1. (a) Concept of mixture with dead space air / eq;
(e.g. air in trachea / air just breathed in) 1

(b) Due to water vapour;
alters relative % of N_2; 2

[3]

2. (a) (i) Oxygen / glucose / amino acids / named ions / water / lipid; 1
(***A*** *monosaccharides* ***R*** *sugars*)
(*One mark awarded only if both substances correct.*)

(ii) More blood will mean <u>more</u> effective supply of oxygen / nutrients / removal of waste products / heat;
Needed to meet increased respiration / metabolism / greater energy demand (of muscle); 2

(b) (i) (Molecules) too large to pass through wall / out of capillary; 1

(ii) Lowers water potential / makes water potential more negative;
Causing water to move into capillary by osmosis / diffusion; 2
(***A*** *Lowers solute potential / increases osmotic pressure*)

[6]

3. (a) Made of tissues; 1

(b) (i) Increase in pressure causes valve **A** to shut;
And valve **B** to open;
Blood will therefore be squeezed in one direction /
valves prevent backflow; 3

(ii) "Residual" pressure / "Suction" due to action of heart /
"Respiratory pump"; 1

(c) (i) Causes an increase up to 4 kPa / stroke volume reaches 100 cm^3 then no further effect / stroke volume remains constant;
Mark for rise then constant with reference to point at which gradient changes. 1

(ii) Heart rate / pulse rate / description; 1

[7]

4. Quality of written communication should be considered in crediting points in the marking scheme. In order to gain credit, answers must be expressed logically in clear, scientific terms.

(a) (i) Correct answer of 17-20 = 1 mark
Supported by correct working = 1 mark 2

(ii) 2880 cm^3 ; 1

(b) Intercostal muscle / diaphragm contracts; Increasing volume of lungs / thorax / chest cavity; 2

(c) Rounding reduces it to zero / only to one decimal place; 1

(d) (i) Some air has been in trachea / bronchi / other parts of gas exchange system / dead space; 1

(ii) Gas exchange / diffusion only takes place in alveoli;
Sample includes air from alveoli and other parts; 2

(e) 1 Large surface area produced by many alveoli;
2 Single layer of epithelial cells / very thin epithelium / squamous / pavement;
3 Capillary walls one cell thick;
4 Giving short diffusion pathway;
5 RBC thin / flattened / disc-shaped so large surface area;
6 No nucleus / mitochondria;
7 Haemoglobin for transport of oxygen;
8 Red cell close to capillary wall; max 6

[15]

5. (a) (i) Units include both volume and time; 1

(ii) Heart beats faster so more blood leaves heart in given time / increased cardiac output;
Needs reference to given time in order to explain rate. 1

(b) Amount of oxygen (falls) in veins from muscles; 1

(c) More blood is flowing to lungs;
More oxygen can diffuse / pass into blood from alveoli / lungs;
More oxygen in blood in pulmonary vein / arteries to body; 2 max

[5]

6. (a) (i) Arteries divide to form arterioles; 1

(ii) Blood goes to (an organ) along an artery and leaves by a vein; 1

(b) (i) Multiply (mean) length by total cross-sectional area; 1

(ii) 2 marks - Correct answer of 6.45/6.5%;; *[Accept: 6.4% / 6%]*
1 mark - Incorrect answer but clearly derived from volume of blood in capillaries divided by total volume of blood in all vessels; 2

(c) (i) Muscle/ skin/ lungs/ heart; 1

(ii) Muscle;
Contracts;
Vasoconstriction/ reduces diameter (of arteriole supplying capillaries); 3

[9]

7. (a) (i) Less/no protein at Y;
(Molecule) too large; 2

(ii) More concentrated;
Water removed; 2

(b) Produces lower water potential;
Water moves into capillary;
By osmosis/diffusion; 3

(c) Starvation linked to low protein content of diet/Low protein concentration in plasma/blood;
Water potential of blood higher/smaller water potential gradient;
Tissue fluid formed faster than returned/less tissue fluid returned to blood; max 2

[9]

8. (a) Made up of tissues; 1

(b) Diffusion;
From (blood in) vessels in wall; 2

(c) (i) Recoil;
Of elastic tissue; 2
[*Note: Do not allow second point where included with other tissues*]

(ii) Each surge in pressure caused by one contraction/heart beat; 1

[6]

9. (a) Caused by blood leaving the heart/entering artery;
As a result of ventricles contracting/systole; 2

(b) Stretch as pressure increases;
Recoil/spring back as pressure drops; 2
Do not accept contract and relax in this context.
Allow 1 mark for 'stretch and recoil' without reference to pressure.

(c) Both have an endothelium/epithelium/squamous cells; 1

[5]

10. (a) Contain different/more than one tissue/type of cell; 1

(b) 0.8 (s) 1

(c) 0.4 (s) as events in right ventricle same as in left; 1

(d) (i) 0 - 0.1/0.4 - 0.9 because the volume increasing/ventricle filling/blood entering; 1

(ii) from 0.9/0.1 – 0.4 because volume decreasing/ventricle emptying/blood leaving; 1

In part (d) Accept any two figures from within the range.

(e) Correct answer of 15.75/15.8/16 = 2 marks
Incorrect answer but clear understanding that 45cm^3 is 100% = 1 mark 2

[7]

11. (a) (i) Pattern described as constant / decrease to 04.00 / 06.00 then rising; 1

(ii) Corresponds to ventricles contracting / systole; 1

(iii) Less / little difference between maximum and minimum / less variation / constant / not pulsed / smoother;
pressure in vein lower 2

(b) (i) The larger the molecule, the less permeable;
Over 68 000 walls not permeable; 2

(ii) Plasma proteins / albumin and globulin too large to leave capillary;
Water lost / Increase in concentration of proteins in blood / plasma; 2

(iii) Haemoglobin in red blood cells/
Haemoglobin too large to pass through membrane of RBC/
Red blood cells (containing haemoglobin) too large to pass through wall; 1

[9]

12. (a) made of (different) tissues/specified tissues; 1

(b) (i) 20 μm as it consists of endothelium only/does not contain muscle,

connective tissues and elastic tissue; 1

(consider other answers and credit understanding.)

(ii) 1 mark calculation derived from diameter - (2 × wall thickness)/ answer of 3mm;
2 marks 2mm/2000µm; 2

(c) stretches as a result of high pressure/surge of blood;
then recoils; 2

[6]

13. (a) allows comparison
due to different sizes of organisms; 2

(b) increase in rate of blood flow, Hb concentration increases; 1

(c) 1.38 × 0.132 = 0.182 and 1.38 × 0.038 = 0.052 / equivalent method;
0.182 – 0.052 = 0.13 / 0.129;
(*correct answer of 0. 13 / 0.129 gains two marks*) 2

[5]

14. (a) Arrows on all five vessels in correct direction; 1

(b) (i) D; 1

(ii) E; 1

(c)

Feature	Vessel C	Vessel E
Valves	Absent	Present
(Relative) thickness of walls	Thicker	Thinner
Elastin/elastic tissue/fibres	More	Less
Muscle	More	Less
Lumen	Narrow	Wide

2 max

Two marks for two correct rows

Accept any pair of contrasting terms with same meaning as those used.

(d) Contracts;

(Causing) vasoconstriction/narrows lumen; 2

(e) (Elastic tissue) stretches when pressure is high;

Springs back/recoils/returns to normal; 2 max

Q *Do not credit references to contracting, relaxing or expanding*

[9]