EXAM PAPERS PRACTICE

ATP

Level: OCR A Level H420
Subject: Biology
Exam Board: Suitable for all boards
Topic: ATP
Type: Mark Scheme

To be used by all students preparing for OCR A Level Biology H420 foundation or higher tier but also suitable for students of other boards.

Mark schemes

1

(a) (more cristae / larger surface area) for electron transport chain /
more enzymes for ATP production / oxidative phosphorylation;
muscle cells use more ATP (than skin cells)(not just more respiration);

2

(b) (i) pyruvate;

1

(ii) carbon dioxide formed / decarboxylation;
hydrogen released / reduced NAD formed;
acetyl coenzyme A produced;

2 max

(c) NAD / FAD reduced / hydrogen attached to NAD / FAD;
H^+ ions / electrons transferred from coenzyme to coenzyme /
carrier to carrier / series of redox reactions;
energy made available as electrons passed on;
energy used to synthesise ATP from ADP and phosphate /
using ATPase;
H^+ / protons passed into intermembrane space;
H^+ / protons flow back through stalked particles / enzyme;

3 max

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2

(a) Electrons transferred down electron transport chain;

Provide energy to take protons / H^+ into space between membranes;

Protons / H^+ pass back, through membrane / into matrix / through ATPase;

Energy used to combine ADP and phosphate / to produce ATP;

Accept: alternatives for electron transport chain.

3 max

(b) (i) Prevent damage to mitochondria caused by
water / osmosis / differences in water potential;

Accept: other terms that imply damage e.g. shrink / burst

1

(ii) Glucose is used / broken down during glycolysis in cytoplasm / not in mitochondria;

Accept: 'glucose is converted to pyruvate' for description of breakdown

Glucose cannot cross mitochondrial membrane / does not enter mitochondria;

Accept: only pyruvate can

2

(iii) Terminal / final acceptor (in electron transport chain) / used to make water;

Could be shown by symbols

1

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3

(a) Hydrolysis (reaction);

1

(b) 1. (Phosphate required) to make RNA;
2. (Phosphate required) to make DNA;

1 and 2. If neither DNA or RNA are named allow one mark for nucleotide/nucleic acid/phosphodiester bonds/sugar-phosphate backbone.

3. (Phosphate required) to make ATP/ADP;
4. (Phosphate required) to make membranes;

Ignore: phospholipids without reference to membranes.

5. (Phosphates required) for phosphorylation;

Accept: as additional mark points any named biological molecule containing phosphate e.g. NADP, AMP, RuBP.

2 max

(c) Accept answer in range from 3.7 : 1 to 4.1 : 1;

Reject any ratio not : 1.

1

(d) 1. Seeds/embryo remain dormant/inactive in winter/cold
OR
Growth/development of seed/embryo during winter/cold;

Ignore: hibernate.

Accept: 'seed survives winter/cold'.

Reject: plant develops or seed germinates during winter/cold.

2. Seeds/plants develop in spring/summer
OR
Seeds/plants develop when temperature/light increases;

Accept: seeds/plants develop when more light or when temperature is higher.

Accept: seed germinates/'sprouts' during spring/summer or when temp/light increases.

3. Plant photosynthesise (in spring/when warm);
4. Produce (more) seeds/offspring in spring/growing season;

3 max

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4 (a)

	Photosynthesis	Anaerobic respiration	Aerobic respiration
ATP produced	✓	✓	✓
Occurs in organelles	✓		✓
Electron transport chain involved	✓		✓

1 mark per column

Mark ticks only. Ignore anything else if different symbols such as crosses are used as well.

If crosses are used instead of ticks allow cross as equivalent to a tick.

Reject tick with a line through

3

(b) $ADP + P_i \longrightarrow ATP$;

Both sides correct, but allow other recognised symbols or words for phosphate ion. Reject P unless in a circle.

Accept = as equivalent to arrow

Accept reversible arrow

Ignore any reference to kJ / water

1

(c) 1. Energy released in small / suitable amounts;

2. Soluble;

3. Involves a single / simple reaction;

1. In context of release, not storage. Ignore producing energy / manageable amounts.

2. Reject "broken down easily / readily". Reject "quickly / easily resynthesised".

2 max

(d) 1. ATP cannot be stored / is an immediate source of energy;

2. ATP only releases a small amount of energy at a time;

2

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5

(a) 1. Releases energy in small / manageable amounts;

1. Accept less than glucose

2. (Broken down) in a one step / single bond broken immediate energy compound / makes energy available rapidly;

2. Accept easily broken down

3. Phosphorylates / adds phosphate makes (phosphorylated substances) more reactive / lowers activation energy;

3. Do not accept phosphorus or P on its own

4. Reformed / made again;

4. Must relate to regeneration

4

(b) 1. Substrate level phosphorylation / ATP produced in Krebs cycle;

Accept alternatives for reduced NAD

2. Krebs cycle / link reaction produces reduced coenzyme / reduced NAD / reduced FAD;

2. Accept description of either Krebs cycle or link reaction

3. Electrons released from reduced / coenzymes / NAD / FAD;

4. (Electrons) pass along carriers / through electron transport chain / through series of redox reactions;

5. Energy released;

5. Allow this mark in context of electron transport or chemiosmosis

6. ADP / ADP + Pi;

6. Accept H^+ or hydrogen ions and cristae

7. Protons move into intermembrane space;

7. Allow description of movement through membrane

8. ATP synthase;

8. Accept ATPase. Reject stalked particles

6 max

(c) 1. In the dark no ATP production in photosynthesis;

1. In context of in photosynthetic tissue / leaves

2. Some tissues unable to photosynthesise / produce ATP;

3. ATP cannot be moved from cell to cell / stored;

4. Plant uses more ATP than produced in photosynthesis;

5. ATP for active transport / synthesis (of named substance);

5

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6 (a) ATP

1

(b) (i) 2.57:1/2.6:1/18:7;
Correct answer however derived scores two marks
72:28 scores one mark
Correct working from wrong figures scores 1 mark

Accept

0.4 / 0.39 / 0.389 / 0.3889

2 max

(ii) Low intensity;
At low intensity/below 40% mainly fat used / at high intensity/ above 40% mainly carbohydrate used;
Long duration exercise;
Percentage fat used increases with time / percentage carbohydrate used decreases with time;

3

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7 (a) (i) 29.47(29.5);

(2 marks for correct answer)

40% / 0.4 of 2800 / 38;

2

(ii) released as heat;

1

(b) (i) glucose only partly broken down / only broken down to lactate;

1

(ii) lactate / lactic acid has built up / been produced;
oxygen used to break down lactate / convert it back to pyruvate / glucose / glycogen;

2

[6]

8 (a) (i) 2 (molecules)

1

(ii) Cannot pass out of cell;
Quickly / easily broken down (hydrolysed) / broken down in a on-step reaction / immediate source of energy;
Stores / releases <u>small</u> amounts of energy;
Do not credit "producing energy"

max 2

(b) Formed when reduced NAD used to <u>reduce</u> / donate H ions to pyruvate / convert pyruvate to ethanol;

1

[4]

9

(a)
1. Calcium ions diffuse into myofibrils from (sarcoplasmic) reticulum;
2. (Calcium ions) cause movement of tropomyosin (on actin);
3. (This movement causes) exposure of the binding sites on the actin;
4. Myosin heads attach to binding sites on actin;
5. Hydrolysis of ATP (on myosin heads) causes myosin heads to bend;
6. (Bending) pulling actin molecules;
7. Attachment of a new ATP molecule to each myosin head causes myosin heads to detach (from actin sites).

5 max

(b)
1. Releases relatively small amount of energy / little energy lost as heat;

   Key concept is that little danger of thermal death of cells

2. Releases energy instantaneously;

   Key concept is that energy is readily available

3. Phosphorylates other compounds, making them more reactive;
4. Can be rapidly re-synthesised;
5. Is not lost from / does not leave cells.

2 max

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10

(a)
1. From ADP and phosphate;

   Accept Pi/PO_4^{3-} / (P)

   Reject P/Phosphorus

   Reject use of water in the reaction

2. By ATP synthase;
3. During respiration/photosynthesis;

2 max

(b)
1. To provide energy for other reactions/named process;

   Reject 'produce' energy

2. To add phosphate to other substances **and** make them more reactive/change their shape;

2

(c) (Can see) 3D image;

1

(d) Crista/cristae;

Ignore matrix

1

(e) Value between 20,750 (83mm) and 21,250 (85mm) two marks;;
Formula given/used but calculation wrong, award 1 mark

$$\text{Magnification} = \frac{\text{image size}}{\text{Object size}}$$

(Large number divided by 4)

2

[8]