M1. (a) High(er) affinity for oxygen / absorbs/loads more oxygen;

At lower partial pressure (of oxygen) / lower pO_2;

Accept: Loads oxygen 'quicker', 'more readily', 'higher saturation', use of figures from graph for first point.

Neutral: References to unloading.

2

(b) 1. (Hydrostatic) pressure lower in capillary/blood / higher in tissues/tissue fluid;

2. Water (returns);

3. By osmosis;

4. Water potential lower/more negative in blood/capillary / higher/less negative water potential in tissues / via water potential gradient;

5. Due to protein (in blood);

6. (Returns) via lymph (system/vessels);

First marking point must be in context of between blood and tissue fluid.

Neutral: References to hydrostatic pressure and water potential at arteriole end of capillary.

3 max

[5]

M2. (a) Helical/spiral/coiled;
Compact/description e.g. 'tightly packed';

Feature = one mark
Explanation = one mark

Insoluble;
Prevents osmosis/uptake of water/does not affect water potential/(starch) does not leave cell;

These must be related for both marks but can be in reverse order.

Large molecule/long chain;
Does not leave cell;

Allow idea of compact/helical/spiral/coiled due to bonding for two marks.

2 max

(b) (i) β/beta Glucose;

Q *Reject alpha glucose*

1

(ii) Glycosidic;

1

(c) Long/straight/unbranched chains (of glucose);

(Joined by) hydrogen bonds;

Q *Ignore reference to alpha glucose*

Form (micro)fibrils/(macro)fibrils;

Provide rigidity/strength/support;

Allow suitable descriptions for last point e.g. 'prevents bursting';

3 max

[7]

M3. (a) Loading/uptake/association of oxygen at high p.O_2;

In lungs (haemoglobin) is (almost) fully saturated/in lungs haemoglobin has a high affinity for oxygen;

Unloads/releases/dissociates oxygen at low p.O_2;

Unloading linked to higher carbon dioxide concentration;

Allow converse for second marking point in tissues i.e. haemoglobin has low affinity/releases most of its oxygen.

Mark for haemoglobin having high affinity for oxygen must be 'in lungs'.

3 max

(b) (i) Larger the mammal the more to the left/steeper/'higher' is the curve/the higher the affinity for oxygen;

Allow converse.

Ignore references to Bohr shift

1

(ii) Smaller mammal has greater surface area to volume ratio;

Smaller mammal/larger SA:Vol ratio more heat lost (per unit body mass);

Allow converse explanation for larger mammals or lower surface area to volume ratio.

Smaller mammal/larger SA:Vol ratio has greater rate of respiration/metabolism;

Allow suitable named mammal as alternative to smaller or larger mammal.

Oxygen required for respiration;

(Haemoglobin) releases more oxygen/oxygen released more readily/haemoglobin has lower affinity;

4 max

[8]

M4. (a) Differentiation/specialisation

1

(b) (i) (cellulose) Cell wall;

1

(ii) Two marks for correct answer 2350–2500;;

Accept measured and real lengths in different units for one mark.

One mark for a measured length divided by real length;

2

(iii) Chloroplasts absorb light;

Q *Do not accept chlorophyll as alternative to chloroplasts*

Large vacuole pushes chloroplasts to edge (of cell);

Thin/permeable (cell) wall to absorb carbon dioxide;

1 max

[5]

M5. (a) Increase in/more carbon dioxide;

Curve moves to the right/depressed;

Q *Any reference to haemoglobin increasing affinity for oxygen disqualifies second mark point.*

2

(b) (i) More haemoglobin;

So can load/pick up more oxygen (in the lungs);

Q *Second mark point must relate to idea of loading oxygen. Answers referring only to transport of oxygen should not be credited this mark.*

2

(ii) (Haemoglobin) has lower affinity for oxygen/more oxygen released;

In/to the cells/tissues;

2

[6]

M6. (a) glucose;

(reject alpha glucose)

1

(b) hydrolysis;

(accept catabolic)

1

(c) (long) straight/unbranched chains;
(idea of more than 1) chains lie side by side / form (micro)fibrils;
idea of H bonds holding chains together;

3

[5]

M7. (a) (i) Chloroplast;

1

(ii) Photosynthesis;

Uses light (energy);

To produce carbohydrates/starch/glucose/sugars/ATP/ reduced NADP;

Note that candidates cannot be expected to have a detailed knowledge of photosynthesis.

max 2

(b) (i) **A**;

1

(ii) **C**;

1

(c) (i) Slows enzymes/prevents enzymes being denatured/ prevents/stops self-digestion;

Ignore references to bacteria. Reject enzymes not working

1

(ii) To remove organelle C/nuclei;
Which are larger/more dense;

2

[8]

M8. (a) More than one polypeptide chain;

1

(b) In lungs, there is a high partial pressure of oxygen;
And low carbon dioxide concentration;

Q *Candidates should refer to partial pressure of oxygen since this is the terms in the graph. Do not credit references to "more oxygen" in the context of this part of the question*

2

(c) (i) Carbon dioxide is a product of respiration;

1

(ii) Displaces dissociation curve to the right/Bohr shift;
Lower affinity for oxygen/less saturated with oxygen;

2

(d) In ground squirrel lower partial pressure of oxygen in lungs;
Haemoglobin can be saturated/load more oxygen;
at lower partial pressure of oxygen;

2 max

[8]

M9. (a) Any two from:

Loop of DNA;	Non-cellulose cell wall;
Plasmid;	Capsule;
Flagellum;	Mesosome;

Accept small ribosomes

2

(b) (i) (Granules) turn blue-black/dark blue/black/purple with iodine;

1

(ii) Cellulose / pectin;

1

(c) Use principle:
Feature of starch;
Consequence in terms of storage;
e.g.
Insoluble;
Therefore will not "wash" out of cell / affect water potential / affect osmosis;
OR
Molecule coiled/branched;
Therefore large amount stored in small space / compact
OR
Does not affect water potential;
So no effect on entry of water (into cell);

2

[6]

M10. (a) It is a measure of the concentration of a gas (in a mixture of gases or a liquid);

1

(b) 37-38%

Accept 36 – 39

(c) muscle contraction causes increased respiration;
increased CO_2 production lowering blood pH;

lactate released lowering blood pH;
increased heat released therefore increased temperature;
increased O_2 consumption lowering tissue PO_2;

max 4

(d) haemoglobin has a lower affinity for oxygen;
more O_2;

for respiration;

max 2

(e) **3.4 times = 2 marks**
(incorrect answer in which candidate shows amount of oxygen removed at rest is 4.6 and amount removed during exercise is 15.8 = 1 mark)

2

(f) Nearly all O_2 is transported by haemoglobin / v. little transported in plasma;

EITHER
Haemoglobin is (nearly) fully saturated with O_2 at the alveoli both at

rest and when exercising;
Therefore no (very little) further increase is possible;
OR
Haemoglobin is only 95% saturated with oxygen at the alveoli;
Therefore enriching inspired /air with oxygen will raise this to 100%;

3

(g) increased depth / rate / pulmonary ventilation;
increase stroke volume/heart rate/Q increases blood flow rate;
arterioles [*Accept* artery] supplying the muscles
dilate / vasodilation / greater proportion of blood flow to the muscles;

max 3

[15]

M11. (a) (i) both are polymers/polysaccharides/built up from many sugar units/ both contain glycosidic bonds/ contain (C)arbon, (H)ydrogen and (O)xygen;

1

(ii) hemicellulose shorter/smaller than cellulose/fewer carbons;
hemicellulose from pentose/five-carbon sugars and cellulose from hexose/glucose/six-carbon sugars;

(only credit answers which compare like with like.)

2

(b) protein/nucleic acid/enzyme/RNA/DNA/starch/amylose/amylopectin
polypeptide;

1

(c) (i) to make sure that all the water has been lost;

1

(ii) only water given off below 90 °C;
(above 90°C) other substances straw burnt/oxidised/broken down; and lost as gas/produce loss in mass;

2 max

(d) enzymes are specific;
shape of lignin molecules;
will not fit active site (of enzyme);
OR
shape of active site (of enzyme);
will not fit molecule;

2 max

(e) 1. made from β-glucose;
2. joined by condensation/removing molecule of water/glycosidic bond;
3. 1 : 4 link specified or described;
4. "flipping over" of alternate molecules;
5. hydrogen bonds linking chains/long straight chains;
6. cellulose makes cell walls strong/cellulose fibres are strong;
7. can resist turgor pressure/osmotic pressure/pulling forces;
8. bond difficult to break;
9. resists digestion/action of microorganisms/enzymes;

(allow maximum of 4 marks for structural features)

6 max

[15]

M12. (a) (i) curve to right of curve for pH 7.4;

1

(ii) more oxygen unloaded/given up / affinity decreased / reduced saturation; oxyhaemoglobin dissociates at higher oxygen concentration/partial pressure / more oxygen unloaded at the same ppO_2;

2

(b) (aerobic) respiration will produce carbon dioxide;
carbon dioxide dissolves in blood;
forming acid;
increases hydrogen ion concentration;
anaerobic respiration produces lactate;

3 max

[6]