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).

$\frac{70-81}{81}$ *or* $\frac{81-70}{81}$ *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 × 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 <u>muscle / tissue / cells / myocytes</u>.

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 <u>if</u> 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 <u>thickening</u> 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]