AQA, OCR, Edexcel

A Level

A Level Biology

Photosynthesis, Respiration Succession and Nutrient Cycle Answers

Name:

MME

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Total Marks:

M1. (a) (i) respiration;

1

(ii) decomposers;
(*accept bacteria / fungi*)

1

(b) $\frac{87402}{1.7 \times 10^6} \times 100 = 5.14 / 5.1\%$;

(correct answer = 2 marks)
(principle: energy in producers ÷ energy of light absorbed = 1 mark)

2

(c) excites chlorophyll / electrons;
release electron(s);

2 max

(d) reduced NADP;
reduces GP / to change GP to TP;
ATP;
provides the energy to reduce GP / convert GP to TP / TP to RuBP / provides phosphate to convert TP to RuBP;

4

[10]

M2. (a) (i) Temperature and light;

1

(ii) Increase in temperature causes increase in rate of photosynthesis / uptake of carbon dioxide;

Increase in light / more / medium / high light (intensity) causes increase in rate of photosynthesis / uptake of carbon dioxide;

2

(b) 2.75 – 2.81 (mg g^{-1} hr^{-1})

Accept answers in range 2.75 – 2.81

1

(c) 1. Growth will decrease (at higher temperature);

2. Rate of respiration will increase at higher temperature;

3. Photosynthesis decreases as limited by light / as there is less light;

Ignore references to effect of temperature on rate of photosynthesis

3

[7]

M3.(a) 1. Oxygen produced in light-dependent reaction;
2. The faster (oxygen) is produced, the faster the light-dependent reaction.

2

(b) 35–36 µmol Oxygen per mg chlorophyll.

Correct difference at 500 µmol photons m^{-2} s^{-1} or incorrect difference but division by 4 shown = 1 mark.

2

c) At all light intensities, chloroplasts from mutant plants:

1. Have faster production of ATP and reduced NADP;
2. (So) have faster / more light-independent reaction;
3. (So) produce more sugars that can be used in respiration;
4. (So) have more energy for growth;
5. Have faster / more synthesis of new organic materials.

Accept converse points if clear answer relates to non-mutant plants

4 max

[8]

M4. (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

3 max

[5]

M5.(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

[10]

M6.(a) 1. Oxidation of / hydrogen removed from pyruvate <u>and</u> 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 <u>complementary</u>.

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

[9]

M7. (a) Ribulose bisphosphate / RuBP;

Accept Ribulose biphosphate or Ribulose diphosphate

Accept phonetic spellings

Accept any variation in upper or lower case for RuBP

1

b) ATP and reduced NADP are produced in grana / thylakoids / present in A / both tubes;

Must be reduced NADP but accept any alternative which show hydrogen attached to NADP

Must be reduced NADP not reduced NAD 1

(c) 1. 4 000;

Accept 'same as in (tube) C', but not 'same' on its own

2. Light-dependent reaction does not occur / ATP and reduced NADP are not produced;

Accept converse for mark point 2

2

d) 1. (Less) GP converted to TP;

GP = glycerate 3-phosphate

TP = triose phosphate but abbreviations are sufficient

2. (Less) TP converted to RuBP;

Accept GALP as TP

2

(e) 1. No / less ATP / ATP produced (during electron transport);

Must be reduced NADP but accept any alternative which shows hydrogen attached to NADP

2. No / less reduced NADP / reduced NADP produced (during electron transport)

2

[8]

M8.(a) (i) So it / CO_2 is not a <u>limiting</u> factor (on growth / photosynthesis);

Accept: CO_2 is a <u>limiting</u> factor

1

(ii) So any difference is due to <u>iron</u> (deficiency);

Accept: <u>iron</u> is the variable

1

(iii) Amount of triose phosphate / TP will be similar / same / low (at start);

Accept: to allow triose phosphate to stabilise / become constant

Reject: so all triose phosphate is used up

Reject: so no triose phosphate

1

(b) 1. (Less) ATP produced;

Accept: alternatives for reduced NADP ie NADP with hydrogen / s attached

2. (Less) reduced NADP produced;

3. ATP / reduced NADP produced during light-dependent reaction;

4. (Less) GP to triose phosphate / TP;

4

(c) 1. Less triose phosphate converted to RuBP;

Accept: less triose phosphate so less RuBP

2. CO_2 combines with RuBP;**2**

[9]

M9.(a)

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

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 CO_2 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 m^2 / m^{-2}

In a known / set time

Ignore 'amount' / concentration of CO_2

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) <u>(Between 06.00 and 12.00</u>, (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]

M10. (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) <u>On the diagram:</u>

(i) '**A**' (ATP used) – <u>between</u> glucose and triose phosphate;

1

(ii) '**B**' <u>Any **two** from</u>:

(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:

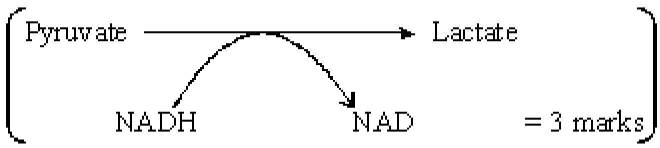
Source of energy / of phosphate;
Active transport;
Phagocytosis / endo- / exocytosis / pinocytosis;
Bile production;
Cell division / mitosis;
Synthesis of: glycogen;
protein / enzymes;
DNA / RNA;
lipid / cholesterol;
urea;

max 3

(e) Any **four** from:
Forms lactate; [extras – C_2H_5OH / CO_2 – *CANCEL*]

Use of reduced NAD / NADH;

Regenerates NAD;



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]

M11.(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 / 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

[9]

M12.(a) (i) Unit of energy / mass, per area, per year.

1

(ii) 1. Less light / more shading / more competition for light;

Neutral: references to animals

2. Reduced photosynthesis.

Accept: no photosynthesis

2

(b) 1. Pioneer species;
2. Change in abiotic conditions / less hostile / more habitats / niches;

Accept: named abiotic change or example of change e.g. formation of soil / humus / organic matter / increase in nutrients

Neutral: reference to change in environment unqualified

Neutral: more hospitable / habitable / homes / shelters

3. Increase in number / amount / diversity of species / plants / animals.

    Accept: other / new species (colonise)

3

(c) 1. Net productivity = gross productivity minus respiratory loss;
2. Decrease in gross productivity / photosynthesis / increase in respiration.

2

(d) 1. Conserving / protecting habitats / niches;
2. Conserving / protecting (endangered) species / maintains / increases (bio) diversity;
3. Reduces global warming / greenhouse effect / climate change / remove / take up carbon dioxide;
4. Source of medicines / chemicals / wood;
5. Reduces erosion / eutrophication.

    Accept: tourism / aesthetics / named recreational activity

1 max

[9]

M13. (a) (i) dissolve (in soil water) / run-off / leaching; *reject nitrogen dissolving.*

1

(ii) insoluble / less soluble;
(molecules) require breaking down / slow release; **2**

(b) increased growth / algal bloom;
blocks light; less photosynthesis;
plants die;
increase in decomposers / bacteria; *ignore growth of bacteria*
bacteria respire;
less oxygen; **4 max** **[7]**

M14.(a) 1. To kill any fungus / bacteria on surface of seeds or in soil;
2. So only the added fungus has any effect. **2**

(b) So that only nitrate or ammonia / type of fertiliser affects growth **1**

(c) 1. So that effects of nitrate or ammonium alone could be seen;
2. So that effects of fungus can be seen. **2**

(d) 1. Weigh samples at intervals during drying;
2. To see if weighings became constant (by 3 days). **2**

(e) With live fungus – showing effects of the fungus:
1. Fungus increases growth of roots and shoots in both;
2. Produces greater growth with nitrate.

With heat-treated fungus – showing effects of fertiliser:

3. Similar dry masses for roots and shoots;
4. (Probably) no significant difference because SDs overlap. **4**

(f) 1. Dry mass measures / determines increase in biological / organic material;
2. Water content varies. **2**

g) 1. Fungus with nitrate-containing fertiliser gave largest shoot: root ratio;
2. And largest dry mass of shoot;
3. 6.09:1 compared with ammonium-containing fertiliser 4.18:1 **2**
max [15]

M15. (a) Nitrification; *Accept nitrifying. Do not accept nitrogen fixing.* **1**

(b) 1. Uptake (by roots) involves active transport;
Reject all references to bacteria

2. Requires ATP / aerobic respiration; **2**

c) (i) 1. Not enough time / fast flow washes bacteria away;
"Not enough time for bacteria to convert all the ammonia to nitrate" gains 2 marks

2. (Not all / less) ammonia converted to nitrate / less nitrification; **2**

(ii) 1. Algal bloom / increase in algae blocks light / plants / algae die;

2. Decomposers / saprobionts / bacteria break down dead plant materials;

3. Bacteria / decomposers / saprobionts use up oxygen in respiration / increase BOD causing fish to die;
3. Accept alternatives such as microbes / saprophytes. **3 [8]**

M16.(a) (i) 1. Amino acid / protein / enzyme / urea / nucleic acid / chlorophyll / DNA / RNA / / ATP / ADP / AMP / NAD / NADP;

2. DNA / RNA / nucleic acid / ATP / ADP / AMP / NADP / TP / GP / RuBP / phospholipids;
1. and 2. Accept any named equivalent examples e.g. nucleotides.
Neutral: ammonia / nitrite / nitrate / phosphate.

2

(ii) 1. Saprobiotic (microorganisms / bacteria) break down remains / dead material / protein / DNA into ammonia / ammonium;
Accept: saprobionts / saprophytes / saprotrophs
Neutral: decomposer

2. Ammonia / ammonium ions into nitrite and then into nitrate;

Allow correct chemical symbols.

Accept: correct answers which use incorrect bacteria e.g. nitrogen-fixing but then reject m.p. 3.

3. (By) Nitrifying bacteria / nitrification;

3

(b) 1. Nitrate / phosphate / named ion / nutrients for growth of / absorbed / used by plants / algae / producers;

2. More producers / consumers / food **so** more fish / fish reproduce more / fish grow more / fish move to area;

Must have idea of more plants related to some increase in fish.

2

[7]

M17.(a) R.

1

(b) 1. Protein / amino acids broken down (to ammonium ions / ammonia);

Accept: nucleic acids / RNA / DNA / urea / any named nitrogen containing compound as an alternative to protein / amino acids

Accept: saprophytes / saprotrophs

2. By saprobionts / saprobiotic (microorganisms).

Neutral: decomposers

Reject: answers where incorrect type of bacteria given as saprobionts e.g. Nitrogen fixing bacteria

2

c) 1. (Fertility increased as) more nitrate formed / less nitrate removed / broken down;

Accept: Nitrate remains

2. Less / no denitrification / process P is decreased / fewer denitrifying bacteria.

Accept: more nitrification / more nitrifying bacteria / process R is increased

2

(d) 1. Grow crops / plants with nitrogen-fixing (bacteria);

Accept: grow legumes / named example e.g. peas, beans, clover

Accept: <u>fallow</u> year

Accept: use different amounts of ions / nutrients

2. (Different crops use) different minerals / salts / nutrients / ions (from the soil);

3. (Different crops have) different pests / pathogens / diseases.

2 max