A-Level Biology

Osmosis

Mark Scheme

Time available: 65 minutes
Marks available: 45 marks

1.

(a) 1. Name of solution/independent variable in first column;

Ignore headings lack detail

Ignore units required

Ignore percentage change required

2. Same number of decimal places in final/column on right

OR

1.3 not 1.29

OR

0.72 not 0.7;

Accept same degree of precision

2

(b) 1. (Warmer water/water at 30 C) has more kinetic energy;

2. More/quicker osmosis

OR

Large(r) difference in mass (in time available);

2

(c) (No)

1. Egg mass increased;

2. Water moves in by osmosis;

3. (So) egg water potential lower (than vinegar water potential)

OR

Vinegar water potential higher (than egg water potential);

Accept ψ/WP for water potential

Accept less negative for "higher"

OR

"more negative" for lower

3

(d) Independent variable

1. Concentration of (sugar) solution;

Determining water potential

Accept water potential/dilution for "concentration"

2. Plot calibration curve

OR

Graph of ratio against concentration (of sugar);

Ignore unqualified "plot graph"

3. Interpolate from ratio of 1;

Accept description of interpolation

4. Change concentration into water potential;

Accept for example, descriptions using a table/graph to find water potential

4

[11]

2. (a) 1. Method to ensure all cut surfaces of the eight cubes are exposed to the sucrose solution;

Credit valid method descriptions to fulfil mp1, 2 and 3 (no explanation is required).

2. Method of controlling temperature;

Accept 'at room temperature' for method

3. Method of drying cubes before measuring;

4. Measure mass of cubes at stated time intervals;

Accept time intervals between every 5 minutes with maximum of every 40 minutes.

Accept 'weigh the cubes at stated time intervals'

3 max

(b) Yes or No (no mark)

Calculation of rate per mm^2 for both sets of data, accept answers in the range
1.6×10^{-5} to 1.8×10^{-5} **and**
1.5×10^{-5} to 1.6×10^{-5};;; Both correct = 3

One correct = 2

Neither correct – look below for max 2

Allow 1 mark for calculation of surface area of two (sets of) cubes 7350 (mm^2) and 14700 (mm^2)

Allow 1 mark for calculation of both rates of osmosis shown in first 40 minutes – between 0.12 and 0.13 **and** between 0.22 and 0.23

If surface area and/or rate of osmosis is incorrect then, allow 1 mark for (their) calculated rate divided by (their) calculated surface area

Accept answers not given in standard form or to any number of significant figures ≥2sf as long as rounding correct.

3 max

[6]

3. (a) (i) 1. Increases (surface) area / inside surface exposed / more cells exposed / shorter distance for water to move;

2. Producing water loss;

Accept better answers, such as diffusion or osmosis relating to water loss.

2

(ii) 1. Sucrose solution / water / liquid (on the slices) would add to the mass / weight of the slices;

2. Would vary;

Ignore references to reliability

2

(b) This is initial mass / the time is too short for water to have left / the time is too short for osmosis / have not been treated;

1

(c) 1. Percentage loss in mass increases with time;

2. Texture decreases then levels out;

Only credit answers that refer to decreasing <u>and</u> levelling out.

3. (Texture levels out) after first 2 hours;

3

(d) 1. Plot graph of percentage loss in mass against time;

2. Draw curve (of best fit);

Although curve is the technical term accept references to line etc

3. Extrapolate / record when no further change in mass / record when curve flattens out;

3

[11]

4.

(a) Accept any three suitable properties e.g.:

- Is a metabolite
- Is a solvent
- Has a (relatively) **high** heat capacity
- Has a (relatively) **large** latent heat of vaporisation / evaporation
- Has cohesion / hydrogen bonds between molecules;

No explanations are needed

However do not accept 'polar' unqualified

3 max

(b) Dilution series;

Accept serial dilution

1

(c) 1. Axes correct way round with linear scales;

2. Axes labelled with mol dm^{-3} and ratio without units;

3. Correct values correctly plotted and suitable curve drawn;

3. Accept point to point or smooth curve but no extrapolation

***NFP** – 3. Graph starts just below 1.4 and finishes just above 0.7 and looks right.*

3

(d) 1. (0.8 mol dm^{-3} sucrose) solution has a more negative / lower water potential than potato (cytoplasm);

OR

potato (cytoplasm) has a less negative / higher water potential than (0.8 mol dm^{-3} sucrose) solution;

2. (therefore) water moves out (of potato) into the (sucrose) solution by osmosis (so cells decrease in mass);

1. Accept sucrose solution is hypertonic / potato cytoplasm is hypotonic

*2. Accept water moves **down** a water potential gradient*

2

[9]

5.

(a) Calculations made (from raw data) / raw data would have recorded initial and final masses.

1

(b) Add 4.5 cm^3 of (1.0 mol dm^{-3}) solution to 25.5 cm^3 (distilled) water.

If incorrect, allow 1 mark for solution to water in a proportion of 0.15:0.85

2

(c) 1. Water potential of solution is less than / more negative than that of potato tissue;

Allow Ψ as equivalent to water potential

2. Tissue loses water by osmosis.

2

(d) 1. Plot a graph with concentration on the *x*-axis and percentage change in mass on the *y*-axis;
2. Find concentration where curve crosses the *x*-axis / where percentage change is zero;
3. Use (another) resource to find water potential of sucrose concentration (where curve crosses *x*-axis).

3

[8]