

Mark schemes

1

(a) Light;

Humidity / moisture in air;

Air movement / wind;

Temperature;

2 max

(b) Decreases chance of error / larger difference in mass / improves accuracy / precision;

Neutral: Reliability, references to anomalies.

1

(c) 1. Stomata open, (water) transpired / evaporates / diffuses out (via) water potential gradient / leaf has higher water potential;

2. Water potential / diffusion gradient reduces (during investigation) as water not being replaced / no water supply;

3. Stomata close / closing;

Must clearly indicate that stomata are open for third marking point. However, allow correct descriptions of guard cells being turgid or flaccid as being equivalent to stomata being open or closed. 'Loss through stomata' on its own is not sufficient.

Neutral: Any reference to 'loss by osmosis'.

3

(d) Stomata (on upper surface) covered / stomata close due to lack of light / (grease provides) longer diffusion pathway;

Less evaporation / transpiration / diffusion out;

Accept: Evaporation / transpiration / diffusion 'stops' for second point as this could be referring to upper surface.

2

[8]

2

(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]

3

- (a) More red blood cells;

More haemoglobin;

2

- (b) Given (only) salt solution;

(Otherwise) treated the same way;

Accept: 'Placebo' in salt solution.

Reference to salt solution is essential for first marking point.

2

- (c) Allows comparison to be made;

Different masses / weights (of volunteers) / different weeks / lengths of treatment;

Accept: 'Both were different' for one mark.

Neutral: Size for second marking point.

2

- (d) To determine (most effective) dose / length of treatment / to find the most cost effective treatment;

Investigate long term effect / toxicity / side effects;

Do not credit marks for descriptions of the information in the table in terms of dose and length of treatment.

2

- (e) More haemoglobin / more red blood cells;
- (More) oxygen can be absorbed / transported (for) respiration / to respiring tissues / cells;
- (More) energy released / more ATP for muscle contraction;
- Delays anaerobic respiration / delays build up of lactate / lactic acid;
- Reject: 'Energy produced or made' but allow 'energy made in form of ATP'.*

4

- (f) Large sample / wide range (of individuals tested);
Random (sampling);
- Tested at different times / more than once;
- Mean / average value determined;
- Idea of establishing a range for the normal concentration / reference to use of standard deviation;

2 max

- (g) Blood thicker / denser / more viscous / more 'concentrated' / heart contraction greater / increases volume of blood;
- Accept: More blood cells in same volume / 'space'.*
- Neutral: 'more red blood cells' / 'more blood' on its own.*
- Neutral: 'Heart pumps / beats more / harder'.*

1

[15]

4

- (a) (i) Assumed that did not eat due to discomfort in the past;
- (ii) Positive correlation / as lactose concentration increases the data in column C increases / percentage who do not eat the food or feel discomfort after eating the food increases;
- (iii) Correlation does not mean that there is a causal relationship;
- May be due to some other factor / example of factor;
- Do not accept casual*

1

1

2

- (b) 1. People self-diagnosed lactose intolerant condition;
2. Discomfort may be due to other factor / infection / other component of diet / is subjective;
3. Large variation in lactose content of specific food items / e.g. variation in lactose content of different soft cheeses;
4. Amount in a serving may vary;
5. Untruthful responses / demand characteristics;
- Sample size = neutral.*

2 max

[6]

5

- (a) More than one polypeptide / chain;
- Ignore references to haem / other groups*

1

- (b) (i) 141;

1

- (ii) 1. Stop / start sequences;
2. Non coding DNA (in the gene) / introns / multiple repeats / junk DNA;
Do not credit "some bases repeated"
3. Two chains / a non-coding strand / complementary base pairs;
4. Addition of base by mutation;

2 max

- (c) Different primary structure / amino acids / different number of polypeptide chains;
- Question is about haemoglobin so do not credit differences in DNA*

1

- (d) 1. Low partial pressure of oxygen in lungs;
2. (Llama) haemoglobin able to load more oxygen / (llama) haemoglobin saturated (at low / particular partial pressure of oxygen);
3. Higher affinity for oxygen;
- The terms used in the graph (or near approximations) should be used in this answer.*
- Ignore references to unloading*
- The answer must relate to llamas*

3

[8]

6

- (a) (i) 1. Removes water vapour / moisture / saturated air;
2. Increases water potential gradient / more diffusion / more evaporation;

2

- (ii) 1. Increases kinetic energy so water molecules move faster;
- 2. Increases diffusion / evaporation;

2

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

1

- (ii) 1. Stomata open and photosynthesis increases / transpiration increases;
- 2. More water pulled up due to cohesion between water molecules / by cohesion tension;

2

- (iii) 1. Water pulled up trunk / moves up at fast rate under tension;
- 2. Sticking / adhesion (between water and) cells / walls / pulls xylem in;
Adhesion is not a specification requirement.
Accept cohesion in this context

2

(c) **Elastic tissue**

- 1. Elastic tissue stretches under pressure / when heart beats then recoils / springs back;
- 2. 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.
2 Do accept controls

Muscle

- 3. Muscle contracts to reduce diameter of lumen / vasoconstriction / constricts vessel;
- 4. Changes flow / pressure;

Epithelium

- 5. Epithelium smooth;
- 6. Reduces friction / blood clots / less resistance;

6

[15]

7

- (i) (Lung volume) increases / reaches a maximum (at **B**);
Do not negate mark for 'breathing out' if qualified e.g. when (lung volume) decreases

1

(ii) Flattens / lowers / moves down;

(Diaphragm / muscle) contracts;

Reject: second mark only if intercostal muscles cause the diaphragm to flatten

2

[3]

8

(a) (i) Healthy volunteers have 'normally' functioning vessels;

OR

Blood vessel / lumen / diameter not affected by other factors / is of normal size;

Accept: a valid ethical argument

e.g. treatment does not harm healthy volunteers

Reject: ref. to change in artery thickness

Accept: converse arguments for unhealthy volunteers

Must be related to this investigation

Neutral: to ensure that the results are due to the independent variable

1

(ii) Avoids bias / selection (by scientists);

Neutral: ref. to having the same number / gender / age of people in each group;

1

(b) (i) Same as experimental group;

Chocolate with no flavenoids;

Neutral: no dark chocolate

Neutral: placebo

Reject: milk chocolate

Neutral: ref. to fair testing

2

(ii) (To ensure that results are) not due to some other substance in the chocolate / due to flavenoids (only);

Must be related to this investigation

Neutral: to ensure that the results are due to the independent variable

Neutral: to show results are not due to other factors

Neutral: to show results are only due to the chocolate

Neutral: to compare results for people who did and did not have flavenoids

1

[5]

9

- (a) 1. (Simple / facilitated) diffusion from high to low concentration / down concentration gradient;

Q Do not allow across / along / with concentration gradient

2. Small / non-polar / lipid-soluble molecules pass via phospholipids / bilayer;
Reject: named molecule passing through membrane by an incorrect route
Accept: diagrams if annotated

OR

Large / polar / water-soluble molecules go through proteins;

3. Water moves by osmosis / from high water potential to low water potential / from less to more negative water potential;
4. Active transport is movement from low to high concentration / against concentration gradient;
Only penalise once if active transport is not named
e.g. 'movement against the concentration gradient involves proteins and requires ATP' = 2 marks
5. Active transport / facilitated diffusion involves proteins / carriers;
Accept: facilitated diffusion involves channels
Reject: active transport involves channels
6. Active transport requires energy / ATP;
7. Ref. to Na⁺ / glucose co-transport;
Credit ref. to endo / exocytosis as an alternative

5 max

- (b) 1. Many alveoli / alveoli walls folded provide a large surface area;
Neutral: alveoli provide a large surface area
2. Many capillaries provide a large surface area;
3. (So) fast diffusion;
Neutral: greater / better diffusion
Neutral: fast gas exchange
Allow 'fast diffusion' only once
4. Alveoli or capillary walls / epithelium / lining are thin / short distance between alveoli and blood;
Reject: thin membranes / cell walls
Accept: one cell thick for 'thin'

5. Flattened / squamous epithelium;
Accept: endothelial
6. (So) short diffusion distance / pathway;
7. (So) fast diffusion;
8. Ventilation / circulation;
Accept: descriptions for ventilation / circulation
9. Maintains a diffusion / concentration gradient;
10. (So) fast diffusion;
*Do not double penalise if description lacks detail
e.g. thin membranes so a short diffusion distance = 1 mark*

5 max

[10]

10

- (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 and 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

(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]

11

(a) Light (intensity) / temperature / air movement / humidity; 1

(b) Prevent air entering / continuous water column;
Allow answer in context of shoot, xylem or potometer. 1

(c) Distance and time;
Reject 'amount bubble moves' 1

Radius / diameter / area (of capillary tube); 1

(d) (used to provide) turgidity / support / description of;
(used in) photosynthesis / (produced in) respiration;
Apparatus not sealed / 'leaks'; 2 max

(e) (i) Returns bubble (to start); 1

(ii) Increases reliability (of results) / anomalous result can be identified;
Q Ignore references to validity / precision / accuracy etc. 1

[8]

12

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

4

[8]

13

- (a) (i) Faster / greater / more effective response in children;

Do not accept children have more haemoglobin

1

- (ii) Use line of best fit;

1

Extrapolate / extend line (and read from graph);

Allow calculation using rate of increase per day = one mark.

However for both marks this must be linked to line of best fit.

1

- (iii) More than one polypeptide chain;

Allow many polypeptide chains.

'Haemoglobin has four polypeptide chains' must be in correct context to gain mark.

1

- (b) (i) Has same water potential;
Allow converse for effect of using distilled water or a concentrated solution. 1
- No (net) water movement / osmosis; 1
- Cells will not swell / burst / change size;
No osmotic lysis = two marks 1
- (ii) Pernicious anaemia (cells) greater range / spread / variation of diameters / widths;
- Some pernicious anaemia (cells) wider than 9 (μm) / some less than 5.5 (μm) / without pernicious anaemia none more than 9 (μm) / none less than 5.5 (μm);
- Pernicious anaemia (cells) peak / most frequent at 8.5 (μm) / peak / most frequent at higher diameter / / without pernicious anaemia peak / most frequent at 7 (μm) / peaks at lower diameter;
- There are several alternatives for marking points 2 and 3*

2 max

[9]

- 14** (a) (i) 14 / 15 – 58 / 59 or 43 – 45 (mg per 100cm³);
Wrong calculation does not disqualify 1
- (ii) The larger the person the more blood they would have so have a lower concentration of blood glucose;
- as same amount of glucose absorbed / all / 50g absorbed; 2
- (b) 1. Any reference to overlap between all 3 groups;
2. One lactase deficient subject had high blood glucose / similar to control;
3. Some control / Group A subjects had the similar blood glucose to LD / Group B subjects / some IBS subjects had similar results to lactase deficient subjects; 3

[6]

- 15** (a) High sucrose / starch diet leads to increase in lactase activity; 1
- (b) Not valid / cannot be certain because overlap in SD between high sucrose and high starch;
- Study based on rats (not human) so may not apply to human; 2

[3]

- 16** (a) pH goes down and levels out;
after 30 min / pH 6.5; 2
- (b) Enzyme not used up in reaction; 1
- (c) Curve will be less steep:
*Only accept answers relating to curve **not** rate of reaction* 1
- [4]**

- 17** (a) Measure with eyepiece graticule / scale;
Calibrate with stage micrometer / scale on slide / object of known size;
Repeats and calculate the mean;
OR
Use a ruler to estimate the field diameter under microscope;
How many droplets go across the field;
Repeats and calculate mean;
Accept references to radius 3
- (b) (i) Two mark for correct answer of 4 : 1;;
One mark for incorrect answer but working shows that candidate has clearly
attempted to compare values of $r^2 / 6^2$ and $3^2 / 36$ and 9;
Idea of comparing ratios
A ratio of 1 : 4 should gain 1 mark 2
- (ii) Small droplets have a larger surface area to volume ratio;
More surface for lipase (to act), leading to faster digestion of triglycerides;
Fatty acids are produced more quickly so pH will drop more quickly in curve Y / with
bile salts / less fatty acids in curve Z / without bile salts so pH drop more slowly; 3
- [8]**