M1. (a) circulating / mixing / described **or** temperature maintenance

1

supply oxygen
or for aerobic conditions
or for faster respiration

*do **not** allow oxygen for anaerobic respiration*

1

(b) energy supply / fuel / use in respiration

*do **not** allow just food / growth*
ignore reference to aerobic / anaerobic

or material for growth / to make mycoprotein

1

(c) respiration

allow exothermic reaction
allow catabolism
ignore metabolism
ignore aerobic / anaerobic

1

(d) (i) any **one** from:

- compete (with *Fusarium*) for food / oxygen **or** reduce yield of *Fusarium*
- make toxic waste products or they might cause disease / pathogenic **or** harmful to people / to *Fusarium*

*do **not** allow harmful unqualified*

1

(ii) steam / heat treat / sterilise fermenter (before use)

***not** just clean*

or
steam / heat treat / steriliseglucose / minerals / nutrients / water (before

use)
or
filter / sterilise air intake
or
check there are no leaks

*allow sterilisation unqualified **not** just use pure glucose*

1

(e) any **three** from:

- beef is best or beef is better than mycoprotein
- mycoprotein <u>mainly</u> better than wheat
- more phenylalanine in wheat than in mycoprotein

  allow equivalent numerical statements
- but no information given on other amino acids / costs / foods

3

<u>overall conclusion:</u>

statement is incorrect because
either
it would be the best source for vegetarians
or
for given amino acids, beef is the best source
or
three foods provide insufficient data to draw a valid conclusion

1

[10]

M2. (a) e.g.

timber
agriculture
roads / urban development / buildings

any two for 1 mark each

2

(b) *ideas that (accept reverse arguments)*
increased carbon dioxide content since less during photosynthesis and locked-up as wood burning increases carbon dioxide content
increased activity of microbes increases carbon dioxide content
oxygen content reduced water vapour content reduced

any five for 1 mark each

5

[7]

M3. Cogently argued based on biological principles, for **and**

against introduction of caterpillar
maximum of 4 pros e.g.
fewer chemicals used therefore less expense
less chemical damage to other plants
consequent benefits to food chains
fewer farm animals poisoned therefore more economic
countryside more varied therefore more attractive to tourists
tourists bring economic advantages
greater variety of habitats therefore greater variety of species

any 4 for 1 mark each

4

cons e.g.
danger to livelihoods if crops destroyed by caterpillar
relatively low chance of success since only one third of schemes effective world-wide
unlikely to be natural predators therefore ecological balance affected

any 2 for 1 mark each

2

cogently argued case **gains up to 2 marks**

2

[8]

M4. (a) increased human population
increased standard of living
each for 1 mark

2

(b) nutrients absorbed by plants not replaced
each for 1 mark

2

(c) increased release of carbon dioxide into atmosphere when trees are burned
reduced rate of carbon dioxide removal from atmosphere
increased carbon dioxide absorbs more of energy radiated by Earth
global rise in temperature
each for 1 mark

4

[8]

M5. (a) any **one** from:

- increase / give light
- increase temperature / make warmer

award marks if the method by which these could be done is given
eg leave lights on all night **or** use a heater

- increase / give CO_2
- add fertiliser / nutrients / minerals / named
  allow nitrogen
  ignore 'food'

1

(b) (i) any **two** from:

- cheaper
  allow grow faster / more grown
- better quality / flavour
  ignore size
- available all year
  accept converse if clear that answer refers to use of British tomatoes
  allow 'Fair Trade'

2

(ii) any **two** from:

- greater distance **or** more food
  miles **or** more transport

idea of more needed only once

- transport needs (more) energy / fuel
- reference to eg greenhouse effect / global warming / pollution / CO_2 release / carbon footprint
  ignore ozone

2

[5]

M6. (a) 860

*correct answer gains **2** marks*
if answer incorrect evidence of (6100 - 1800) ÷ 5
***or** 4300 ÷ 5*
***or** (900 + 600 + 1000 + 700 + 1100) ÷ 5 gains **1** mark*
allow ecf from 1 incorrect graph reading

2

(b) *ignore references to oxygen / sulfur dioxide / nitrogen oxides / acid rain* *ignore global warming*

Effects of deforestation

deforestation increases the amount of carbon dioxide in the atmosphere
award this point only if linked to deforestation

1

any **two** from:

- due to less photosynthesis **or** less carbon dioxide taken in **or** carbon dioxide not locked up in (forest) trees
- due to burning of forest / from machinery
- due to activity of microorganisms / decay

2

Effects of growing palm for fuel

carbon dioxide released when palm oil used as fuel

1

(eventually) CO_2 intake and output might balance out **or** burning palm oil carbon neutral
accept less carbon dioxide than from burning fossil fuels

1

[7]

M7. (a) (i) kills / gets rid of / reduces methane bacteria

allow kills / gets rid of / reduces bad bacteria

ignore acts like antibiotic

1

(ii) less food converted to methane

allow can keep more cattle without further environmental damage

ignore energy

1

more growth / meat / muscle / milk produced / more profit / fatter animals

ignore references to bacteria and disease

1

(b) absorbs energy / heat radiated by Earth

allow absorbs / traps energy / heat / from Earth

*do **not** allow absorbs energy / heat from Sun*

1

some energy / heat reradiated

ignore reflected

*do **not** allow reradiates energy / heat from Sun*

1

leading to global warming / enhanced greenhouse effect

accept effects of global warming eg melting ice caps

accept methane is a greenhouse gas

ignore references to ozone

1

[6]

M8. (a) any **two** from:

- fewer trees to take in carbon dioxide for photosynthesis
- decomposers / microorganisms respire (as they decay debris) releasing carbon dioxide
- burning of wood releases carbon dioxide

allow carbon dioxide released by burning fossil fuels in vehicles / factories

2

(b) Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best − fit' approach to the marking.

0 marks
No relevant content.

Level 1 (1 − 2 marks)
There is a brief description of some steps in the process but the order is not clear with little biological vocabulary used.

Level 2 (3 − 4 marks)
There is a reasonably clear description of the process involving many of the steps and using some biological vocabulary.

Level 3 (5 − 6 marks)
There is a clear, logical and detailed scientific description of the process using appropriate biological vocabulary.

examples of biology points made in the response:

- this contains mineral ions (and organic matter)
- this increases growth of algae / water plants
- the plants / algae (underneath) die
- due to lack of light / photosynthesis / space
- decomposers / microorganisms feed on decaying matter **or** multiply rapidly
- the respiration of decomposers uses up all the oxygen
- so invertebrates die due to lack of oxygen
- this is called eutrophication

6

[8]