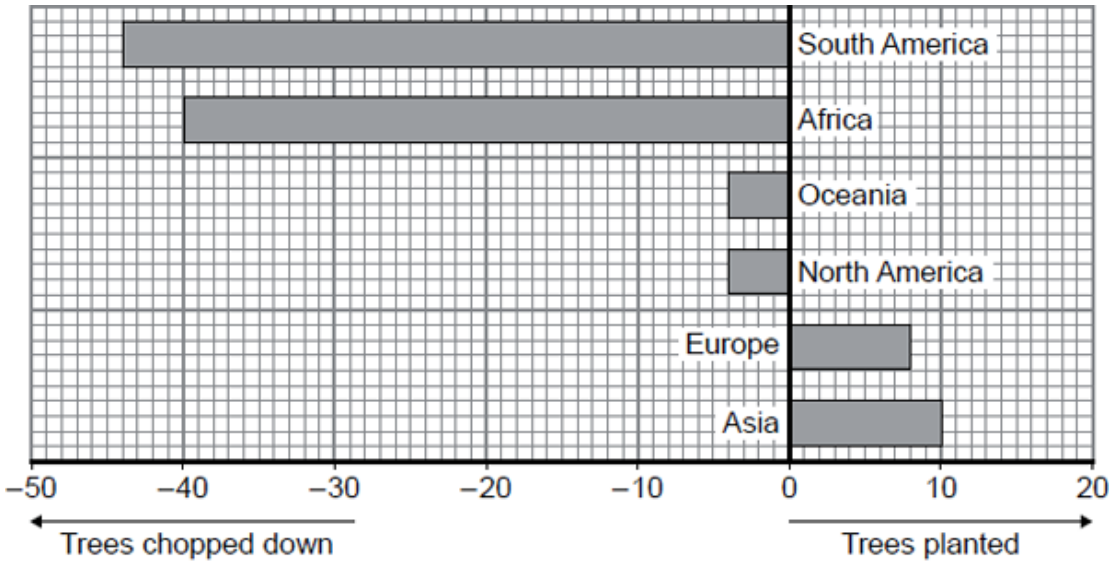
Q1. In many parts of the world, forests are being chopped down (deforestation) so that the land can be used to grow food crops. In other parts, trees are planted to produce new forests.

The graph shows how the area of forest in each of the continents is changing each year.



(a) (i) What area of forest is being lost in Africa each year?

Area = ... thousand km^2

(1)

(ii) Use **Steps 1**, **2** and **3** to calculate the total change to the area of forest each year.

Step 1 Calculate the total area of trees chopped down.

.....

Total area chopped down = ... thousand km^2

Step 2 Calculate the total area of trees planted.

.....

Total area planted = ... thousand km^2

Step 3 Use your answers from **Steps 1** and **2** to calculate the total change in the area of forest.

.....

Total change in area of forest ..... thousand km^2

(3)

(b) Draw a ring around the correct answer to complete each sentence.

(i) Large scale deforestation reduces the number of species of

plants only.

animals only.

both animals and plants.

(1)

(ii) The remains of the trees are broken down into carbon dioxide by

lichens.

microorganisms.

plants.

(1)

(iii) The gas released into the atmosphere when trees are burned is

carbon dioxide.

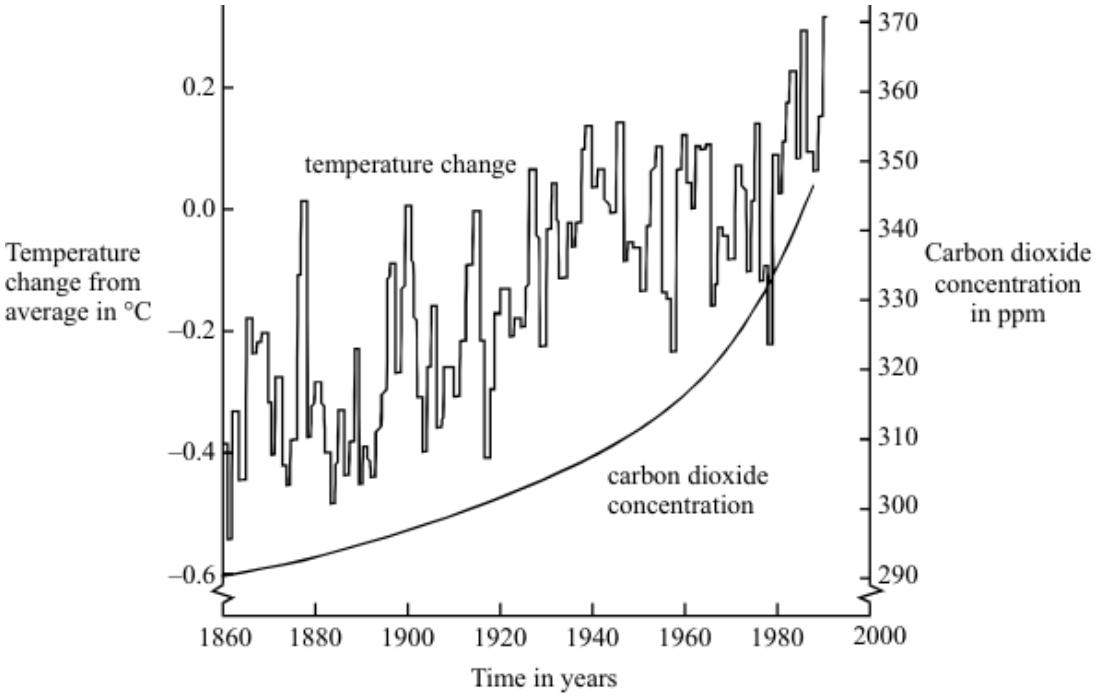
methane.

oxygen.

(1)

(Total 7 marks)

Q2. The graph shows changes in temperature and in carbon dioxide concentration in the earth's atmosphere between 1860 and 1990.



(a) Give **two** human activities which may have helped to increase the concentration of carbon dioxide in the atmosphere.

1 .....

2 .....

(2)

(b) (i) Describe the changes in temperature shown by the graph between 1860 and 1990.

.....

.....

.....

(2)

(ii) Do the data in the graph prove that increased carbon dioxide concentrations in the atmosphere caused the changes in temperature you described in part (b)(i)? Give a reason for your answer.

.....

.....

(1)

(c) Describe **one** way in which a change in temperature such as that shown in the graph might affect the environment.

.....

.....

(1)

(Total 6 marks)

Q3. The table shows the effects that two different concentrations of sulphur dioxide in the air had on the growth of rye grass plants.

Sulphur dioxide concentration in the air in micrograms per m^3	**9.0**	**191.0**
Number of leaves per plant	85.6	47.3
Total leaf area in cm^2	417.2	203.6
Dry mass of stubble in grams	0.48	0.22

(a) What human activity releases sulphur dioxide into the air?

.....

(1)

(b) (i) What effect does sulphur dioxide have on rainwater?

.....

.....

(1)

(ii) Use information from the table to describe **one** effect of sulphur dioxide on the leaves of the grass plants.

.....

.....

(1)

(c) The stubble consists of the bases of the stems of the plants and the roots left in the soil after harvesting.

Use your answer to part (b) to explain why the dry mass of the stubble was less at the higher concentration of sulphur dioxide.

.....

.....

.....

.....

(2)
(Total 5 marks)

Q4. The number of fish in the oceans is decreasing.

The table below shows information about the mass of fish caught by UK fishermen between 2002 and 2010.

Year	Mass of fish caught by UK fishermen from ALL SOURCES in thousands of tonnes	Mass of fish caught by UK fishermen from SUSTAINABLE SOURCES in thousands of tonnes	Percentage of fish caught from sustainable sources
2002	690.0	427.8	62.0
2004	655.0	396.6	60.5
2006	619.0	386.0	62.4
2008	589.0	436.1	74.0
2010	611.5	465.0	

(a) (i) Calculate the percentage of fish caught from sustainable sources in 2010.

.....

.....

.....

..... %

(2)

(ii) Describe the pattern in the table above for the mass of fish caught from all sources.

Suggest reasons for this pattern.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(4)

(iii) Suggest why the percentage of fish caught from sustainable sources is increasing.

.....

.....

(1)

(b) Give **two** methods of maintaining fish stocks at a sustainable level.

1 .....

2 .....

(2)

(c) The image below shows a fish farm.

In a fish farm, large numbers of fish are grown in cages in the sea.

Why do fish in the cages grow faster than fish of the same species that are free in the sea?
You should refer to energy in your answer.

.....

.....

.....

.....

.....

.....

.....

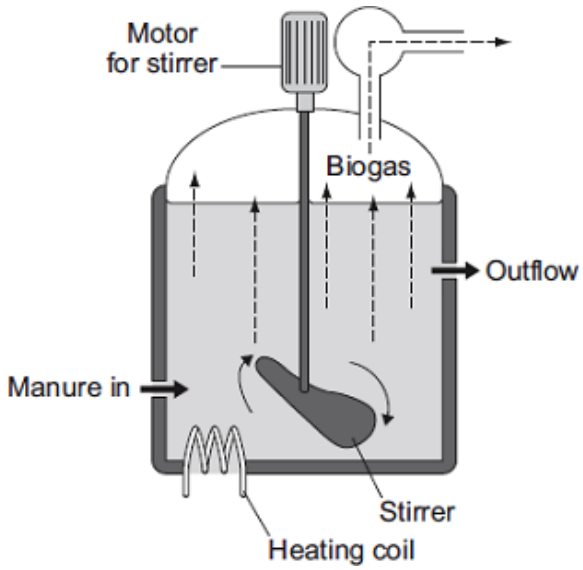
.....

.....

.....

(4)
(Total 13 marks)

Q5. The diagram shows one type of *anaerobic* digester. The digester is used to produce biogas.



(a) (i) What does *anaerobic* mean?

.....

.....

(1)

(ii) The concentration of solids that are fed into this digester must be kept very low.

Suggest **one** reason why.

.....

.....

(1)

(iii) This digester is more expensive to run than some other simpler designs of biogas generator.

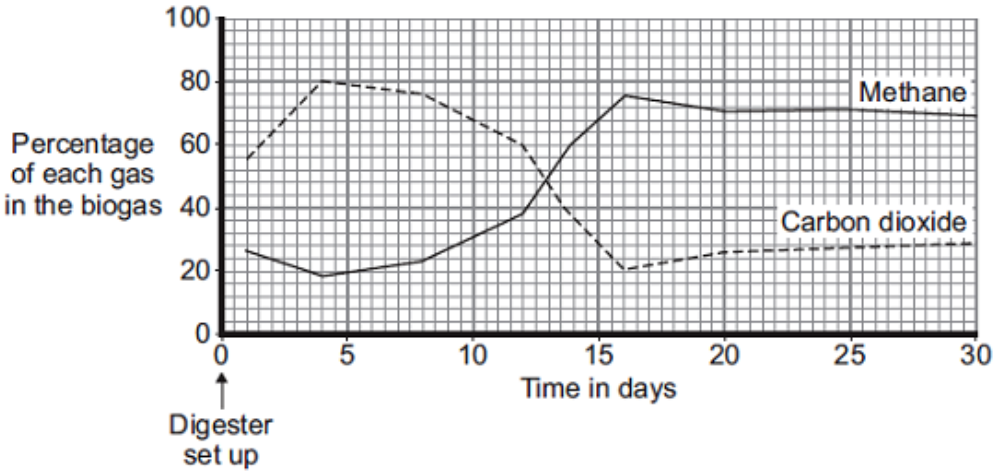
Suggest **one** reason why.

.....

.....

(1)

(b) The graph shows how the composition of the biogas produced by the digester changed over the first 30 days after the digester was set up.



Use information from the graph to answer the following questions.

(i) Describe how the percentage of carbon dioxide changed over the 30 days.

.....

.....

.....

.....

.....

.....

(3)

(ii) On which day was the best quality biogas produced? .....

(1)

(c) Four days after the digester was first set up, the biogas contained a high percentage of carbon dioxide.

Suggest an explanation for this.

.....

.....

.....

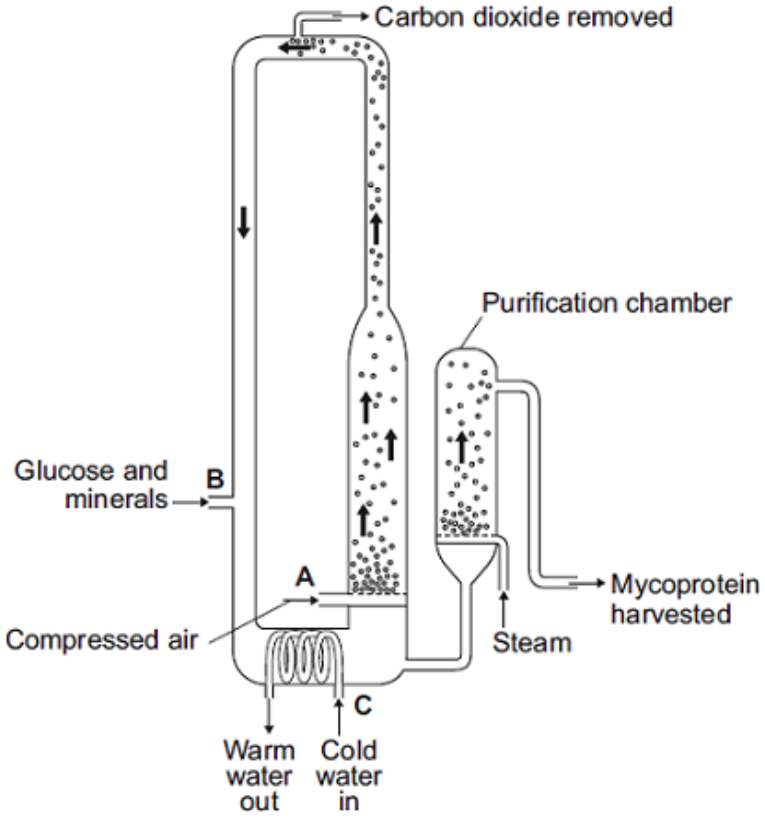
.....

(2)

(Total 9 marks)

Q6. The diagram shows a fermenter. This fermenter is used for growing the fungus *Fusarium*.

Fusarium is used to make mycoprotein.



(a) Bubbles of air enter the fermenter at **A**.

Give **two** functions of the air bubbles.

1.....

.....

2.....

.....

(2)

(b) Why is glucose added to the fermenter?

.....

.....

(1)

(c) The fermenter is prevented from overheating by the cold water flowing in through the heat exchanger coils at **C**.

Name the process that causes the fermenter to heat up.

.....

(1)

(d) It is important to prevent microorganisms other than *Fusarium* growing in the fermenter.

(i) Why is this important?

.....

.....

(1)

(ii) Suggest **one** way in which contamination of the fermenter by microorganisms could be prevented.

.....

.....

(1)

(e) Human cells cannot make some of the amino acids which we need. We must obtain these amino acids from our diet.

The table shows the amounts of four of these amino acids present in mycoprotein, in beef and in wheat.

Name of amino acid	**Amount of amino acid per 100 g in mg**			**Daily amount needed by a 70 kg human in mg**
	Mycoprotein	**Beef**	**Wheat**	
Lysine	910	1600	300	840
Methionine	230	500	220	910
Phenylalanine	540	760	680	980
Threonine	610	840	370	490

A diet book states that mycoprotein is the best source of amino acids for the human diet.

Evaluate this statement.

Remember to include a conclusion in your evaluation.

.....

.....

.....

.....

.....

.....

.....

.....

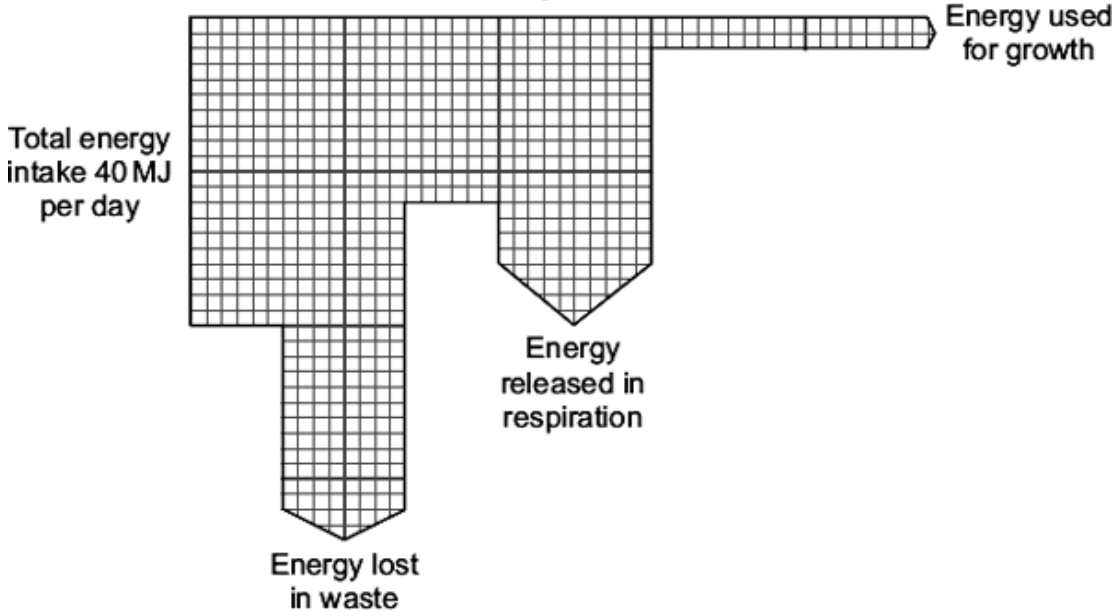
.....

.....

(4)
(Total 10 marks)

Q7. (a) **Diagram 1** represents what happens to the energy in the food eaten by a herbivore (an animal that eats plants).

Diagram 1



(i) How much energy is released in respiration by the herbivore?

.....

.....

Answer ..... MJ per day

(1)

(ii) What proportion of the total energy intake of the herbivore is used for growth?

Show clearly how you work out your answer.

.....

.....

.....

Proportion .....

(2)

(b) Give **two** ways in which the energy, released in respiration, is used by a herbivore.

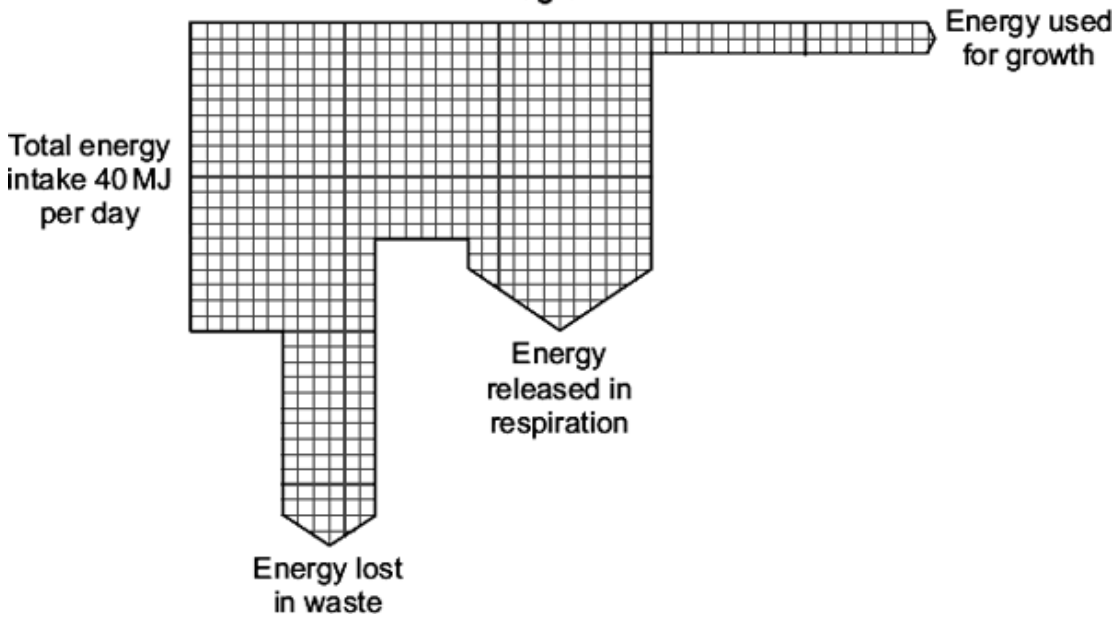
1 .....

2 .....

(2)

(c) **Diagram 2** represents what happens to the energy in the food eaten by a carnivore (an animal that eats other animals).

Diagram 2



The carnivore releases a greater proportion of energy in respiration than the herbivore.

Suggest **one** reason for this.

.....

.....

(1)

(d) Some farmers keep their animals outdoors. Other farmers keep their animals indoors.

Keeping farm animals indoors increases the proportion of energy in their food that is converted into growth.

Give **two** reasons why.

1 .....

.....

2 .....

.....

(2)
(Total 8 marks)

M1. (a) (i) 40

accept -40 or +40

1

(ii) **Step 1** 92

1

Step 2 18

1

Step 3 74

*correct subtraction of answer in **step 2** from answer in **step 1** gains **1** mark*

*correct answer 74 with no working gains **3** marks*

ignore sign

1

(b) (i) both animals and plants

1

(ii) microorganisms

1

(iii) carbon dioxide

1

[7]

M2. (a) burning / combustion fossil fuels / burning wood

accept named fossil fuel
accept driving cars / any vehicles
*do **not** accept burning / combustion unqualified*
*do **not** accept factories*
ignore factory chimneys unqualified
ignore respiration

1

deforestation

1

(b) (i) (overall) increase

1

fluctuations

highs are higher <u>and</u>

*lows are not as low = **2** marks*

1

(ii) no – could be due to some other factor **or**
could be coincidence **or** fluctuations ±
same size as the overall rise or large
fluctuations or sometimes when CO_2 rises temperature doesn't

1

(c) any **one** biotic **or** abiotic effect eg:

*do **not** credit just "climate / weather change"*
allow <u>extreme</u> climate / weather change

changes in rainfall

accept drought, desert formation

ice-caps melting / rise in sea level

accept flooding

changed pattern of winds

changed pattern of migration

changed species survival

changed growth

1

[6]

M3. (a) burning fossil fuels / coal / gas / oil

accept driving <u>vehicles</u> / eg cars
accept coal-fired power station
accept car emissions
ignore combustion unqualified
*do **not** accept power station unqualified*
*do **not** accept <u>using</u> fossil fuels*

1

(b) (i) (SO_2) makes it acidic / makes acid rain / lowers pH

1

(ii) any **one** from:

(SO_2) kills leaves reduces number of leaves reduces leaf area

or smaller leaves causes fewer leaves to grow

ignore correct extras, eg
withered, yellow etc

1

(c) any **two** from:

(fewer leaves / less leaf S.A) so less photosynthesis

less food / less sugar / less starch supplied (to roots / to stems)

(SO_2) lowers pH of soil / makes soil acidic

ions (/minerals / salts / nutrients) less available (to plants)

accept don't get enough nutrients

2

[5]

M4. (a) (i) 76.0 / 76

correct answer with or without working gains 2 marks

allow 76.04 for 2 marks

allow 76.04 with extra decimal places eg 76.042 for 1 mark

$\frac{465}{611.5}$ *for 1 mark*

2

(ii) mass of fish declines (until 2008)

ignore use of numbers

allow number of fish decline (until 2008)

1

(due to an) increase in fishing / overfishing

1

and then rises (until 2010)

1

(which could be due to) quotas / net restrictions working

allow any reasonable suggestion, such as countries swapping quotas or restrictions on fishing during breeding seasons

ignore less fishing

*if no other marks awarded allow 1 mark for a decrease in mass **and** an increase in mass if answer relates to sustainable fishing*

1

(iii) (this is due to) public awareness / demand

allow legislation / rules

1

(b) fishing quotas / bans

1

(small) net / mesh size

if size of net is stated then it must be smaller

if size of mesh is stated then it must be larger

1

(c) (fish) cannot move freely / as much

1

(therefore) less <u>energy</u> loss from the fish

*do **not** allow 'no energy is lost'*

ignore references to less heat loss through controlling body temperature

ignore references to respiration

1

(there is) more food available / better quality food / fed more often

accept 'high-protein food (for making cells)'

1

(so) there is more energy for growth **or** (more food) is converted to biomass

1

[13]

M5. (a) (i) without <u>oxygen</u>

ignore reference to 'air'

1

(ii) otherwise difficult to stir / to pump / to transfer

allow prevent 'clogging' owtte

1

(iii) need to stir / pump / heat

1

(b) (i) rises then falls

1

then levels / slight rise

1

quantitative descriptor

- e.g. to 80% / max. on day 4 / min. on day 16

accept other valid quantitative descriptor

allow accuracy ± ½ small square

1

(ii) 16 (15.5 to 16.4)

1

(c) any **two** from:

- oxygen present
- (CO_2 produced) by aerobic respiration

  or not much anaerobic respiration
- **not** much methane / CH_4 produced

2

[9]

M6. (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 / sterilise
glucose / 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]

M7. (a) (i) 20

1

(ii) one tenth / 0.1 / 10% / 1:9 / 1 in 10 / 1 out of 10 / $\frac{1}{10}$

for correct answer irrespective of working ***2*** *marks*
ignore any units
accept equivalent fractions eg $\frac{4}{40}$ / $\frac{2}{20}$

do ***not*** *allow eg 1:10 / 1 to 10*
if answer is incorrect
clear selection of 2 ***and*** *20,* ***or*** *equivalent* ***or*** *1:4:5 / 1:5:4 gains* ***1*** *mark*

2

(b) any **two** from:

*do **not** accept sweating / cooling /excretion*

- (body) heat / maintaining body temperature

  allow keep warm

- movement (max 2)

  *allow **2 different** examples of movement, internally and / or externally eg breathing / exercise / eating / circulation*
  allow muscle contraction if no other muscle action is credited
  movement + breathing = 1 mark

- growth / cell division / repair / reproduction / building molecules

  allow examples eg making proteins (from amino acids)
  ignore 'chemical reactions' / digestion

- accept active transport

2

(c) more movement / have to hunt / catch food

allow converse if stated for herbivore eg herbivores food is all around
*ignore reference to size **or** predator unqualified*

1

(d) any **two** from

ignore reference to food

- less movement

  allow no movement
  allow less space to move
  ignore less space unqualified

- less heat loss

  *allow no heat loss **or** they are kept warm*

- less respiration

2

[8]