



EXAM PAPERS PRACTICE

Mark schemes

- 1** (a) Filaments / lamellae provide large surface area;
- Thin / flattened epithelium / one / two cell layers so short diffusion pathway (between water and blood);
- Countercurrent / blood flow maintains concentration / diffusion gradient;
- Q Do not credit thin cell walls / membranes*
- 2 max**
- (b) (i) Large / wide range of values (so can fit on graph);
- 1**
- (ii) Decrease in uptake with increase in mass / negative correlation;
- 1**
- (iii) Enables comparison;
- As animals differ in size / mass;
- 2**
- [6]**
- 2** (a) Krebs cycle / link reaction / pyruvate to acetylcoenzyme A;
- Q Accept valid alternative for any of these steps.*
- 1**
- (b) (Respiratory reactions controlled by) enzymes;
- Rate decreases as less kinetic energy / fewer collisions (between substrate and active site) fewer E-S complexes formed;
- 2**
- (c) Requires hydrogen / electrons / is reduction;
- Hydrogens from reduced NAD / reduced NAD reduces (pyruvic acid) / reduced NAD oxidised;
- Information may be on diagram*
- 2**
- (d) Respiring anaerobically;
- (Anaerobic respiration / respiration with nitrogen) less efficient / produces less ATP;
- More anaerobic respiration / more glucose / substrate must be respired to produce same amount of ATP (so more carbon dioxide produced);
- 3**
- [8]**



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- 3** (a) (i) Crista / inner membrane; 1
(ii) Matrix; 1
(b) B; 1
(c) (i) Reduce / prevent enzyme activity; 1
(ii) Prevents osmosis / no (net) movement of water;
So organelle / named organelle does not burst / shrivel;
Q Allow reference to cell rather than organelle for first mark point only.
Regard damage as neutral 2
(d) (Mitochondria) use aerobic respiration;
Mitochondria produce ATP / release energy required for muscles (to contract);
Q Do not accept reference to making / producing energy. 2
[8]
- 4** metabolic water / from respiration;
allow condensation reactions. Ignore 'oxidation'.
aerobic / use of oxygen; ('From aerobic respiration' = 2 marks) [2]
- 5** (a) pyruvate; 1
(b) Krebs cycle; 1
(c) ATP formed as electrons pass along transport chain;
oxygen is terminal electron acceptor / accepts electrons from electron transport chain / electrons cannot be passed along electron transport chain if no O₂ to accept them;
forms H₂O / accepts H⁺ from reduced NAD / FAD / oxidises reduced NAD / FAD; 3
[5]
- 6** (a) (i) Yield increases by 0.6 kg m⁻² (when extra carbon dioxide present); 1
(ii) Temperature / light intensity so could be lower in these weeks (as temperature / light intensity not fully controlled / monitored) (over period 1998 – 2000); 1



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- (b) Two marks for correct answer of 50.6%;;
One mark for incorrect answer in which candidate has shown clearly that calculation based on an increase / 0.42 and original mass / 0.83
- 2
- (c) Cost of supplying carbon dioxide;
Price of (very early) tomatoes;
- 2
- (d) Lowest price paid for tomatoes;
Some carbon dioxide lost as windows open in summer;
Little / no mean increase in yield in summer;
- 2 max
- (e) Grow with extra carbon dioxide in one glasshouse and without carbon dioxide in other glasshouse at same time;
So all environmental conditions / light and temperature same for experiment and control;
- 2

[10]

- 7** (a) greater rate of oxygen consumption / leads to greater rate of respiration and greater rate of uptake;

(allow this mark even if spread through account but cause and effect must be within the correct context)

oxygen required for respiration;
respiration produces ATP / releases energy;
(ignore ref to producing or making energy)
potassium ions taken up by active transport / against concentration gradient;

4

- (b) (i) 0.25 (mol dm⁻³);
- 1
- (ii) 1 mark Incorrect answer but derived from ratio of 1.2 and initial length of 90 mm
2 marks Correct answer of 108 mm;
- 2
- (iii) water potential inside potato higher / less negative than in solution;
water moves out by osmosis;
- 2

[9]



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- 8
- (a) (i) glycolysis; 1
- (ii) oxygen removed from pyruvate / reduced NAD is oxidised / donates hydrogen / donates electrons; 1
- (iii) allows NAD to be recycled / re-formed;
so that glycolysis / described / candidates answer to (i) can proceed / so that
(more) glucose can be converted to pyruvate / so that process X can continue; 2
- (b) (i) ATP formed / used;
pyruvate formed / reduced;
NAD / reduced NAD;
glycolysis involved / two stage process; 2 max
- (ii) ethanol / alcohol formed by yeast, lactate (*allow lactic acid*)
by muscle cell; CO₂ released by yeast but not by muscle cell;
(note: need both parts of the comparison for the mark) 2
- (c) (i) allows anomalies to be identified / increases reliability (of means /
averages / results);
allows use of statistical test; 2
- (ii) $\frac{38.3 + 27.6 + 29.4}{3} = 31.8 / 31.76 / 31.77;$
(units not required)
 $\div (5 \times 60) = 0.106 / 0.11 / 0.1;$
(correct answer scores two marks, however derived.)
(correct mean volume (31.8 cm³) however derived scores 1 mark) 2
- (iii) Volume(s) less / no gas evolved;
So (volume) CO₂ evolved = (volume of) O₂ taken in; 3
- [15]
- 9
- (a) (Absorption of) light; 1
- (b) Inner membrane / cristae / stalked particles of mitochondria; 1
- [2]



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- 10** (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 small amounts of energy;
Do not credit "producing energy" max 2
- (b) Formed when reduced NAD used to reduce / donate H ions
to pyruvate / convert pyruvate to ethanol; 1
- [4]**
- 11** (a) (i) **P** = 3;
Q = acetylcoenzyme A; 2
- (ii) 36 ATP, however derived = 2 marks
30 ATP, however derived = 1 mark 2
- (iii) *Correct statement in the context of aerobic respiration or
anaerobic respiration concerning:*
Oxygen as terminal hydrogen / electron acceptor allowing operation of electron
transport chain / oxidative phosphorylation;
Fate of pyruvate;
Significance of ATP formed in glycolysis; 3
- (b) (i) Thick walls exclude oxygen;
Produced by photosynthetic cells (of fern and *Anabaena*);
Contain no chlorophyll so do not photosynthesise;
Do not produce oxygen;
Oxygen would inhibit nitrogen fixation process; max. 3
- (ii) Decomposers / bacteria / fungi / saprobionts (in fields);
Convert protein / organic nitrogen (in cells of fern) into
ammonium ions (*allow ammonia*);
Ammonium ions (ammonia) converted to nitrite, then converted to nitrate;

Allow 1 mark for $NH_3 / NH_4^+ \rightarrow NO_3^-$
By nitrifying bacteria / correctly named;
Nitrate used to form protein / amino acids in rice; 5
- [15]**



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12

- (a) X = Carbon dioxide;
Y = Acetyl coenzyme A;

(ACCEPT Acetyl CoA)

Z = Water;

3

- (b) (i) Cytoplasm;

1

- (ii) Mitochondrion;

(IGNORE named part)

1

- (c) On the diagram:

- (i) 'A' (ATP used) – between glucose and triose phosphate;

1

- (ii) 'B' Any two from:

(ATP produced) – between triose phosphate and pyruvate;
in Krebs cycle;
from electron carriers
(to right of bracket & not below grey box);

max 2

- (d) Any three from:

Source of energy / of phosphate;
Active transport;
Phagocytosis / endo- / exocytosis / pinocytosis;
Bile production;
Cell division / mitosis;
Synthesis of: glycogen;
protein / enzymes;
DNA / RNA;
lipid / cholesterol;
urea;

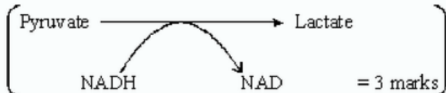
max 3

- (e) Any four from:

Forms lactate; [extras – C₂H₅OH / CO₂ – CANCEL]

Use of reduced NAD / NADH;

Regenerates NAD;





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NAD can be re-used to oxidise more respiratory substrate / correct e.g. / allows glycolysis to continue;
Can still release energy / form ATP
when oxygen in short supply / when no oxygen;

max 4

[15]

13

- (a) It is a measure of the concentration of a gas
(in a mixture of gases or a liquid);
- (b) 37-38%
Accept 36 – 39
- (c) muscle contraction causes increased respiration;
increased CO₂ production lowering blood pH / lactate released
lowering blood pH;
increased heat released therefore increased temperature;
increased O₂ consumption lowering tissue PO₂;
- (d) haemoglobin has a lower affinity for oxygen;
more O₂ for respiration;
- (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)
- (f) Nearly all O₂ is transported by haemoglobin / v. little transported in plasma;
EITHER
Haemoglobin is (nearly) fully saturated with O₂ 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%;
- (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;

1

4

2

2

3

max 3

[15]

14

- (a) CO₂, water, ATP, reduced NAD / FAD;
(accept creatine phosphate)(any 2 - one tick)

1



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- (b) (i) build up / increased concentration of lactate lowers pH / increases H^+ / increases acidity; enzymes / named protein inhibited(*not denatured*); 2
- (ii) lactate / pyruvate is an energy source; muscles have increased / immediate energy or ATP supply; (*accept lactate replenishes glycogen or glucose*) restores pH levels; 2 max

[5]

15

- (a)

| | | |
|---|---|----|
| ✓ | ✓ | x; |
| x | x | ✓; |
| ✓ | ✓ | ✓ |
| ✓ | x | x |

 4
- (b) (i) pyruvate / succinate / any suitable Krebs cycle substrate; 1
- (ii) ADP and phosphate forms ATP; oxygen used to form water / as the terminal acceptor; 2
- (iii) Y X W Z; order of carriers linked to sequence of reduction / reduced carriers cannot pass on electrons when inhibited; 2

[9]

16

- (a) used in (aerobic) respiration / to provide energy / ATP (and not replaced by breathing) / used up by muscle and not replaced; (*reject used up and used up and not replaced*) 1
- (b) 36; 1
- (c) converted back to pyruvate / glycogen / glucose / CO_2 and H_2O ; reacted with oxygen / oxidised; (*reject "breaking down" with respect to glycogen and glucose*) 2
- (d) (i) vasoconstriction / contraction of muscles in arteries / arterioles / arteries / arterioles close; (*reject contraction of arteries / arterioles / capillaries*) 1
- (ii) supplies oxygen / glucose or removal of carbon dioxide / lactate; so cells can respire when not contracting / breathing; 2

2



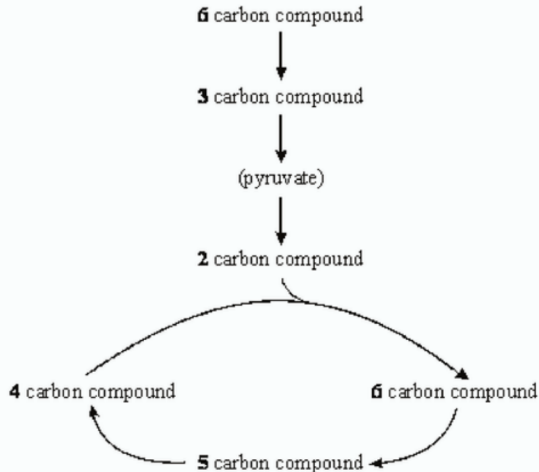
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- 17** (a) matrix; 1
- (b) pyruvate;
ADP;
P / inorganic phosphate;
reduced NAD;
oxygen; 2 max
- (c) larger surface area for electron carrier system / oxidative phosphorylation; provide ATP / energy for contraction; 2
- [5]**
- 18** (a) (i) ammonia / ammonium ions / compound; 1
- (ii) glucose; 1
- (b) final acceptor for hydrogen:
to form water; 2
- (c) glycolysis can continue;
NAD can accept more hydrogen; 2
- (d) secondary / tertiary structure;
produces particular shape of active site;
or
(shape of) active site;
complementary to shape of substrate; 2
- (e) sodium ions / non-competitive inhibitor binds to enzyme
at a site other than active site;
resulting in change of shape of active site / no longer complementary;
substrate can no longer bind with the enzyme / enzyme-substrate
complexes no longer formed; 3
- [11]**



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19 (a)



(1 mark for three correct answers)
(2 marks for six correct answers)

2

- (b) reduced NAD / NADH / NADH₂;
reduced FAD / FADH / FADH₂;
ATP;

3

[5]

20

- (a) (i) in case normal coffee differs in some other way /
to control concentration of caffeine;
- (ii) not telling them what the drink contained / purpose of experiment;
- (b) (i) able to continue for longer; (*not just increases performance*)
(*disqualify if also refers to fatty acids and glycerol*)
- (ii) breakdown of fats;
at increased rate / by mobilisation of fat stores;

1

1

1

2



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- (c) (i) idea that volumes of oxygen and carbon dioxide the same;
reference to equal moles, or quotient as 1 divided by 1 / or 6 by 6; 2
- (ii) glycogen is a carbohydrate / broken down to glucose, linked to RQ;
with no caffeine, RQ nearer 1.0 / less carbon dioxide exhaled and
more oxygen inhaled (or vice versa) / with caffeine higher proportion of fats /
fatty acids respired;
increased time to exhaustion suggests slower use of glycogen: 3
- 21** (a) (i) RuBP – 5; GP – 3; TP – 3; Glucose – 6;
(all correct = 2 marks; 3 or 2 correct = 1 mark) [10] 2
- (ii) stroma; 1
- (iii) light-dependent reaction / (photo)phosphorylation;
(accept photolysis) 1
- (iv) 5 out of 6 / 83% / equivalent; 1
- (b) enzymes involved / not a photochemical reaction;
slow rate of enzyme / chemical reaction at low temperature /
less kinetic energy / fewer collisions; 2
- 22** (a) adding CO₂ decreases pH / makes more acid
OR removing CO₂ increases pH / makes more alkaline;
(credit anywhere but do not credit this mark if
stated that oxygen is an alkaline gas) [7] 4
- rate of photosynthesis > rate of respiration in **A**;
respiration only in **B**;
rate of photosynthesis = rate of respiration in **C**;
- (b) (i) shows that indicator alone does not change colour in light; 1
- (ii) so that all tubes receive same amount of heat 1
- 23** (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); [6] 2



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- (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

[8]

24

- (a) (i) Cytoplasm (of cell);
Accept sarcoplasm/cytosol 1
- (ii) In membranes/cristae (of mitochondria);
Reject matrix of mitochondria 1
- (b) NO stops uptake/use of oxygen (by cells); 1
- Stops (electron transport chain of) respiration;
Accept – stops oxidative phosphorylation 1
- NO changes shape of protein (in chain); 1
- Oxygen no longer required as final electron acceptor (however stated);
Accept – protein denatured or description 1
- As oxygen conc. gets lower effect of NO lasts longer, because
NO more likely to interact with protein;
Reject accepts hydrogen from etc in 3rd marking point 1

1
3 max

[5]



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25

- (a) (i) Cytoplasm;
Accept - cytosol 1
- (ii) Inner membrane of mitochondrion / cristae;
Reject – crista/ particle 1
- (b) Oxygen is the terminal acceptor;
(No) electron transfer chain / proton transfer / no oxidative phosphorylation;
Accept ETC abbreviation
- Which produces most of the ATP (in aerobic respiration);
Only glycolysis takes place;
Pyruvate used to make lactate;
Accept lactic acid
- Only produces (net) 2 ATP (per molecule of glucose);
Accept only 4 ATP are made

2 max

[4]

26

- (a) (i) to increase surface area (for carbon dioxide absorption); 1
- (ii) oxygen is used / carbon dioxide emitted is absorbed;
so decrease in volume / pressure; 2
- (iii) change of level of (manometer) liquid over time;
bore of tube;
mass of snails;
time interval; 3 max
- (b) (i) *valid similarity taking into account SD e.g. between 5 and 15 °C*
both show little effect of temperature / intakes similar
between 5 and 15 °C; 1
- valid difference taking into account SD above 15 °C e.g.*
rise at 20 °C and above is less when snails kept in sea water; 1
- (ii) standard deviations high;
means unreliable;
(accept 25 °C being out of normal range for snail /
not enough temperature readings for 1 mark) 2

[10]



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- 27** (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]