A-Level Biology

Respiration

Time available: 72 minutes
Marks available: 51 marks

Mark schemes

1.

(a) 1. Phosphorylation of glucose using ATP;

2. Oxidation of triose phosphate to pyruvate;

Accept removal of hydrogen from triose phosphate for oxidation.

3. Net gain of ATP;

Accept any description that indicates a net gain e.g., 4 produced, 2 used.

4. NAD reduced;

Accept NADH/$NADH_2$/NADH + H^+ produced.

Accept all mark points in diagrams.

4 max

(b) 1. Less/no reduced NAD/coenzymes

OR

Fewer/no hydrogens/electrons removed (and passed to electron transfer chain);

Accept less/no FAD reduced.

2. Oxygen is the final/terminal (electron) acceptor;

2

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2.

(a) (So the) oxygen is used/absorbed/respired;

1

(b) 1. Anaerobic respiration produces carbon dioxide;

2. Increase in pressure/volume (of gas);

Reference to either volume or pressure required for the mark

2

(c) 1. Correct answer in range of
4.9×10^{-4} to 4.91×10^{-4} = **2 marks**;;

Accept any equivalent mathematical representation of this answer

2. Incorrect answer buts shows division by 24 = **1 mark**
OR
Incorrect answer but shows a number from 1175 to 1178 (ignore position of decimal point, standard form and any numbers that follow) = **1 mark**;
OR
Incorrect answer but show the number 49 (ignore position of decimal point, standard form and any numbers after 49) = **1 mark**;

2

(d) Large range/difference/increase in numbers;

Accept reference to exponential (increase)

Ignore if the answer only refers to numbers being high

Ignore to 'fit on the scale'

1

(e) Decrease/no glucose/substrate

OR

Increase in ethanol/carbon dioxide/acidity;

*Accept decrease/no oxygen as **Figure 2** is not linked to **Figure 1**.*

Accept competition for glucose/oxygen.

Accept any named sugar

Accept decrease in pH

Accept increase in toxins

Ignore food/nutrients

1

(f) 1. Correct answer of 298000 or 297766 or 297765.59 or 296826 = **2 marks**;;

Accept: any equivalent answer with appropriate rounding

e.g. 2.98×10^5,

29.78×10^4 etc.

2. Incorrect answer but working shows 2000 × 2.72 = **1 mark**;

OR

Incorrect answer but working shows $2.72^{0.5 \times 10}$ / 2.72^5 / $e^{0.5 \times 10}$ / = **1 mark**

2

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3.

(a) 1. Equilibrium reached.

Accept equilibrate

2. Allow for expansion / pressure change in apparatus;
3. Allow respiration rate of seeds to stabilise.

Ignore seeds acclimatise

3

(b) 1. Optimum temperature / temperature for normal growth of seeds;
2. (Optimum temperature) for enzymes involved in respiration.

2

(c) 1. Oxygen taken up / used by seeds;
2. CO_2 given out is absorbed by KOH (solution);
3. Volume / pressure (in **B**) decreases.

3

(d) 0.975 / 0.98.

If incorrect,

0.26 × 6 / or incorrect numbers divided by 1.6 for 1 mark

2

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4.

(a) (i) Cytoplasm/cytosol;

1

(ii) 1. Regenerates/produces NAD / oxidises reduced NAD;
2. NAD reduced in stage 1/glycolysis / NAD accepts hydrogen in stage 1/glycolysis;

Note: penalise use of NADP for first marking point obtained.

Do not accept NAD accepts only protons but allow accepts protons and electrons.

2

(b) (i) 1/one/1.0;

1

(ii) 1. Aerobic and anaerobic respiration occurring;

Accept: some/mainly anaerobic respiration occurring.

2. More carbon dioxide produced than oxygen uptake;

2

(c) 1. Oxygen is final/terminal (electron) acceptor / oxygen combines with electrons and protons;
2. (Aerobic respiration) oxidative phosphorylation / electron transfer chain;
3. Anaerobic (respiration) only glycolysis occurs / no Krebs / no link reaction;

Ignore: number of ATP produced.

3. Accept: without oxygen.

3. Ignore: converse.

2 max

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5.

(a) 1. Oxidation of / hydrogen removed from pyruvate and carbon dioxide released;

2. Addition of coenzyme A.

Accept: NAD reduced for oxidation

2

(b) (i) 1. Change (in shape) of active site / active site moulds around the substrate;

Reject: reference to inhibitor

Accept: change in tertiary structure affecting active site

2. (Substrate / active site) now complementary.

Neutral: references to two active sites

2

(ii) 1. Is a competitive inhibitor / attaches to active site;

Neutral: reference to inhibitor forming an enzyme-substrate complex

2. Reduces / prevents enzyme-substrate / E-S complex forming.

Accept: Reduces / prevents acetylcoenzyme A binding to enzyme / citrate synthase

2

(c) (i) 1. Regenerates / produces NAD / oxidises reduced NAD;

2. (NAD used) in glycolysis.

Accept: description of glycolysis

Accept: glycolysis can continue / begin

2

(ii) (Pyruvate used) in aerobic respiration / (lactate / lactic acid) is toxic / harmful / causes cramp / (muscle) fatigue.

Accept: (pyruvate) can enter link reaction

Accept: reduces cramp / (muscle) fatigue

Neutral: 'reduces muscle aches'

1

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6. (a) 1. No aerobic respiration / electron transfer / oxidative phosphorylation;

Reject reference to anaerobic respiration.

2. (Because) no (respiratory) substrate / nothing to respire;

Reject idea of 'little' or 'less' − this would result in a change in oxygen concentration.

Accept the idea of no residual respiratory substrate in the mitochondria.

2

(b) (i) (Oxygen concentration falls because)

1. Aerobic respiration (uses oxygen);

Accept 'oxidative phosphorylation / electron transfer takes place'.

2. Oxygen is terminal / electron <u>acceptor</u>;
3. (oxygen combines with) protons / H^+ **and** electrons / e^- **to form** water / H_2O;

All aspects are required to gain mark.

2 max

(ii) <u>Phosphate</u> (ions) / inorganic <u>phosphate</u> / P_I;

Reject 'phosphorus' or 'P'.

Accept 'PO $_4$'.

1

(c) 1. Oxygen concentration continues to fall in plants but stays constant in animals;

For 'plants' accept 'line R to T', for 'animals' accept 'line R to S'.

MP1 and MP2. Accept answers in terms of 'use' of oxygen rather than change in concentration.

2. (Oxygen concentration) falls more slowly in plants than before cyanide added;
3. (Because aerobic) respiration continues in plant (mitochondria);

Accept (because aerobic) respiration stops in animal (mitochondria).

4. (Because) electron transfer / oxidative phosphorylation continues in plant (mitochondria);

Accept (because) electron transfer stops in animal (mitochondria).

*Accept for **one additional mark***

(up to 4 max) use of Resource A i.e: idea that plant cytochrome oxidase is (more) resistant to cyanide

OR

idea that animal cytochrome oxidase not resistant to cyanide.

4

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