M1. (a) beating/pumping of heart / contraction of ventricles/heart;

1

(b) (at arterial end) hydrostatic pressure/blood pressure;
greater than pressure of water potential gradient /greater than osmotic uptake;

2

(c) removed by lymphatic system / lymph; returned to blood;

2

(d) less protein in blood;
water potential gradient is lower (less –ve/higher ψ).

2

[7]

M2. (a) exchange/diffusion across body surface/skin;
short <u>diffusion</u> pathway/distance/large SA:V ratio;

2

(b) large numbers of lamellae so large SA;
lamellae thin so short (diffusion) pathway to blood/capillaries;
high rate of oxygen uptake for respiration/energy release;
(accept more oxygen)

3

[5]

M3. (a) (i) arteriole;

1

(ii) *any two*
oxygen/glucose/amino acids / fatty acids / glycerol / minerals;

1

(b) small diameter/ lumen / small mean cross sectional area / increase in (total) cross sectional area;
more surface in contact with blood;
greater friction / resistance;
(causes) loss of pressure;

2 max

(c) (i) artery;

1

(ii) stretches/expands to accommodate increase in blood volume / when ventricle contracts/ increase in blood pressure;
recoils when blood volume decreases / when ventricle relaxes / blood pressure decreases;

2

[7]

M4. (a) (i) 1. Removes water vapour/moisture/saturated air;

2. Increases water potential gradient/more diffusion/more evaporation;

2

(ii) 1. Increases kinetic energy;

2. Water molecules move faster;

3. Increases diffusion/evaporation;

2 max

(b) (i) Positive correlation/as light intensity increases so does rate of water movement/follows same pattern/directly proportional;

1

(ii) 1. Stomata open;

2. Photosynthesis increases/transpiration increases;

3. More water pulled up;

4. Cohesion between water molecules/by cohesion tension;

2 max

(iii) 1. Water pulled up trunk/moves up at fast rate;

2. (Water column under) tension;

3. Sticking/adhesion (between water and) cells/walls/xylem;
Adhesion is not a specification requirement.
Accept cohesion in this context

4. Pulls xylem in;

2 max

(c) **Elastic tissue**

1 Elastic tissue stretches under pressure/when heart beats;

2 Recoils/springs back;

3 Evens out pressure/flow;

Do not allow credit for expands/contracts/relaxes in this context.

From a marking viewpoint ignore all specific references to arteries and arterioles. Consider all points as applying to both.

3 Do accept controls

Muscle

4 Muscle contracts;

5 Reduces diameter of lumen/vasoconstriction/constricts vessel;

6 Changes flow/pressure;

4–6 Accept converse

Epithelium

7 Epithelium smooth;

8 Reduces friction/blood clots/less resistance;

6 max

[15]

M5. (a) (diffusion) gradient will be maintained all the way along the gill / the amount of oxygen in the water is always higher than in the blood / the numbers in the water are always higher than in the blood;
more oxygen will diffuse into the blood;

2

(b) (i) 100 cycles per minute;

(principle of 60/x or 0.6 seen gains one mark)

2

(ii) shuts mouth;
raises the floor of the mouth cavity;
decreases volume in the mouth cavity;

2 max

(iii) the fish has lowered the floor of its mouth cavity;
(therefore) the pressure in the mouth falls below that of the opercular cavity;

OR

the fish has closed the flap covering the opercular cavity;
(therefore) the pressure in the opercular cavity increases above that of the mouth cavity;

2

[8]

M6. (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;

Do not accept contract and relax in this context.

Allow 1 mark for 'stretch and recoil' without reference to pressure.

2

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

1

[5]

M7. (a) (gills have) lamellae on filaments;
lots of both;

2

(b) (i) all 3 go up;

Accept converse

1

(ii) more oxygen can be supplied;
for more respiration;

Accept answer relating to CO_2

2

[5]

M8. (a) Endothelium/epithelium;

Allow endothelial/epithelial

Reject: epidermis/endodermis

1

(b) Measurement divided by 8;

1

Allow answer in range of 3-3.3 for two marks;

Correct answer gains 2 marks.

1

(c) (i) Stretches/'expands' under high pressure/when ventricle contracts/systole;

Recoils/'springs back' under low pressure/when ventricle relaxes/diastole;

Q *References to aorta contracting or relaxing negates marks for stretch and recoil.*

Smooths blood flow/maintains blood pressure/reduces pressure surges;

Stretch and recoil without reference to blood pressure etc. = one mark.

Stretch and recoil to smooth blood flow etc. = two marks

Ignore references to aorta withstanding blood pressure or not being damaged.

2 max

(ii) (Muscle) contracts;

'It' in answer = muscle

1

(Arteriole) constricts/narrows/alters size of lumen/reduces/regulates blood flow (to capillaries);

Allow converse (muscle) relaxes and (arteriole) dilates etc/increase blood flow etc.

Ignore references to pressure

1

(d) (i) Large/increase in (total) cross sectional area/friction/resistance;

1

(ii) (More) time for exchange of substances;

1

[9]

M9. (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;

(consider other answers and credit understanding.)

1

(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]

M10. (a) lymph;

1

(b) arrow drawn from right to left . no mark *(if wrong direction disqualify)*
correct reference to blood entering capillary having higher hydrostatic pressure;

1

(c) HP forces water out;
idea that HP is "higher" than WP;
proteins remain in blood (increases WP);
idea that WP is now "higher" than HP;
water returns by osmosis / along WP gradient;
water moves out at arteriole end and back in (at venule end);

4 max

(d) high respiration rate means high demand for oxygen;
shrew <u>haemoglobin</u> has lower affinity for oxygen / gives up O^2 more readily;

shrew Hb lower saturation rate than human Hb at same partial pressure / more O^2 released at same pp;

3

[9]

M11. (a) *(explanation must be linked to structures to gain second mark for each linked pair)*

filaments/lamellae ;	large SA;
gill plates or secondary lamellae;	
large number of capillaries;	to remove oxygen / to maintain a gradient;
thin epithelium;	short diffusion pathway;
pressure changes;	to bring in more water / to maintain gradient;
countercurrent flow (or description);	exchange/diffusion along whole length / concentration gradient maintained / equilibrium not achieved / blood always meets water with higher oxygen concentration;

6

(b) (i) requires 20 cm^3 of oxygen / extracts 7.2 cm^3 of oxygen
reject if referring to volume of water

/ $\frac{20}{7.2}$;

2.7/2.8 (dm^3h^{-1});
(correct answer award 2 marks)

2

(ii) high (relative) density/heavy;
requires large input of energy;
difficult to push back out;

2 max

(c) (*for each pair second point must be linked to first*)
to provide same amount of oxygen;
need to have more water flowing over gills;
OR
metabolic rate/respiration increases (with increase in temperature);
so more oxygen required;

2 max

[12]
QWC 1

M12. (a) The muscle in the wall/sphincter contracts;
Accept converse

Reducing blood flow/narrowing/closing arteriole;
The muscle to which the candidate is referring must be clearly in the wall of the arteriole.

2

(b) (i) Blood flow increased in humans/reduced in seals;

1

(ii) Less oxygen/blood taken to muscles;
None is incorrect

(More) oxygen available for organs/brain;
Can stay under water longer (without breathing);

max 2

[5]

M13. (a) (i) one feature;
then linked Explanation;

(many) filaments / lamellae / secondary lamellae;
so large surface area;

large number of capillaries; (NOT "good blood supply")
maintains a diffusion gradient / removes oxygen;

thin epithelium / lamellae wall;
short diffusion pathway;

2

(ii) maintains diffusion / concentration gradient / equilibrium not reached;
diffusion occurs across whole length (of lamellae / gill);

2

(b) fish closes mouth and raises the floor of the mouth;
this decreases the volume / increases the pressure (of mouth);
Increased volume / decreased pressure of opercular cavity;
water forced over the gills;
operculum / opercular valve opens;

3 max

(c) less energy needed / continuous flow of water or O2;

1

[8]

M14. (a) Small surface area to volume ratio;
Loses less heat (to the water);

2

(b) (i) Diffusion through cell/body surface;

Q *The key term here is diffusion*

1

(ii) Small organisms have large surface area to volume ratio;
Rate of diffusion depends on surface area;
All parts of cell only a short distance from exchange surface;

2 max

(c) Surface area of leaves;
Different shoots will have leaves with different surface areas;

2

(d) Draw line/curve of best fit/from line/curve of best fit;
Find slope/gradient/divide distance moved by time;

2

(e) 1 Air enters through (open) spiracles;
2 Through tracheae;
3 Diffusion gradient in trachea
4 Tracheae associated with all cells/closely associated with cells;
5 Oxygen diffuses into cells;
6 Ventilation replacing air in tracheae;
7 Body covered with (waterproof) waxy layer/cuticle;
8 Spiracles are able to close;

6 max

[15]

M15. (a) Made up of different tissues/more than one tissue;

Q *Made up of tissues implies more than one so allow. Ignore references to function*

1

(b) Deoxygenated/less pressure;

1

Q *Unqualified pronouns in the context of this question refer to pulmonary artery*

(c) Thick muscular walls;
Greater elastic content;
Do not have valves;
Small/narrow lumen;

QWC Unqualified pronouns in the context of this question refer to artery

2 max

(d) (i) Decreases with increased distance from the heart;

1

(ii) Friction /resistance to flow;

1

[6]

M16. (a) (Blood) plasma;

1

(b) More/larger proteins/less urea/carbon dioxide/more glucose/amino acids/fatty acids/oxygen/high(hydrostatic) pressure;

Q *Reference to blood cells/water potential = neutral*
Q *<u>No</u> Protein should not be credited*

1

(c) (i) Contracts;

Q *Do not accept pumping of heart/heart beating*

1

(ii) Loss of fluid/volume;

Friction/resistance (of capillary wall);

Q *Reference to a narrow lumen is not sufficient to gain a mark unless friction or resistance is mentioned.*

1 max

(d) Water potential (in capillary) not as low/is higher/less negative/water potential gradient is reduced;

More tissue fluid formed (at arteriole end);

Less/no water absorbed (into blood capillary);

by osmosis; (into blood capillary);

Q *The last two marking points must be in context of movement into the blood capillary*

3 max

[7]

M17. (a) Filaments/lamellae provide large surface area;

Thin/flattened epithelium/one/two cell layers so short diffusion pathway (between water and blood);

Countercurrent/blood flow maintains concentration/diffusion gradient;

Q *Do not credit thin cell walls/membranes*

2 max

(b) (i) Large/wide range of values (so can fit on graph);

1

(ii) Decrease in uptake with increase in mass/negative correlation;

1

(iii) Enables comparison;

As animals differ in size/mass;

2

(iv) Smaller animals have larger surface area to volume ratio;

Allow converse for larger animals.

Allow appropriately named animal as an alternative to smaller or larger animals.

Lose more heat per gram of tissue;

Respire more/faster (relative to body mass);

Oxygen used in respiration;

3 max

[9]

M18. (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

Two marks for two correct rows

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

2 max

(d) Contracts;

(Causing) vasoconstriction/narrows lumen;

2

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

Springs back/recoils/returns to normal;

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

2 max

[9]