

Mark schemes

Q1.

- (a) 1. Renal vein;
 2. Vena cava to right atrium;
 3. Right ventricle to pulmonary artery;

3

- (b) 1. Vein;
 2. Wide(r) lumen

OR

Thinner wall;

2

- (c) 1. (Plasma) proteins remain;
Accept albumin/globulins/fibrinogen for (plasma) protein
 2. (Creates) water potential gradient

OR

Reduces water potential (of blood);

3. Water moves (to blood) by osmosis;
 4. Returns (to blood) by lymphatic system;

4

[9]**Q2.**

- (a) 1. Only use single lines/do not use sketching (lines)/ensure lines are continuous/connected;
 2. Add labels/annotations/title;
 3. Add magnification/scale (bar);
 4. Draw all parts to same scale/relative size;
 5. Do not use shading/hatching;

2 max

- (b) 1. Blood vessel **X** – artery/arteriole **and**
 Blood vessel **Y** – vein/venule;
 2. (Difference in) lumen size

OR

(Difference in) wall thickness;

Ignore name of blood vessel, eg. (pulmonary) artery

2

- (c) 1. Carry/wash sharp instruments by holding handle

OR

Carry/wash sharp instruments by pointing away (from body)/down;

Accept for 'instruments', a suitable named example, eg. scalpel

2. Disinfect instruments/surfaces;

*Accept for 'instruments', a suitable named example, eg. scalpel**Accept for 'disinfect', sanitise OR use antiseptic*

3. Disinfect hands

OR

Wash hands with soap (and water);

Accept for 'disinfect', sanitise OR use antiseptic

4. Put organ/gloves/paper towels in a (separate) bag/bin/tray to dispose;

2 max

[6]**Q3.**

- (a) 1. Muscle contracts;

2. Constricts/narrows arteriole/lumen;

*Accept decreases for constricts/narrows**Accept vasoconstriction for 1 mark*

2

- (b) (Ventricles and arteries)

1. Ventricle (muscles) relaxed

OR

Arteries recoiled;

*Accept references to ventricle, artery or atrium (singular)**Accept no muscle activity***OR***Diastole***OR***Arteries smoothing blood flow*

2. No (blood) backflow (into ventricles)

OR

No blood movement to/in/from arteries;

Accept flow/pumped for movement

(Atria and ventricles)

3. Atria (muscle) contracted;

4. Blood movement from atria (into ventricles);

Accept flow/pumped for movement

4

- (c) Vena cava;

1

- (d) 2 marks for correct answer = 130 (beats min⁻¹);;

1 mark for correct stroke volume = 104

2

[9]

Q4.

- (a) 1. Aortic/semi-lunar valves is closed;

Accept 'aorta valve' or 'valve to the aorta' or 'valve between the aorta and the ventricle'.

Do not accept S-L/A-V valve.

2. Because pressure in aorta higher than in ventricle;

Accept 9-10kPa in ventricle and 13kPa in aorta.

Ignore incorrect figures.

2

- (b) 1. Elastic recoil (of the aorta wall/tissue);

Reject muscle contracting.

Ignore reference to muscle relaxing.

2. Smooths the blood flow

OR

Maintains rate of blood flow

OR

Maintains blood pressure;

Ignore reference to preventing backflow of blood.

2

- (c) 1. Peaks/contractions at the same/similar time

OR

Same/similar pattern;

Mark the answer as a whole.

Accept 'shape (of curve)' for 'pattern'.

2. Lower pressure;

2

(d) 167 (beats minute⁻¹)

OR

164 (beats minute⁻¹)

OR

171 (beats minute⁻¹);

Full answers

166.6 recurring, 164.383562, 171.428571

Accept any number of decimal places as long as rounding correct.

1

[7]

Q5.

(a) 1. Increases dissociation of oxygen;
Accept unloading/ release/reduced affinity for dissociation

2. For aerobic respiration at the tissues/muscles/cells

OR

Anaerobic respiration delayed at the tissues/muscles/cells

OR

Less lactate at the tissues/muscles/cells;

2

(b) 1. (Time) 10 minutes;

2. (Ratio) 1.6875(:1);

Allow 1 mark for correct ratio calculated from wrong time

For the ratio accept any correct rounding

2

(c) 1. Increase in breathing (rate);

*Award mark points 1 and 2 **OR** 3 and 4*

Allow more breaths per minute

Reject more BPM

2. Similar/same $p\text{CO}_2$ per breath, but more breaths;
OR
 3. Increase in tidal volume;
Accept each breath is deeper
 4. Similar/same $p\text{CO}_2$ per breath, but increased volume per breath; 2
- (f) 1. (EPO) causes blood to thicken;
Accept descriptions of thickening, eg more viscous
 2. (The thickened blood) could block the coronary arteries
OR
 (The thickened blood) slows blood flow
OR
 (The thicker blood) could cause clots;
Reject atheroma/plaque (forms)
Accept could cause thrombus/embolus 2
- (g) 1. Some cyclists will gain a bigger advantage/increase
OR
 Cyclists with a haematocrit of 50% would not be able to gain an advantage;
Accept use of the data, or suitable calculations, eg some may have an 8% increase, others 0%
Some cyclists might naturally have a haematocrit over 50% (and so not be allowed to compete)
 2. There are health risks (associated with) taking EPO;
Accept dangerous side-effects of taking EPO, or examples of health risks 2
- [15]**

Q6.

- (a) 1. Increases/more oxygen dissociation/unloading
OR
 Decreases haemoglobin's affinity for O_2 ;
Accept more readily
Accept releases more O_2
 2. (By) decreasing (blood) pH/increasing acidity;
Reject if reference made to active site

2

- (b) 1. High(er) affinity for O₂ (than haemoglobin)
OR
 Dissociates oxygen less readily
OR
 Associates more readily;
Accept holds O₂ at lower ppO₂
2. Allows (aerobic) respiration when diving/at low(er) pO₂
OR
 Provides oxygen when haemoglobin unloaded
OR
 Delays anaerobic respiration/lactate production;
Accept acts as an oxygen store

2

- (c) Correct answer for 2 marks

10.8 to 11 (mins)

OR

10 minutes and 48 seconds = 2 marks;;

Accept for 1 mark, 10.48 minutes

OR

Reference to 2057.7 to 2058 (10 700 ÷ 5.2, time oxygen would last if its mass was 1 kg)

OR

Reference to 56 to 56.3 (10700 ÷ 190, oxygen in 1 kg of seal)

OR

Reference to 988 (5.2 × 190, oxygen used min⁻¹ by the seal)

OR

Incorrect answer with correct answer shown in working

2

[6]**Q7.**

- (a) Valve **A**

(Left) atrioventricular

Chamber **B**

Left ventricle;

Reject right side in either context

Accept mitral/bicuspid for Valve A.

Reject tricuspid for Valve A

Ignore AV for Valve A

1

- (b) Accept any **two** suitable safety precautions for 1 mark, eg;

Use a sharp scalpel/scissors

Wash hands/wear gloves

Disinfect bench/equipment

Cover any cuts

Cut away from self/others/on a hard surface

Safe disposal

Ignore take care with scalpel/scissors or keep away from fingers

Ignore goggles

1 max

- (c) 1. Pressure in (left) atrium is higher than in ventricle/**B causing** valve to open;
OR
 (When) pressure above valve is higher than below valve it opens;
Ignore pressure in front of/behind valve
As long as direction of opening/closing of valve is correct, ignore 'semi lunar'
2. Pressure in (left) ventricle/B is higher than in atrium **causing** valve to close;
OR
 (When) pressure in below valve is higher than above valve it closes;
Accept cords/tendons prevent valve turning inside out
Ignore pressure in front of/behind valve
As long as direction of opening/closing of valve is correct, ignore 'semi lunar'
- 2
- (d) 1. More impulses/action potentials along sympathetic (nervous system pathway/branch);
Ignore signals/information/ messages
Idea of more impulses/action potentials is required
2. To SAN increasing the heart rate (seen in **Figure 2**);
- 2
- (e) 73
- (this is the *best* answer since all numbers quoted in the question are to 2 s.f.)
- (73.4375)*
Accept 73.4 / any correct rounding
- 1
- (f) **Group to be given**
1. Sugar solution (only)

OR

A drink with sugar (**and** no caffeine);

Accept 'glucose' for sugar

Ignore named drinks unless qualified

Ignore 'sugar' by itself

Ignore references to use of a placebo tablet

Reason

2. To show/prove that sugar (alone) is not causing the increases (in HR)

OR

To show that sugar does not have an effect;

Accept 'to see the effect of sugar'

2

[9]

Q8.

- (a) D;
G;
F;

3

- (b) Coronary arteries;

Accept coronary artery

Ignore aorta, arteriole and capillary

Reject coronary veins

Do not accept coronary by itself

Accept phonetic spelling

1

Q9.

- (a) 1. Binding of first oxygen changes tertiary / quaternary (structure) of haemoglobin;

Ignore ref. to 'positive cooperativity' unqualified

Ignore ref. to named bonds

Accept conformational shift caused

2. Creates / leads to / uncovers second / another binding site

OR

Uncovers another iron / Fe / haem group to bind to;

Reject ref. to active site

2

Q10.

- (a)

	open	closed
Semi-lunar valves	2	3

Atrioventricular valves	4	1
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One mark for each correct column

General marker

2

- (b) (Acceptable range is) 6315.79 to 6400;

Allow one mark for (SV = 120 - 40 =) 80 (cm³)

OR

(1 cycle = 1.24 - 0.48 =) 0.76 (s)

OR

79 / 80 (beats minute⁻¹)

2

- (c) 1. Contraction of ventricle(s) produces **high** blood / hydrostatic pressure;
 2. (This) forces water (and some dissolved substances) out (of blood capillaries);

1. Do not accept contraction / pumping of the heart

1. Reject blood / plasma / tissue fluid forced out

2

- (d) Excess tissue fluid cannot be (re)absorbed / builds up;

The idea of excess is important

Accept 'drained' for absorbed

1

[7]

Q11.

- (a) First oxygen binds (to Hb) causing change in shape; (Shape change of Hb) allows more O₂ to bind (easily) / greater saturation with O₂

OR

Cooperative binding;

2

- (b) 1. (HbA has) lower affinity for O₂ at low partial pressures;
OR
 (HbA has) lower affinity for oxygen at pp found in tissues;
 2. Easier unloading of O₂ for (aerobic) respiration;

2

- (c) 1. A large/significant increase in HbF;
 2. (HbF has) higher affinity for O₂ (than faulty HbA);
 3. Higher proportion of HbF in blood so more oxygen carried;

OR

More oxygen carried after treatment;

3

[7]