

Mark schemes

1

- (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. CO₂ 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

- [10] (a) 1. Reduction in ATP production by aerobic respiration;

2

2. Less force generated because fewer actin and myosin interactions in muscle;
3. Fatigue caused by lactate from anaerobic respiration.

3

- (b) Couple **A**,

1. Mutation in mitochondrial DNA / DNA of mitochondrion affected;
2. All children got affected mitochondria from mother;
3. (Probably mutation) during formation of mother's ovary / eggs;

Couple **B**,

4. Mutation in nuclear gene / DNA in nucleus affected;
5. Parents heterozygous;
6. Expect 1 in 4 homozygous affected.

4 max

- (c) 1. Change to tRNA leads to wrong amino acid being incorporated into protein;
2. Tertiary structure (of protein) changed;
3. Protein required for oxidative phosphorylation / the Krebs cycle, so less / no ATP made.

3

- (d) 1. Mitochondria / aerobic respiration not producing much / any ATP;

2. (With MD) increased use of ATP supplied by increase in anaerobic respiration; 3. More lactate produced and leaves muscle by (facilitated) diffusion.

3

- (e) 1. Enough DNA using PCR;
2. Compare DNA sequence with 'normal' DNA.

2

[15] (a) 1. Respiration/metabolism/ammonification;

3

2. (Releases/produces) heat;
Reject: 'produces energy'.

2

- (b) 1. SD is spread of data around the mean;
Accept: variation around the mean.
Accept: range is difference between highest and lowest values/extremes or range includes anomalies/outliers.
2. (SD) reduces effect of anomalies/ outliers;
Reject: (SD) removes anomalies/outliers.
3. (SD) can be used to determine if (difference in results is) significant/not significant/due to chance /not due to chance; *Ignore: reliability/accuracy/validity.*

2 max

- (c) 1. Distributes heat / prevents 'hot' spots;
2. Distributes microorganisms;
3. More enzyme-substrate complexes;
4. Increases rate of decomposition;
Accept: increases nitrification/ammonification or 'breaks down waste faster'.
5. Aeration/provides oxygen;

2 max

- (d) 1. Microorganisms change the abiotic conditions/temperature /organic waste /provide nutrients;
Must refer to microorganisms or bacteria/named bacteria causing the change.
Ignore: change the environment.
2. Less hostile conditions;
3. Decline in Cocci **and** increase in rods;
Accept: 'decrease in cocci, others are going up'.
Accept: decrease in cocci and increase in either rod type or increase in both types.
4. Gram positive outcompete / better competitors;
Accept: rods outcompete (cocci) / better competitors.

3 max

- (a) 1. Time taken to reach maximum blood flow varied widely/significantly;

[9]

4

*Must be emphasis on idea of 'widely'. Mention only of 'vary' is insufficient. Ignore use of numbers unless a comparison is given
Ignore any mention of a correlation between maximum percentage increase in blood flow and time taken to reach maximum increase in blood flow*

2. Quickest after a carbohydrate-only meal;
OR
Slowest after a protein-only meal;

2

- (b) 1. More blood flows to (skeletal) muscles (during exercise);
2. (supplying) more oxygen / glucose / removing more carbon dioxide/lactic acid/ heat;

1 and 2. Idea of 'more' is needed

More blood to muscles delivering oxygen = 2 marks

3. For high (rate of) respiration / to meet increased demand for energy/ATP;
OR
Prevents anaerobic respiration/lactic acid build up;

Accept: reduces/delays for prevent

3

(c) **Immediate effect of exercise after meal**

1. Meal increases blood flow in (mesenteric) artery AND exercise decreases blood flow in (mesenteric) artery;

1. Will relate to information given in the tables

Overall effect on blood circulation

2. Insufficient blood (flow to small intestines / muscles);

2. Accept: blood diverted away/shunted

Ignore references to 'strain on heart', 'heart disease', 'cardiovascular diseases'

Ignore references to controlling variables and reliability

Effect on blood flow of type of meal

3. Carbohydrate meal quick(er) / during exercise;

OR

Protein/fat meal slow(er) / after exercise;

Effect of reduced blood flow on cells

4. (More) anaerobic (respiration) / lactic acid produced;

OR

less aerobic respiration;

Consequence for person of changed blood flow

5. Less absorption (of digested food) / faeces contains digested food;

6. Cramp / indigestion / discomfort / fatigue;

*Look for **ideas** in each of 5 areas*

MP1 might be spread throughout the answer

6. Ignore references to digestion

Max 4

- (c) 1. (blood flows from kidney along) renal vein to vena cava;

2. (along) vena cava to right atrium/side of heart;

3. (along) pulmonary artery to lungs;

4. (along) capillaries to pulmonary vein;

5. (along) pulmonary vein to left atrium/side of heart;

6. (along) aorta to renal artery (to kidney);

7. Blood may pass through several complete circuits before returning to kidney;

Reject: 'blood vessel pumps' only once

Ignore references to valves

Ignore references to heart action/cardiac cycle

Accept labelled diagram must include directional arrows

Max 6

[15]

- (a) (i) Cytoplasm/cytosol;

5

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

- [8] (a) 1. Antigen stimulates immune response / activates B/T cells;

6

2. B/T cells divide OR antibodies produced;
3. Antibodies/T cells attack myelin sheaths;
Ignore references to antigen binding to myelin

3

- (b) 1. Fewer cristae/smaller surface area (of cristae);
2. So less electron transport/oxidative phosphorylation;
3. (So) not enough ATP produced

OR

Not enough energy to keep neurones alive;

1. *Accept 'inner membrane' as 'cristae'*
2. *Accept fewer ATP synthase enzymes*
2. *Accept lower rate of electron transfer/oxidative phosphorylation*
3. *Accept less use/stimulation of neurone leads to death of cell*
3. *Accept no/less ATP produced/no energy to keep neurones alive*
3. *Ignore references to glycolysis/ Krebs cycle*

3

- (c) (i) (Transmission) electron (microscope) – **no mark**

Need high resolution (to see structure of mitochondria)

Accept 'scanning electron microscope' /TEM/SEM

Accept – optical microscope not high enough resolution

1

- (ii) 1. Took photographs/areas at random;
2. Counted total number (of normal) and number of unusual mitochondria;
3. Divided number of unusual mitochondria by total number and multiplied by 100;
1. Accept (very) large number of areas/photos/samples
MP 3 = 2 marks (includes MP2)

3

[10]

(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

2. Separate gene pools / no interbreeding / gene flow (between populations);
Accept: reproductive isolation
This mark should only be awarded in context of during the process of speciation. Do not credit if context is after speciation has occurred.
3. Variation due to mutation;
4. Different selection pressures / different abiotic / biotic conditions / environments / habitats;
Neutral: different conditions / climates if not qualified
Accept: named abiotic / biotic conditions
5. Different(ial) reproductive success / selected organisms (survive and) reproduce;
Accept: pass on alleles / genes to next generation as equivalent to reproduce
6. Leads to change / increase in allele frequency.
Accept: increase in proportion / percentage as equivalent to frequency

6

- (b)
1. Capture / collect sample, mark and release;
 2. Method of marking does not harm lizard / make it more visible to predators;
 3. Leave sufficient time for lizards to (randomly) distribute (on island) before collecting a second sample;
 4. (Population =) number in first sample × number in second sample divided by number of marked lizards in second sample / number recaptured.

4

- (c)
1. High concentration of / increase in carbon dioxide linked with respiration at night / in darkness;
 2. No photosynthesis in dark / night / photosynthesis only in light / day; *Neutral: less photosynthesis*
 3. In light net uptake of carbon dioxide / use more carbon dioxide than produced / (rate of) photosynthesis greater than rate of respiration;
 4. Decrease in carbon dioxide concentration with height;
More carbon dioxide absorbed higher up
Accept: less carbon dioxide higher up / more carbon dioxide lower down
 5. (At ground level) less photosynthesis / less photosynthesising tissue / more respiration / more micro-organisms / micro-organisms produce carbon dioxide.
Neutral: less leaves unqualified or reference to animals

5

- [15] (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 acceptor;
3. (oxygen combines with) protons / H⁺ **and** electrons / e⁻ **to form** water / H₂O;
All aspects are required to gain mark.

2 max

- (ii) Phosphate (ions) / inorganic phosphate / P_i;

Reject 'phosphorus' or 'P'.

Accept 'PO₄'.

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

[9] (a) Prevents oxygen being taken up / entering / being absorbed;

10

Accept: any idea of no contact with oxygen.

Neutral: for anaerobic respiration / anaerobic conditions.

Neutral: prevents entry of air.

Reject: prevents entry of oxygen and another named gas.

1

(b) (i) 0.0155 / 0.016 = 2 marks;;

0.0775 / 0.077 / 0.078 / 0.08 = 1 mark

/ 0.62 = 1 mark

2

(ii) Glucose decreases / is a limiting factor / increase in ethanol / yeast / cells die / toxins build up;

Accept: glucose is used up.

1

(iii) 1. (Stays the) same / level / (relatively) constant;

2. Same volume / amount of oxygen uptake and carbon dioxide release;

Note: if m.p. 1 is awarded m.p 2 can be obtained without referring to 'same volume / amount'.

2

(c) 1. Oxygen is final / terminal (electron) acceptor / oxygen combines with electrons and protons;

2. Oxidative phosphorylation / electron transport chain provides (most) ATP / only glycolysis occurs without oxygen / no Krebs / no link reaction;

2

[8] (a) 1. (Protein / molecule) that moves from cytoplasm to DNA;

11

Accept 'it' as TF.

Accept moves into nucleus

2. (TF) binds to specific gene / genes / to specific part of / site on DNA / binds to promoter / RNA polymerase;

Accept regulator / enhancer region

3. Leads to / blocks (pre)mRNA production / allows / blocks binding of RNA polymerase (to DNA) / allows RNA polymerase to work;

Ignore translation unless context wrong

Max 1 if refer to oestrogen as a transcription factor

2 max

(b) 1. (Binding to CREB) prevents transcription / mRNA formation; *Accept that lack of protein leaves NAD reduced*

2. (Binding of huntingtin) prevents production / translation of protein (that removes electrons / protons from NAD);
3. Fewer electrons to electron transport chain / electron transport chain slows / stops / stops / slower oxidative phosphorylation;
4. Fewer protons for proton gradient;
5. Not enough ATP produced / energy supplied to keep cells alive / anaerobic respiration not enough to keep cell alive;

Accept neurones require ATP for active transport of ions

Ignore references to resting potential

3 max

- (c) 1. Mitochondrion has two membranes / inner and outer membranes; *Accept cristae for inner membrane*
2. For each (different) membrane a (different) carrier required;
Ignore reference to channel proteins

2

[7]

(a)

12

Part of ecosystem	Mean rate of carbon dioxide production / $\text{cm}^3 \text{ m}^{-2} \text{ s}^{-1}$	Percentage of total carbon dioxide production measured by the scientists
Leaves of plants	0.032	25.0
Stems and roots of plants	0.051	<u>39.8</u>
Nonphotosynthetic soil organisms	0.045	<u>35.2</u>

2 correct = 2 marks;;

Adding rates to get 0.128 = 1;

If rounded to 40 and 35 in table;

- *but working shows decimal points, then award 2 marks*
- *but no working shown, then 1 max*

2 max

- (b) 1. Data only include (heterotrophic) soil organisms;
2. Doesn't include animals (above ground) / other (non-soil) organisms;

3. Doesn't take into account anaerobic respiration;

Award points in any combination

Accept for 1 mark idea that CO₂ for leaves doesn't take into account photosynthesis – not told in dark until part (d)

2 max

(c) **All three** of following = 2 marks;;

Two of them = 1 mark;

Volume of carbon dioxide given off

(From known) area / per m² / m⁻²

In a known / set time

Ignore 'amount' / concentration of CO₂

Accept per second / per unit time

2

(d) 1. (In the light) photosynthesis / in the dark no photosynthesis;

2. (In light,) carbon dioxide (from respiration) being used / taken up (by photosynthesis);

2

(e) (i) (Rate of respiration)

Assume "it" means soil under trees

1. In soil under trees (always) higher; *Accept converse for soil not under trees*

Accept 'in the shade' means under the trees

2. In soil under trees does not rise between 06.00 and 12.00 / in the middle of the day / peaks at 20:00-21.00 / in the evening;

3. In soil **not** under trees, peaks at about 14:00-15:00 / in middle of day;

2. and 3. No mm grid, so accept 'between 18.00 and 24.00' or 'between 12.00 and 18.00'

2 max

(ii) (Between 06.00 and 12.00, (No Mark))

Respiration higher in soil under tree, (No mark)

Do not mix and match mark points

No list rule

1. Tree roots carry out (a lot of) respiration;

2. More / there are roots under tree;

Accept converse for soil not under trees

OR

3. More food under trees;
4. So more active / greater mass of / more organisms (carrying out respiration);
Accept converse for soil not under trees

OR

Soil not under trees respiration increases (No mark)

5. Soil in sunlight gets warmer;
6. Enzymes (of respiration) work faster;
Accept converse for soil under trees

2 max

- (f) (i)
1. Photosynthesis produces sugars;
 2. Sugars moved to roots;
Do not penalise named sugars other than sucrose
 3. (Sugars) are used / required for respiration;

2 max

- (ii) Takes time to move sugars to roots;
Look for movement idea in (i) – can carry forward to (ii)

1

[15]

1. (Drink) contains carbohydrates / sugars so High GI / (drink) contains carbohydrates /

13

sugars so raises blood glucose concentration quickly;

Each alternative requires both aspects for credit

The second alternative requires a reference to speed eg 'quickly' or 'immediately'

2. Contains salt so glucose more rapidly absorbed;
3. Increases glucose to muscles for respiration;
4. More / faster respiration so more / faster energy release;
Reject reference to energy production
Accept more ATP produced

[3] (a)

14

	Glycolysis	Link reaction	Krebs cycle
Occurs in mitochondria		√	√
Carbon dioxide produced		√	√
NAD is reduced	√	√	√

Mark horizontally

3

- (b) (i) 1. Glucose is used / broken down during glycolysis / in cytoplasm;
 1. *Accept: glucose to pyruvate or glucose not converted to pyruvate for one mark*
 2. Glucose cannot cross mitochondrial membrane(s) / pyruvate can cross mitochondrial membrane(s);

2

- (ii) 1. Is a competitive inhibitor / attaches to active site;
 1 *Accept: inhibitor / malonate attaches to active site to form an enzyme-substrate complex*
 2. Reduces / prevents enzyme-substrate / E-S complex forming;
 2 *Accept: substrate / succinate cannot bind to enzyme*
 2 *Accept mark point 2, but not mp1 in context of non-competitive inhibition*

2

- (iii) 1. Krebs cycle inhibited as NAD / Coenzyme / FAD not / less reduced;
 2. Hydrogens not passed to ETC therefore oxygen not used as (much as a) final / terminal (electron) acceptor;

2

[9] (a) 1. Affects enzymes;

15

'respiration involves enzymes' = two marks

2. Affects respiration;
Ignore reference to controlling a variable

Or

3. Affects volume / pressure of gases;
Mark point 4 can only be awarded if mark point 3 has been credited

4. Affects readings;

2 max

- (b) (i) 1. Oxygen taken up / used (by seeds);
Reject air is taken up for mark point 1
2. Carbon dioxide (given out) is absorbed by solution / potassium hydroxide;
3. Decrease in volume / pressure (inside flask);
Reference to vacuum negates mark point 3

3

(ii) 4;

1

- (c) 1. Remains the same;
2. No oxygen uptake / used;
*Any reference to 'carbon dioxide **not** being produced' disqualifies mark point 2*

2

[8]

16

- (a) 1. Carbohydrate / sugar / named carbohydrate;
2. Minerals / named mineral ion;
*Accept alternatives for mineral such as inorganic substances / ions.
Accept symbol for ion. Accept incorrect symbols providing that answers are not ambiguous.*
3. Amino acids / protein;
4. Vitamins;

2 max

- (b) 1. Shake / stir / mix;
2. Even distribution of yeast / cells;
Accept other terms with a similar meaning for both points

2

(c) Two marks for correct answer of 20 / 20.2 / 20.22;;

One mark for incorrect answer in which student clearly shows increase as 8.912 – 7.413 or as 1.499;

Ignore references to 10^6

2

- (d) 1. More competition;
 2. Less oxygen;
 3. Less glucose / sugar / carbohydrate / respiratory substrate;
 4. Ethanol / alcohol becomes toxic / inhibits respiration / inhibits reproduction;
 5. Fall in pH;

2 max

[8] (a) 1. No oxygen can enter;

17

2. Ethanol produced during anaerobic respiration;

OR

3. No ethanol / carbon dioxide can escape;
 4. Allows accuracy of measuring;

OR

5. To prevent entry of / contamination with microorganisms;
 6. Prevent competition with yeast;

Any two pairs of answers

Second mark of each pair must be related to the first point of the pair.

4 max

- (b) 1. Yeast respiring aerobically;
 2. Oxygen used equal to carbon dioxide produced;

2

- (c) 1. 7.0 / 7;
 2. Ethanol production starts;

2

- (d) (i) 1. Repeat;
 2. Identify anomalies / see if results are similar / enough results for statistical test / give more reliable mean;
 3. Carry out statistical test / statistical analysis;
 4. Ensure results are significant / find probability of results being due to chance;
 5. Peer review;
 6. Allows procedure to be checked / see if other scientists get similar results;

Two pairs of linked points, each pair a suggestion and an explanation. The explanation must relate to the suggestion to gain the second point of the pair.

4

- (ii) 1. Curve levelling off / rate of increase is decreasing / very little extra ethanol produced;
2. Becomes less cost effective / less profit;
2. *Accept a description of cost effectiveness*

2

- (iii) 1. (Funding agency) might want particular results;
2. Results may be withheld / results may not be published / results may be confidential;

2 max

[16] (a) (i) Non-living / physical / chemical factor / non biological;

18

Do not accept named factor unless general answer given.

1

- (ii) Accept an abiotic factor that may limit photosynthesis / growth;

Reject altitude / height

Water

Named soil factor

Not "soil" / "weather"

Light

Carbon dioxide

Accept Oxygen

Incline / aspect

Wind / wind speed

1

- (b) 1. Correct explanation for differences between day and night e.g. photosynthesis only during the daytime / no photosynthesis / only respiration at night;
2. Net carbon dioxide uptake during the day / in light

OR

No carbon dioxide taken up at night / in dark / carbon dioxide released at night / in dark;

3. At ground level more respiration / in leaves more photosynthesis;
4. Carbon dioxide produced at ground level / carbon dioxide taken up in leaves;

Principles

Comparing day and night / light and dark

1. *Explanation in terms of photosynthesis / respiration*

2. Effect on carbon dioxide production / uptake

Comparing leaves with ground level

3. Explanation in terms of photosynthesis / respiration

4. Effect on carbon dioxide production / uptake

2 and 4 must relate to why the change occurs

4

- (c) 1. Variation in original colonisers / mutations took place;
2. Some better (adapted for) survival (in mountains);
2. Allow "advantage so able to survive"
3. Greater reproductive success;
4. Allele frequencies change;
4. Reject gene / genotype

3 max

[9]

19

- (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

[15]

(a)

20

	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) $\text{ADP} + \text{P}_i \rightarrow \text{ATP}$;

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 / easilyresynthesised".*

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

[8] (a) 1. Hydrolysis breaks proteins / hydrolyses proteins / produces amino acids (from

21

proteins);

2. Protein synthesis involves condensation;

2

(b) Amino acids (from calliphorin) can be joined in different sequences /rearranged;

1

- (c) 1. Fall, rise and fall;
2. Rise after 40 and fall after 80;
- Ignore concentration values.*

2

(d) (i) Fall / increase then fall;

Lysosomes associated with tissue breakdown;

2

- (ii) 1. Tissues / cells are being broken down;
2. RNA is digested / hydrolysed / broken down;
3. By enzymes from lysosomes;
4. New proteins not made / no new RNA made;

2 max

- (e) 1. (RNA) associated with making protein;
2. New / adult tissues are forming;

2

- (f) 1. In the first 6 days no / little oxygen supplied / with breakdown of tracheae, no / little oxygen supplied;
2. (Without tracheae) respire anaerobically;
3. Anaerobic respiration involves reactions catalysed by enzyme **B** / conversion of pyruvate to lactate / involves lactate production;
4. Enzyme **A** / Krebs cycle is part of aerobic respiration; *Or, with emphasis on aerobic respiration:*
1. *Tracheae supply oxygen / after 6 days oxygen supplied;*
2. *(With tracheae) tissues can respire aerobically.*

4

[15]

22

- (a) (i) 1. Gases / correct named gas not released;
2. Conditions (in digester) can be controlled;
3. Products / named product can be collected;
4. Open ponds associated with health risk / environmental damage / eutrophication;
Correct named gases include: methane, carbon dioxide, hydrogen sulphide, nitrogen oxides 1. Allow substance = product
4. *Accept 'pond' in any context*

2 max

- (ii) 1. Respiration causes temperature increase / release of heat;
2. Enzymes would be denatured / microorganisms killed;

2

- (b) (i) 1. Increase algae / algal bloom causes light to be blocked out;
2. Plants can't photosynthesise / plants and / or algae die;
3. Bacteria / saprobionts / EW feed off / breakdown dead organisms using up oxygen / bacteria respire / BOD rises;

3

- (ii) 1. Acts as soil conditioner / improves drainage / aerates soil / increases organic content of soil;
2. Contains other elements / named element / wider range of elements;

3. Production of artificial fertiliser energy-consuming;
4. Less leaching / slow release (of nutrient);
Unspecified answers relate to natural fertiliser. Ignore references to cost / eutrophication
2. i.e. elements other than nitrogen, phosphorus and potassium

1 max

[8] (a) (i) 1. Oxygen taken up / used (by woodlouse);

23

2. Carbon dioxide (given out) is absorbed by solution / potassium hydroxide;
3. Decrease / change in pressure;
Reference to vacuum negates last marking point
Reject reference to pressure increasing inside tube

3

- (ii) 1. Distance (drop moves) and time;
2. Mass of woodlouse;
3. Diameter / radius / bore of tubing / lumen / cross-sectional area;
If answer refers to measuring volume using the syringe allow 2 max
– one mark for measuring volume; one mark for mass of woodlouse;

3

- (b) 1. Less / no proton / H⁺ movement so less / no ATP produced;
2. Heat released from electron transport / redox reactions / energy not used to produce ATP is released as heat;
3. Oxygen used as final electron acceptor / combines with electrons (and protons);

3

[9] (a) Electrons transferred down electron transport chain;

24

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

[7]

- (a) Increase in the first 3 – 4 hours and then decrease;

25

1

- (b) Little / no difference (at 8 hours);

Between all groups;

2

- (c) Respiration (produce CO₂);

By cells / tissues;

2

- (d) Clear differences between the lactose deficient and IBS / control group;

No overlap in SD;

Accept between all groups

2

[7] (a) (i) Yield increases by 0.6 kg m⁻² (when extra carbon dioxide present);

26

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

- (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]