

M1.(a) 53–70 / 70-53 / 17 (beats per minute).

1

(b) 13.6 / 13.58 / 14;

If answer is incorrect, 1 mark for the principle of difference (11) divided by initial heart rate (81).

$$\frac{70-81}{81} \quad \text{or} \quad \frac{81-70}{81} \quad \text{for 1 mark}$$

Ignore + or - signs

2

(c) 1. Allows comparison;
2. (Initial / resting) heart rates different (between males and females).

2

(d) 1. Cardiac output = stroke volume × heart rate
1. *Accept* $CO = SV \times HR$
2. (So) stroke volume increases / increased size or volume of ventricles.
2. *Neutral: more blood leaves heart*
2. *If the term stroke volume is not used, it must be defined*

2 max

[7]

M2.(a) 1. (Carry) oxygen / glucose;
Accept: oxygenated blood
Ignore references to removing waste products
Ignore references to arteries 'pumping' blood
2. (To) heart muscle / tissue / cells / myocytes.
Must be supply to heart or cardiac

2

- (b) (i) **A**;
Accept: A on its own even if outside box
Reject if two (or more) letters given 1
- (ii) **H**;
Accept: H on its own even if outside box
Reject if two (or more) letters given 1
- (c) (Aorta)
1. (is) close / directly linked to the heart / ventricle / pressure is higher / is very high;
 2. (Aorta has) elastic tissue;
Accept elasticity
Ignore reference to muscle
 3. (Aorta has) stretch / recoil.
Q Reject: contracts / relaxes / pumps
Accept: for mp 2 and mp 3, converse for small arteries if qualified by little / less 3
- [7]**
- M3.(a)**
1. Many / more capillaries (than arterioles);
 2. (Cross-sectional) area of capillaries (much) greater (than of arterioles).
Note: maximum of 1 mark for this question 1 max
- (b)
1. Short pathway / short distance between blood and outside of capillary;
Reference to blood and cells required
 2. Large surface area (of blood) in contact with walls of capillaries;
Idea is per unit volume of blood but candidates need not say this
 3. Fast exchange / fast diffusion / fast osmosis.
Must relate to increased speed 2 max

- (c) Width / size / diameter of blood cell.

Accept named blood cell

Reject platelet

Accept idea that below a certain diameter friction becomes too great for blood to flow

1

- (d) (Fluid) in tissue fluid / (fluid) in lymph.

1

[5]

M4.(Maintaining constant pH to avoid)

1. Named protein / enzyme (in blood) sensitive to / affected by change in pH;

Accept converse for MP2 and MP3.

Named example should be a protein that might be affected (by change in pH) eg haemoglobin, carrier protein in plasma membrane.

Accept 'change in H⁺ concentration' for 'change in pH'.

2. (Resultant) change of charge / shape / tertiary structure;

The change in charge idea relates to the enzyme / protein and not the blood (plasma) or red blood cells.

'Denaturation' alone is insufficient.

3. Described effect on named protein or enzyme.
e.g. less oxygen binds with haemoglobin / less transport across membranes / fewer substrates can fit active site / fewer enzyme-substrate complexes.

Idea of 'less' or 'fewer' required. Ignore suggestion of 'no' or 'none'.

[3]

- M5.(a)**
1. (Overall) outward pressure of 3.2 kPa;
 2. Forces small molecules out of capillary.

2

- (b) Loss of water / loss of fluid / friction (against capillary lining).

1

- (c) 1. High blood pressure = high hydrostatic pressure;
 2. Increases outward pressure from (arterial) end of capillary / reduces inward pressure at (venule) end of capillary;
 3. (So) more tissue fluid formed / less tissue fluid is reabsorbed.
Allow lymph system not able to drain tissues fast enough

3

- (d) 1. Water has left the capillary;
 2. Proteins (in blood) too large to leave capillary;
 3. Increasing / giving higher concentration of blood proteins (and thus wp).

3

[9]

- M6.(a)** 1. Ventricle pressure rises **then** blood starts to flow into aorta because pressure causes (aortic / semilunar) valve to open;
Accept times, eg ventricle pressure rises at 0.3 (25) seconds, followed by blood flow into aorta at 0.35 / 0.4 seconds
Idea of sequence is essential
Accept times

2. Ventricle pressure starts to fall **so** blood flow falls;
Idea of sequence is essential

2

- (b) 1. Thickness of wall increases **because** ventricle (wall) contracts;
Must be idea that increase in thickness is linked to contraction
Accept muscle for ventricle and systole for muscle contraction
2. Contraction **causes** the increase in pressure;
Accept thickening of wall

2

- (c) *2 marks for correct answer*

1. Between 120 ± 5 ;
Length of cycles varies slightly
2. Length of cardiac cycle correct but final answer wrong;
Length of cardiac cycle = 0.45 - 0.52

2

[6]