



A-Level Biology

Energy and Ecosystems

Mark Scheme

Time available: 68 minutes

Marks available: 61 marks

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Mark schemes

1.

- (a) 1. Low respiration;
Accept less energy lost in respiration
2. More growth/biomass/colonisation;
Allow examples of more carbon-containing molecules eg glucose

2

- (b) 1. Less nitrification

OR

Fewer/less active nitrifying bacteria;

OR

Nitrification/nitrifying bacteria require oxygen/aerobic conditions;

2. (Less) oxidation/conversion of ammonium (ions) to nitrite (ions) and to nitrate (ions);

Order must be nitrite then nitrate

Accept ammonia for ammonium ions

Accept correct chemical formulae for ions, eg there will be little oxidation/conversion of $\text{NH}_4^+ \rightarrow \text{NO}_2^- \rightarrow \text{NO}_3^-$

Ignore 'breakdown' for oxidation/conversion

3. More denitrification

OR

More/more active denitrifying bacteria

OR

Denitrification/denitrifying bacteria do not require oxygen

OR

Denitrification/denitrifying bacteria require anaerobic conditions;

4. (So more) nitrate (ions) reduced/converted to nitrogen (gas);

Accept correct chemical formulae eg So more NO_3^- reduced/converted to N_2 ;

2 max

- (c) 1. Assumed that height is (directly) proportional to biomass;
Accept descriptions of 'is proportional to', eg correlates to, is equivalent to
2. (Plants may put biomass into) other named aspect of growth (other than height)

OR

Height does not include the roots

OR

Some increase in height results from water gain;

Examples of other named aspects of growth could include root growth, flower/seed/fruit formation, lateral growth, wider leaves

2

- (d) 1. Answer of 12 days = **2 marks**;;
2. 12.16 (12.15774433) = **1 mark**

OR

4 days (used 387 and 268, ie not calculated starting length) = **1 mark**;

2

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2.

- (a) 1. (Colonisation by) pioneer species;
2. Pioneers/species/organisms change the environment/habitat/conditions/factors;
*Accept example of change e.g. forms soil/humus/organic matter/nutrients.
 Must convey idea of change being caused by pioneers/species /organisms*
3. (Environment becomes) less hostile for other/new species
OR
 (Environment becomes) more suitable for other/new species
OR
 (Environment becomes) less suitable for previous species;
Accept previous species out-competed.
4. Change/increase in diversity/biodiversity;
Ignore increase in genetic diversity.
5. (To) climax community;

4 max

- (b) 0.155;

Accept standard form e.g. 15.5×10^{-2}

1

- (c) 1. Answer of 180/178/177.5 = **2 marks**;;
Ignore any numbers following 177.5
2. Incorrect answer but shows use of numbers 57 **and** 127 (with decimal points in any position) within the calculation = **1 mark**;

2

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3.

- (a) 1. Is widely / commonly used;
2. Provides a standard / benchmark / reference;
*Allow a variety of descriptors for marking point 2 e.g. 'provides a base line',
 'produces known amount of carbon dioxide'
 Mark point 2, do not accept 'for comparison' on its own as
 'comparison' is in stem of question*
3. Produces large amount of carbon dioxide;
4. Is a decreasing resource / could be replaced by biofuel;
Ignore reference to a control

2 max

- (b) 1. Independent / no bias / trustworthy;
2. Non-profit making;
3. (Focused on) effect on environment / climate;

2 max

- (c) 1. CO₂ taken up in photosynthesis;
2. More taken up than produced (when it is used) with less CO₂ produced than petrol;

2

- (d) 1. (These microorganisms) don't have (cellulose-digesting) enzymes;
Accept 'don't make enough of these enzymes' for mark point 1
2. (Cellulose) is a polysaccharide / polymer / long (molecule / chain);
Accept 'large' for mark point 2
3. (Cellulose) is insoluble / glucose / product of digestion is soluble;
4. Broken down into glucose / monomers / monosaccharides;
*Ignore (alpha) glucose for mark point 4.
 Do not accept sugars for mark point 4*
5. Sugars / glucose used in glycolysis / glucose can be converted to pyruvate;
6. Produces more ethanol / fuel produces ethanol / fuel quicker;
Accept 'speeds up process' for mark point 6

3 max

- (e) 1. Removes species / fewer species / growth of single crop / single plant species / monoculture;
Deforestation or removal of hedges on its own should not be credited
2. Removes habitats / fewer habitats / niches / only one habitat;
3. Removes variety of food sources / fewer food sources / only one food source;

2 max

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4.

- (a) (i) 1. Same breed so similar alleles;
1. Allow different alleles have different effects
2. Controls / removes variable / so genes not a factor / only temperature affects results / rate of growth affected by genes;
2. Accept idea worded in such terms as inherited.
- (ii) 1. Different growth rates / gained different biomass / grew different amount;
Allow "more food for growth"
Ignore references to efficiency of conversion.
2. Not due to temperature / the independent variable;
- (b) (i) Rise then fall with peak at 20 °C;
Do not accept 0.85 as alternative to 20.
- (ii) 1. Temperature may be between 10 and 30 / 10 and 20 / 20 and 30;
No mark for yes or no.
2. Intervals are 10°C / large / not small / should be smaller / should be intermediates;
- (c) (i) 1. Growth rate decreasing / conversion staying same / decreasing;
2. (Scientists would be) looking for high growth rate / conversion / data shows unlikely to improve growth / yield;
3. Wastes time / resources / would not relate to farming conditions;
3. Ignore cruelty to pigs

2

2

1

2

2 max

- (ii) 1. Will lose more heat / not as much energy used to maintain body temperature;
 1. *Must be a comparative statement*
Accept energy as equivalent to heat in the context of this question
2. Heat resulting from respiration / more respiration;
 2. *Do not credit answers relating to energy made in respiration*
3. More food used in respiration;

2 max

(d) **In support**

Read standard deviation as standard error

1. Food **B** produces greater mass than control / greater than 100%;
 1. *Must refer to control*

But

2. Error bars for **B** mean **B** could be no better / not different from control;
3. Overlap of error bars for **B** and **A**;
4. A no better than / not different from **B**;
 4. *Neutral: "Results not significant". Mark must compare **A** to **B***

Experimental limitations

5. Experiment only ran for 10 days;
6. Experimental conditions / breed of pig may not be the same as on the farm;
7. No information about cost;

4 max

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5.

- (a) (i) Reduced cost;
 Less feed / less land use / more growth rate with same amount of food;
Allow is 'cost effective'
- (ii) Amount of food taken in less than expected.
Allow 'expected food intake is higher,
Allow 'food intake is lower than it should be'

2

1

(b) Type of food (not a mark)

1. May vary in protein / fat / carbohydrate / fibre / roughage / vitamins / minerals;
2. May affect absorption / digestibility / energy value / tastiness / growth / overall food intake;

For mark point 1 allow appropriately named food compound e.g. cellulose, glucose

For mark point 2 it must be clear that these factors are affected by the type of food.

Temperature (not a mark)

3. Will affect heat loss / gain / respiration / metabolism;
4. More food / energy can be used for growth;

Note: two maximum marks for effect of temperature.

4

(c) RFI does not affect methane production /

There is no difference in the rate of methane production for low and high RFI values /

The difference between the rates of methane production is due to chance /

No correlation / relationship / link between RFI and methane production;

Any clear statement that there is no link between RFI and methane production should be credited.

1

(d) (i) Sulfate without straw;

1

- (ii) 1. May affect yield / damages rice crop;
2. Substance / treatment may affect other organisms / environment;
3. Cost of substance / application / labour;
4. Method / frequency / timing of application / amount of substance required;

2 max

(iii) Not flooded aerobic conditions / more oxygen / with flooding anaerobic conditions / less oxygen;

Not flooded fewer / less active anaerobic microorganisms / respiration / not flooded more / more active aerobic microorganisms / respiration;

2

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- 6.** (a) (i) mass produced increases then levels off at 17.1 kg m^{-2} / concentrations above 40 kg ha^{-1} ; 1
- (ii) replaces nutrients removed; fertiliser provides nitrate needed for protein / amino acid production; as more fertiliser added, there is more growth / protein / amino acid / yield; 2
- (iii) plants already have enough nitrate / nitrate no longer limiting; another named factor / element is limiting growth; 2
- (b) because cattle excreted / produced faeces / droppings / cowpats / manure; in field B crop used elements / minerals / nitrates / nutrients last year; 2
- [7]**