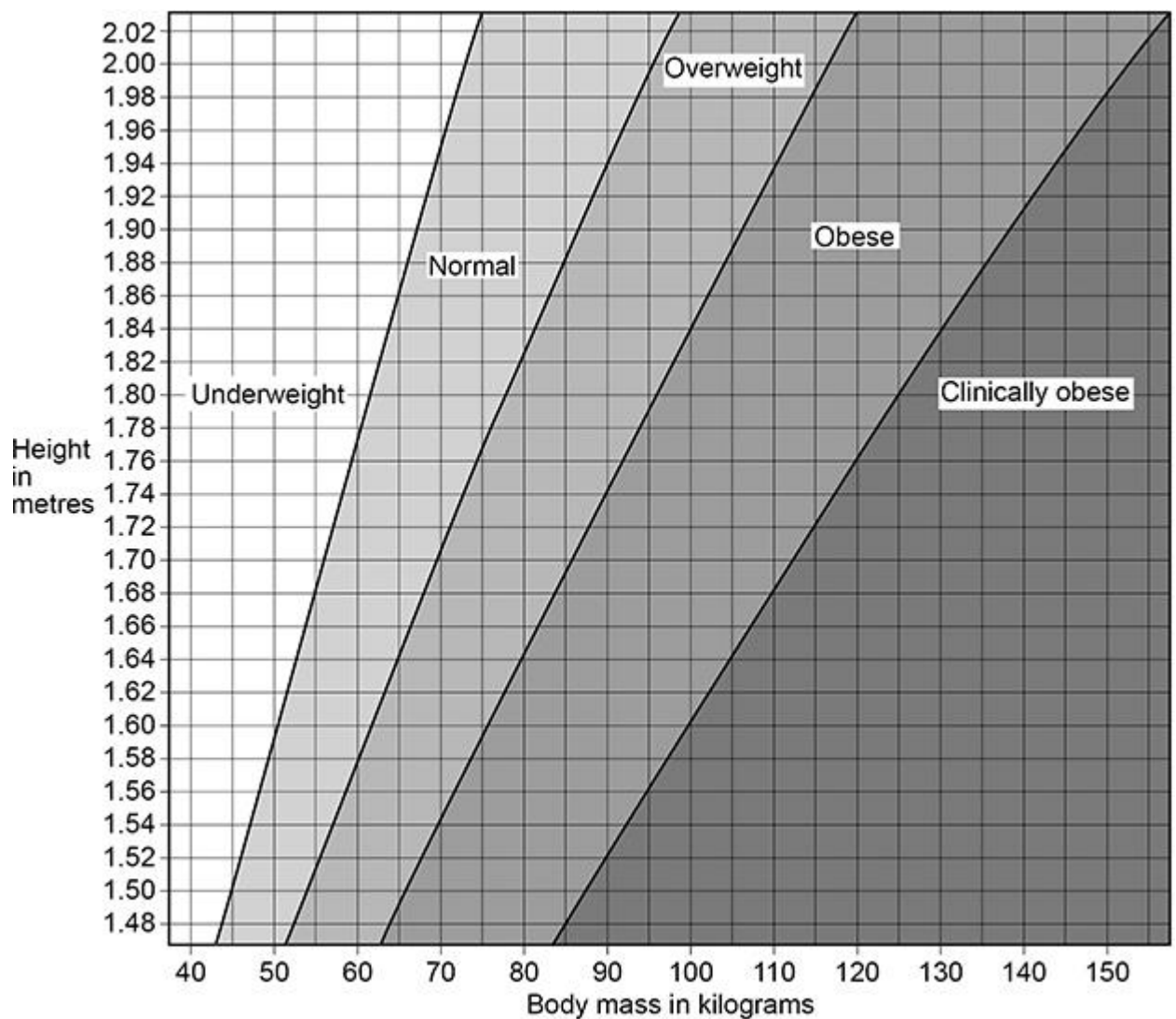
Body Mass Index (BMI) is a way of finding out if a person's body mass falls within a healthy range for their height.

Table 1 shows information about two people.

Table 1

Person	Body mass in kg	Height in m	BMI in kg/m ²
A	63	1.65	23.1
B	92	1.71	X

The graph below shows five BMI categories for adults.



- (a) Which is the BMI category of person **A** in **Table 1**?

Tick (✓) **one** box.

Clinically obese

☐

Normal

☐

Obese

☐

Overweight

☐

Underweight

☐

(1)

- (b) Calculate value **X** in **Table 1**.

Use the equation:

$$\text{BMI} = \frac{\text{body mass}}{\text{height}^2}$$

Give your answer to 3 significant figures.

X = _____ kg/m²

(3)

Scientists think there is a link between BMI and life expectancy.

Table 2 shows information about predicted life expectancy of men after the age of 50.

Table 2

BMI Category	Predicted number of years living in good health after the age of 50	Predicted number of years living in bad health after the age of 50
Normal	19.06	4.98
Overweight	18.68	5.32
Obese	16.37	7.08
Clinically obese	13.07	10.10

(c) Describe **two** patterns shown in **Table 2** about the effects of BMI category.

1 _____

2 _____

(2)

The number of people who are obese in the UK is increasing.

(d) Explain the financial impact on the UK economy of an increasing number of people who are obese.

(2)

- (e) A person who is obese is more at risk of arthritis.

Arthritis is a condition that damages joints.

Suggest how arthritis could affect a person's lifestyle.

(1)

- (f) A person who eats a diet high in saturated fat might become obese.

Name **two** health conditions that might develop if a person eats a diet high in saturated fat.

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

1

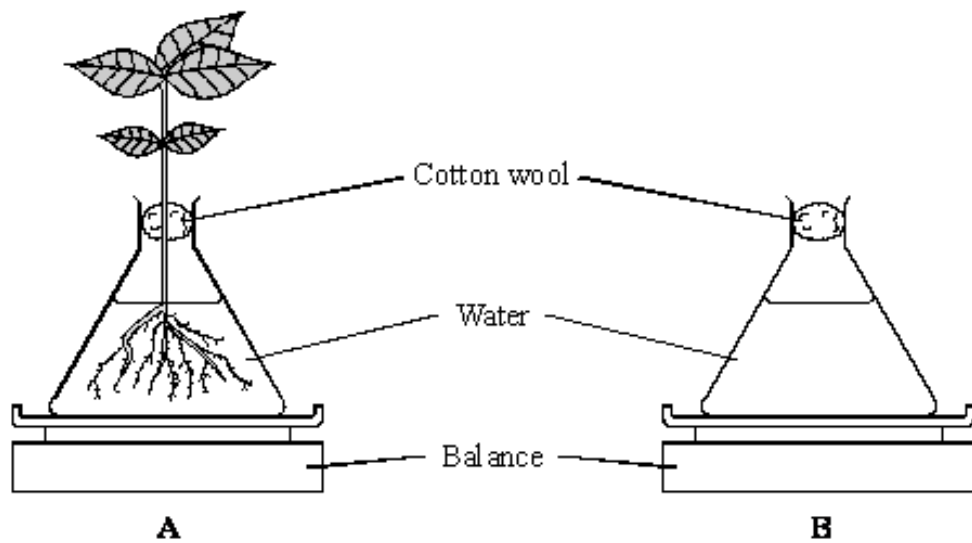
2

(2)

(Total 11 marks)

Q3.

Some students set up the following apparatus.



The balances show the same mass at the start of the investigation.

After 24 hours the mass of flask **B** was the same but the mass of flask **A** had changed.

- (i) Describe and explain the change to the mass of flask **A**.

(3)

- (ii) Why did the students need to set up flask **B**?

(1)

(Total 4 marks)

Higher Tier

Q4.

Fresh milk is a mixture of compounds including fat, protein and about 5 % lactose sugar. Lactose must be digested by the enzyme lactase, before the products can be absorbed.

Lactase can be added to fresh milk to pre-digest the lactose. This makes 'lactose-free' milk, which is suitable for people who do not produce enough lactase of their own.

A student investigated the effect of changing pH and temperature on the digestion of lactose in milk.

The results are shown in **Tables 1** and **2**.

Table 1
Effect of pH

pH	Time taken to digest lactose in minutes
4.0	20
5.0	18
6.0	13
7.0	7
8.0	5
9.0	6

Table 2
Effect of temperature

Temperature in °C	Time taken to digest lactose in minutes
30	20
35	14
40	11
45	6
50	12
55	23

- (a) The label on a carton of lactose-free milk states:

'Lactase is normally produced in the stomach of mammals.'

The results in **Table 1** show that this statement is unlikely to be true.

Explain how.

(2)

- (b) Explain as fully as you can the results shown in **Table 2**.

(3)

- (c) Bile is produced in the liver and is released into the small intestine.

Explain how bile helps the digestion of milk.

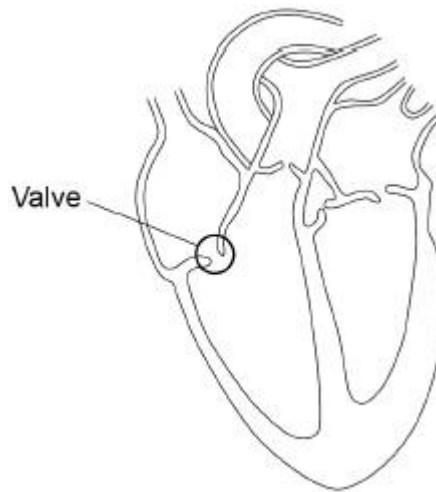
(2)

(Total 7 marks)

Q5.

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)

Mark schemes

Q1.

- | | | |
|-----|--|---|
| (a) | $C_6H_{12}O_6$ | 1 |
| (b) | carbohydrase | 1 |
| (c) | beaker
<i>allow water bath</i> | 1 |
| (d) | so that both solutions could reach 10 °C | 1 |
| (e) | 10 / ten (minutes) | 1 |
| (f) | test the mixture with iodine solution every 30 seconds | 1 |
| (g) | 35 °C | 1 |
| (h) | enzyme / amylase is denatured
or
enzyme / amylase stops working
<i>allow active site / enzyme has changed shape</i>
<i>do not accept enzyme / amylase has died</i> | 1 |
| | (so) starch is not broken down
or
starch is still present | 1 |
- [9]**

Q2.

- | | | |
|-----|---|---|
| (a) | normal | 1 |
| (b) | $92 \div 1.71^2$ | 1 |
| | 31.46(...)
<i>allow correctly calculated value using</i>
<i>$92 \div 1.71$</i> | 1 |
| | 31.5 | 1 |

(c) any **two** from:

*allow 'more overweight' or 'more obese'
for higher BMI category throughout*

- the higher the BMI (category) the lower the number of years living in good health
allow the lower the BMI (category) the higher the number of years living in good health
- the higher the BMI (category) the higher the number of years living in bad health
allow the lower the BMI (category) the lower the number of years living in bad health
- the higher the BMI (category), the lower total life expectancy
allow the lower the BMI (category), the higher total life expectancy
if no other marks awarded, allow for 1 mark idea that as BMI increases, quality of life decreases

2

(d) costs the NHS / UK health service / Government / hospitals more money

(because need to pay for) additional surgery / medication / hospital stay to treat stroke / diabetes

*allow other correct named conditions
e.g. heart attack / immobility / disability / arthritis*

1

or

more time off work (if in hospital / unwell) (1)

allow more people unable to work

(so) employer / Government have to give financial support (1)

allow (so) decreased productivity (in workplace)

1

(e) allow any **one** from:

- movement issues
allow example of movement issue
 - loss of job / income
 - disability
 - mental health impact of lack of movement
- or**
- mental health impact of pain
 - need to visit the doctor / take medication regularly
 - may need surgery

(f) type 2 diabetes

allow atherosclerosis

1

1

CVD / CHD

or

heart attack / disease

or

stroke

*allow **two** named vascular conditions
for 2 marks from heart attack **or** stroke
or high blood pressure **or** high (blood)
cholesterol*

allow cancer

allow liver disease

1

[11]

Q3.

(i) the mass got less

accept it got lighter

award 1 mark for water was lost from the plant

1

water was taken into the plant **or** roots
absorbed water

*do **not** accept soaked into plant*

1

and lost through transpiration **or** the
leaves **or** evaporated from the leaves
or stomata

1

(ii) to check the effect of the plant **or** to
act as a control **or** to show that it was
not due to evaporation from water

*do **not** accept to keep it fair **or** to check that it was
fair*

*do **not** accept fair test*

1

[4]

Q4.

(a) stomach is acidic / has low pH

allow any pH below 7

ignore stomach is not alkaline

1

lactase works best / well in alkali / high pH / neutral / non-acidic conditions

allow any pH of 7 and above

accept works slowly in acid conditions

*allow figures from table with a **comparison***

ignore reference to temperature

1

(b) any **three** from

- (below 45(°C)) increase in temperature increases rate / *speed* of reaction
- reference to molecules moving faster / colliding faster / harder / more collisions
- optimum / best at 45(°C)
allow value(s) in range 41 - 49
- high temps / above 45(°C) (rate slows due to) denaturation of enzyme /lactase
*allow synonyms of denaturation but **not** killed*
*denaturation at high **and** low temperature does **not** gain this mark*
ignore body temperature
ignore references to time / pH

3

(c) any **two** from

- acid neutralised **or** conditions made neutral / alkali
accept bile is alkaline
- (allow) emulsification / greater surface area of fat / lipid
allow description of emulsification eg fat is broken down / broken up into droplets
- enzymes (in small intestine) work (more effectively / better)
allow better for enzymes

2

[7]

Q5.

- (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]