



GCSE Biology

The Heart and Heart Disease

Mark Scheme

Time available: 90 minutes

Marks available: 81 marks

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Mark schemes

| | | |
|-----------|--|-----|
| 1. | (a) less blood flows through or less blood flows to the heart (muscle / cells / tissue) | 1 |
| | less oxygen (reaches the heart muscle) | |
| | <i>allow less respiration</i> | |
| | <i>allow less energy released</i> | |
| | <i>do not accept less energy produced / made / created</i> | 1 |
| | (b) D | 1 |
| | (c) B | 1 |
| | (d) is more likely to get a blockage (with high cholesterol) | |
| | or | |
| | blockage could be biggest | |
| | <i>ignore has the highest blood cholesterol concentration</i> | 1 |
| | (e) 4 and 5.6 | 1 |
| | $\left(\frac{5.6}{4}\right) = 1.4$ | |
| | <i>allow correct division using</i> | |
| | <i>either 5.3 or 5.8 (for person D)</i> | 1 |
| | (f) opens / widens (artery) | |
| | <i>allow pushes blockage to the side</i> | 1 |
| | so (more) blood can flow through | |
| | <i>allow (more) oxygen(ated blood) can flow through</i> | 1 |
| | (g) platelets | 1 |
| | (h) Level 2: A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given. | 3–4 |
| | Level 1: Relevant points are made. They are not logically linked. 1–2 | 1–2 |
| | No relevant content | 0 |

Indicative content:

Advantages:

- **only** have to take the tablet once a day
- **only** a tablet so easy to take **or only** a tablet so not painful to take
- (drugs are effective so) less likely to get a blood clot
- drugs are cheap so less cost to NHS **or** drugs are cheap so (more) people can afford them
- drugs have been used for a long time so must be safe / trusted

Disadvantages:

- patients have to make sure they always have a supply of drugs
- patients could forget to take the drugs (every day)
- patients could still get a blood clot in the first week
- restrictions on lifestyle because patients have to have a blood test every few weeks
- restrictions on lifestyle because patient can't eat certain foods
- patients may get a blood clot if they eat the wrong food
- risks associated with puncturing skin / infection
- patient may have a fear of needles
- higher risk of bleeding / bruising

For **Level 2** students must evaluate, including consideration of, the advantage and disadvantage of anti-clotting drugs.

[14]

2.

- (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

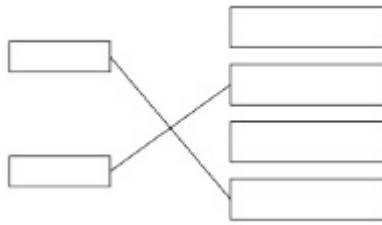
allow less leaky with a pig valve

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]

3.

(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

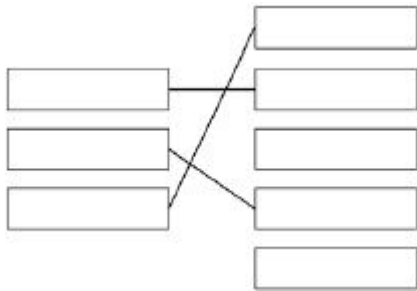
- both are readily available
- little wait time

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

[14]

4.

(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) $250 \times 60 (= 15\,000)$

or

15 000

allow 0.25×60

1

15

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]

5.

- (a) any **two** from:

allow proteins / hormones / antibodies / vitamins / minerals / ions / fatty acids / glycerol

- carbon dioxide
- water
- glucose
- amino acids

ignore sugar / enzymes / nutrients / waste

- lactic acid

2

(b) more haemoglobin

max 2 marks if 'more' is not given

1

(therefore) more oxygen can be carried / transported

1

(for) more (aerobic) respiration of muscle (cells)

or

more energy released for muscle (cells)

allow less anaerobic respiration / lactic acid / oxygen

debt / fatigue in muscle (cells)

i.e. addition of 'debt'

*do **not** accept energy produced*

1

(c) pulmonary artery

1

vena cava

1

(d) B

1

(e) any **three** from:

- arteries have a **thicker** layer of muscle (tissue) **or** veins have a **thinner** layer of muscle (tissue)*

- arteries have a **thicker** layer of elastic tissue **or** veins have a **thinner** layer of elastic tissue*

if neither marking points 1 or 2 awarded, allow arteries have a thick wall **and veins have a thin wall*

or

*arteries have a **thicker** wall or veins have a **thinner** wall for 1 mark*

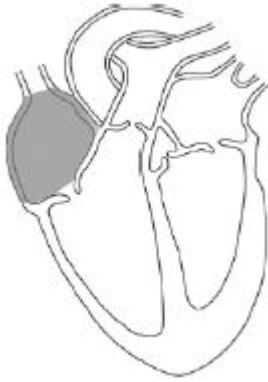
*do **not** accept 'cell wall'*

- arteries have a **narrower** lumen **or** veins have a **wider** lumen
allow descriptions of 'lumen'

- arteries do not have valves **and** veins have valves
*allow **only** veins have valves*

3

(f) allow an X drawn anywhere in grey shaded area below:



if a large X is drawn, award the mark if the intersection touches the grey area

if a label line is used, award marks if the end of the label line touches the grey area

allow label 'pacemaker'

ignore label 'right atrium'

1

(g) an irregular heart beat

allow arrhythmia

allow fibrillation

ignore heart failure

*do **not** accept cardiovascular disease / heart murmur*

1

[13]

6.

(a) (i) muscular

1

(ii) 7

1

(iii) an electrical device

1

(b) (i) in sequence:

5

1

7

1

2

1

(ii) 3

1

(c) (i) prevent backflow (of blood) / allow flow in only one direction / in the correct direction

1

(ii) **A**

no mark, but max 2 marks if incorrect

2 / atrium contracts / pressure in **2** increases

1

blood pushes ball (down / towards ventricle / towards **5**)

allow this point even if valve in wrong part of heart

1

(opens valve which) allows blood into **5** / ventricle

or converse points re closing the valve

1

(d) (i) involvement of platelets / eg platelets 'trigger' clotting process / release enzyme(s) / release 'clotting factors'

1

fibrinogen to fibrin

or

meshwork formed (which traps blood cells)

1

(ii) any **four** from:

to gain 4 marks candidates should include at least:

***one** advantage and **one** disadvantage*

Advantages

(improved circulation / O₂ supply) provides:

- more cell respiration
- more energy released
- (more) active life / not so tired / more physical activity

Disadvantages

- danger of surgery / operation
- infection from surgery / operation
- valve may need replacing
- clots may form and block blood vessels
may need to take anti-coagulants – eg warfarin
- clots may cause heart attacks / strokes

4

[17]