M1. (a) methane is produced

ignore bad smell

1

which is a greenhouse gas / causes global warming

1

(b) (9.80 / 0.20 = 49 therefore) 49:1

1

(c) horse (manure)

*allow ecf from **11.2***

closest to 25:1 (ratio)

1

(d) **Level 3 (5–6 marks):**
A detailed and coherent explanation is given, which logically links how carbon is released from dead leaves and how carbon is taken up by a plant then used in growth.

Level 2 (3–4 marks):
A description of how carbon is released from dead leaves and how carbon is taken up
by a plant, with attempts at relevant explanation, but linking is not clear.

Level 1 (1–2 marks):
Simple statements are made, but no attempt to link to explanations.

0 marks:
No relevant content.

Indicative content

statements:
- (carbon compounds in) dead leaves are broken down by microorganisms / decomposers / bacteria / fungi
- photosynthesis uses carbon dioxide

explanations:
- (microorganisms) respire
- (and) release the carbon from the leaves as carbon dioxide
- plants take in the carbon dioxide released to use in photosynthesis to produce glucose

use of carbon in growth:
- glucose produced in photosynthesis is used to make amino acids / proteins / cellulose
- (which are) required for the growth of new leaves

6

(e) any **three** from:
(storage conditions)
- (at) higher temperature / hotter
- (had) more oxygen
- (had) more water / moisture
- (contained) more microorganisms (that cause decay)

allow reference to bacteria / fungi / mould

3

[13]

M2. (a) photosynthesis

1

(b) (i) 140

1

(ii) (10 billion tonnes) more added (to atmosphere) than removed

allow ecf from part (b)(i)

1

[3]

M3. (a) (i) counts / 12

1

× 120 × 80 / × 9600
or
× area of field

1

(ii) (more) quadrats / repeats

1

placed randomly
ignore method of achieving randomness

1

(b) (i) any **three** from:
- temperature / warmth / heat
- water / rain
- minerals / ions / salts (in soil)

allow nutrients / fertiliser / soil fertility
ignore food
- pH (of soil)
- trampling
- herbivores

ignore predators
- competition (with other species)
- pollution qualified e.g. SO_2 / herbicide
- wind (related to seed dispersal).

ignore space / oxygen / CO_2 / soil unqualified

3

(ii) light needed for photosynthesis

1

for making food / sugar / etc.

1

effect on buttercup distribution eg more plants in sunny areas / fewer plants in shady areas

1

(c) (i) fertiliser / ions / salts cause growth of algae / plants

1

(algae / plants) block light

1

(low light) causes algae / plants to die

1

microorganisms / bacteria feed on / break down / cause decay of organic matter / of dead plants

*do **not** allow germs / viruses*

1

(aerobic) <u>respiration</u> (by microbes) uses O_2

*do **not** allow anaerobic*

1

(ii) sewage / toxic chemicals / correct named example eg metals / bleach / disinfectant / detergent etc

allow suitable named examples eg metals such as Pb / Zn / Cr / oil / SO_2 / acid rain / pesticides / litter

ignore chemicals unqualified

ignore waste unqualified

ignore human waste / domestic waste / industrial waste unqualified

1

(d) (i) 2

1

(ii) more food

allow other sensible suggestion eg more species colonise from tributary streams after forest

1

(iii) number of stonefly species decreases (from **A** to **B** / **B** to **C** / **A** to **C**) as more pollution enters river / less oxygen

allow fewer species in more polluted water

ignore none are found at site C

1

[19]

M4. (a) wear a face mask

allow wear gloves

1

(b) **Level 2 (3–4 marks):**
A detailed and coherent plan covering all the major steps. It sets out the steps needed in
a logical manner that could be followed by another person to produce an outcome which
will address the hypothesis.

Level 1 (1–2 marks):
Simple statements relating to steps are made but they may not be in a logical order. The plan may not allow another person to produce an outcome which will address the hypothesis.

0 marks:
No relevant content.

Indicative content

Plan:
- cut a specified number of pieces of bread to the same size
- place mould spores on the bread
- the number of mould spores needs to be the same quantity of mould spores on
  each piece of bread
- place bread in different sealable plastic bags
- place in different temperatures (minimum of three) eg fridge, room, incubator
- leave each for the same amount of time eg four days
- measure the percentage cover of mould on each piece of bread
- repeat experiment

additional examiner guidance:
- good level 2 answer will describe how the growth of mould can be measured and
  will give a range of different temperatures to be used
- allow equivalent levels of credit for alternative methodologies that would clearly produce a measurable outcome in terms of mould growth at various temperatures

4

(c) any **one** from:
- type of mould
- amount of mould (put on each piece of bread)
- amount of air in the plastic bags
- size of the pieces of bread
- type of bread

- amount of moisture / water added

1

(d) (56 − 4 = 52) / 5

1

10.4

*allow 10.4 with no working shown for **2** marks*

1

*ecf for incorrectly read figures for **1** mark*

(e) (decomposition occurs at a faster rate when the temperature is higher
or
amount of decomposition is higher when temperature is higher

1

[9]

M5. (a) limiting their movement
or
controlling the temperature of their surroundings

1

reason:
reduces energy transfer

*if no other marks awarded, allow **1** mark for: 'fit more chickens in same space'*

1

(b) (i) without oxygen

ignore 'without air'

1

(ii) any **two** from:
- ethanol

  allow alcohol
- carbon dioxide
- lactic acid.

***do not accept** energy / ATP (apply list rule)*

2

(c) enzymes are denatured / change shape

ignore microbes are killed

1

(enzyme) shape is vital for function **or** won't work (as efficiently)

1

(d) (i) 200

1

(ii) 120

allow ecf from (d)(i)

e.g.

$\frac{60}{100} \times$ *(i)*

1

(e) causes global warming

1

one predicted consequence of global warming

eg rising sea levels, climate change, change in migration patterns, change in distribution of species

or

methane is flammable
so might cause fire / damage

*if no other marks awarded, allow methane is a greenhouse gas for **1** mark*

1

[11]