

Ecology part 7 AQA Triple Biology

Name:

Class:

Date:

Time: **77 minutes**

Marks: **71 marks**

Comments:

Students investigated the effect of temperature on the decay of milk.

This is the method used.

1. Place 25 cm³ of fresh milk into each of three beakers.
2. Keep one beaker of milk at 5 °C.
3. Keep one beaker of milk at 15 °C.
4. Keep one beaker of milk at 25 °C.
5. Record the pH of the milk in each beaker every day for 4 days.

The table below shows the results.

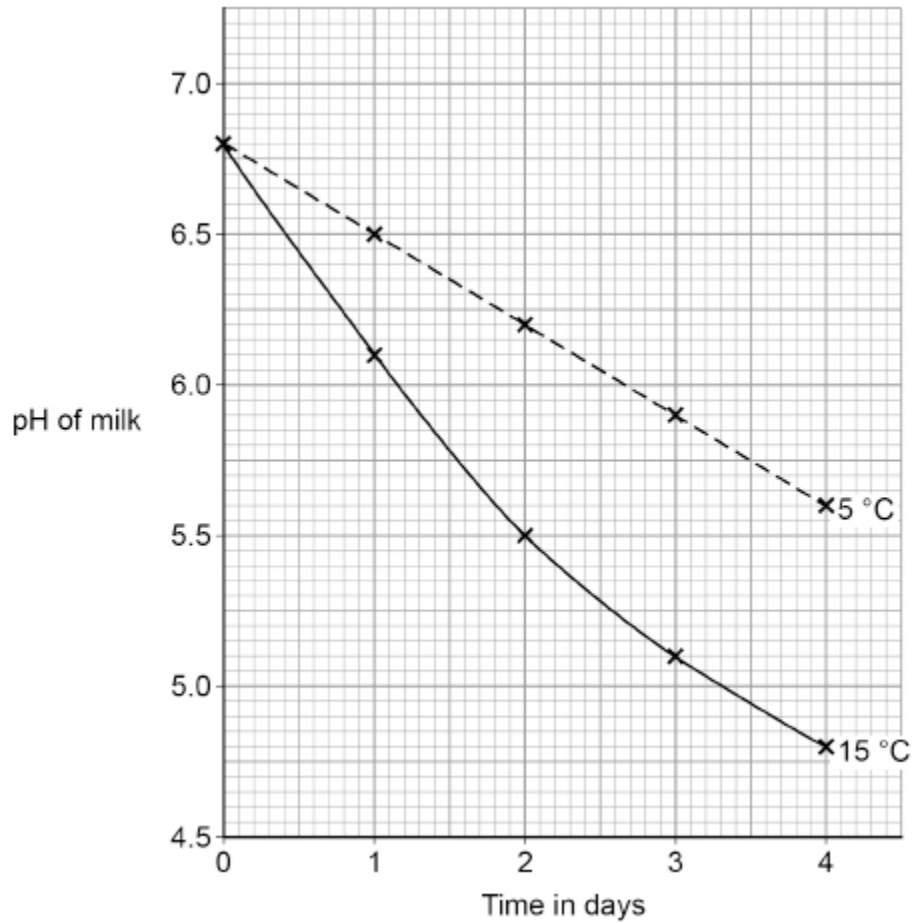
Time in days	pH of milk		
	5°C	15°C	25°C
0	6.8	6.8	6.8
1	6.5	6.1	5.3
2	6.2	5.5	4.9
3	5.9	5.1	4.8
4	5.6	4.8	4.8

- (b) Suggest **one** improvement the students could have made to the method.

(1)

Figure 1 shows the results at 5 °C and at 15 °C.

Figure 1



(c) Complete **Figure 1**.

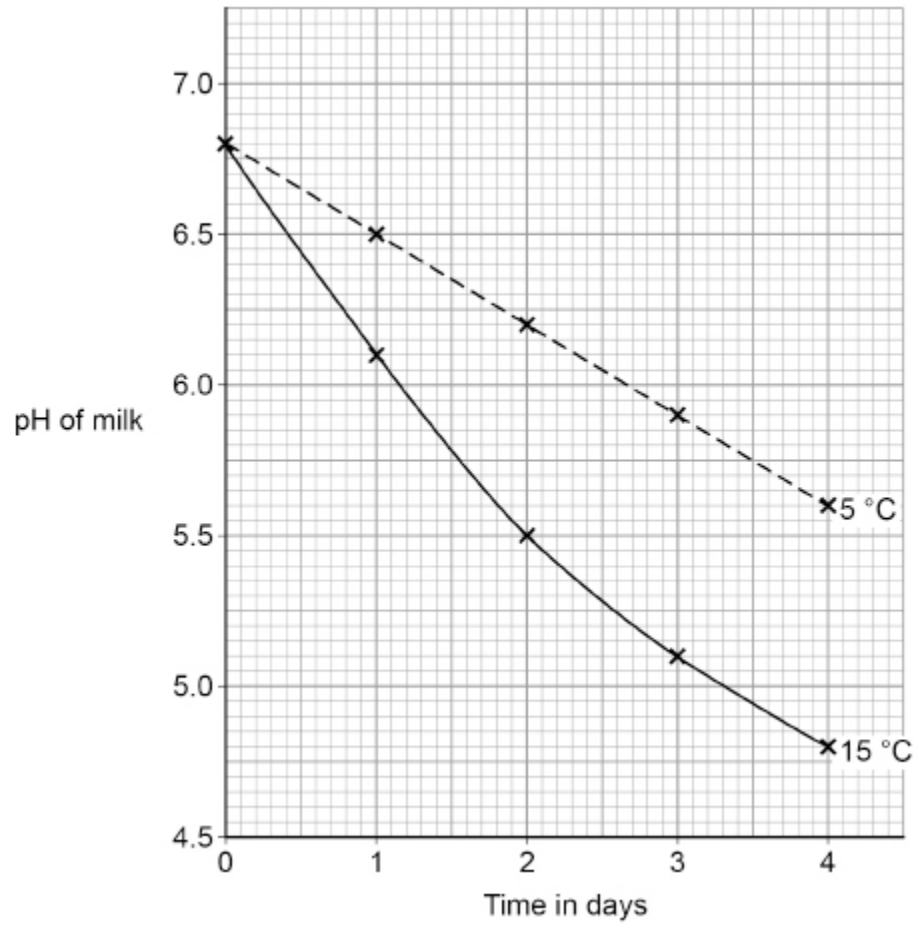
You should:

- plot the data for 25 °C from the table above
- draw a line of best fit.

(3)

Figure 2 shows the results for 5 °C and at 15 °C again.

Figure 2



(d) The rate of pH change increases with an increase in temperature.

The rate of pH change at 5 °C is 0.3 pH units per day.

Calculate how many times faster the rate of pH change is at 15 °C than the rate of pH change at 5 °C, at **day 2**.

You should draw a tangent on **Figure 2**.

Rate at 15 °C is _____ times faster.

(4)

(e) Milk contains lipids.

The lipids are broken down when the milk decays.

Explain why the pH changes more quickly when the temperature is higher.

(3)

(Total 17 marks)

2.

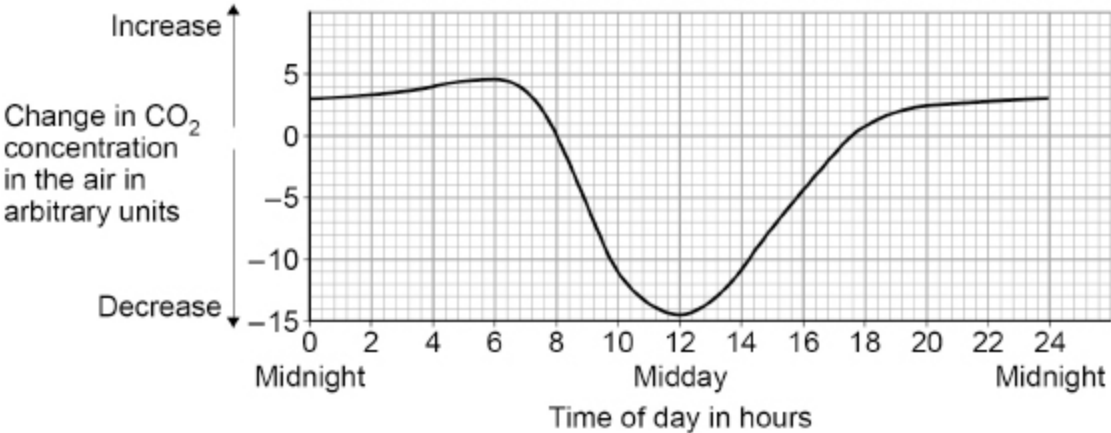
This question is about the effects of deforestation and agriculture.

The processes of photosynthesis and respiration affect the carbon dioxide concentration in the air.

Figure 1 shows the changes in the carbon dioxide concentration in the air in a tropical rainforest during one day.

The data are mean daily values over a whole year.

Figure 1



(a) Explain what causes the changes in the carbon dioxide concentration in the air:

- from 0 to 6 hours
- from 8 to 12 hours.

Use information from **Figure 1**.

0 to 6 hours _____

8 to 12 hours _____

(4)

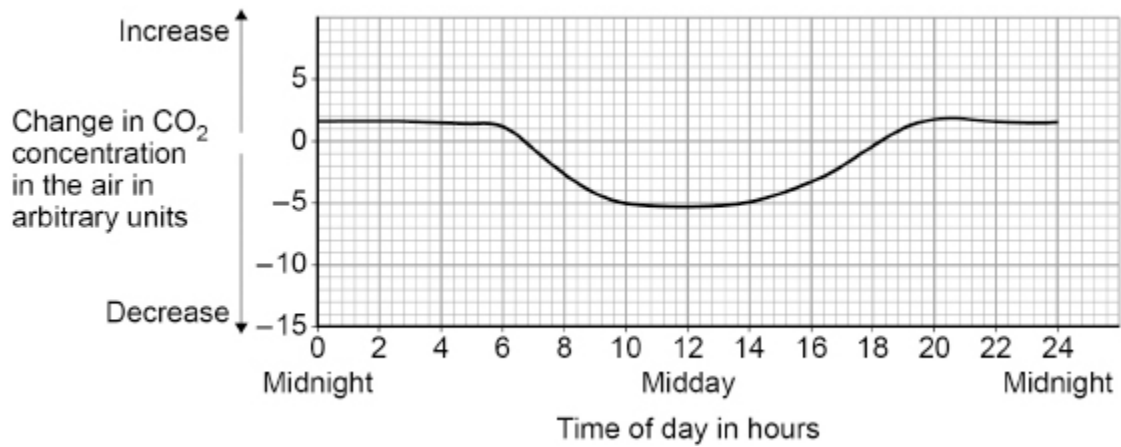
(b) An area of rainforest is cut down and replaced with a field of maize plants.

Only one crop of maize is grown each year.

Figure 2 shows the changes in the carbon dioxide concentration in the air in the field of maize during one day.

The data are mean daily values over the 6-month growing period.

Figure 2



The maize grows for only 6 months of the year.

Explain why replacing rainforest with maize will increase the carbon dioxide concentration in the air after one year.

Use information from **Figure 1** and **Figure 2**.

(2)

A tropical rainforest can contain over 1000 different tree species.

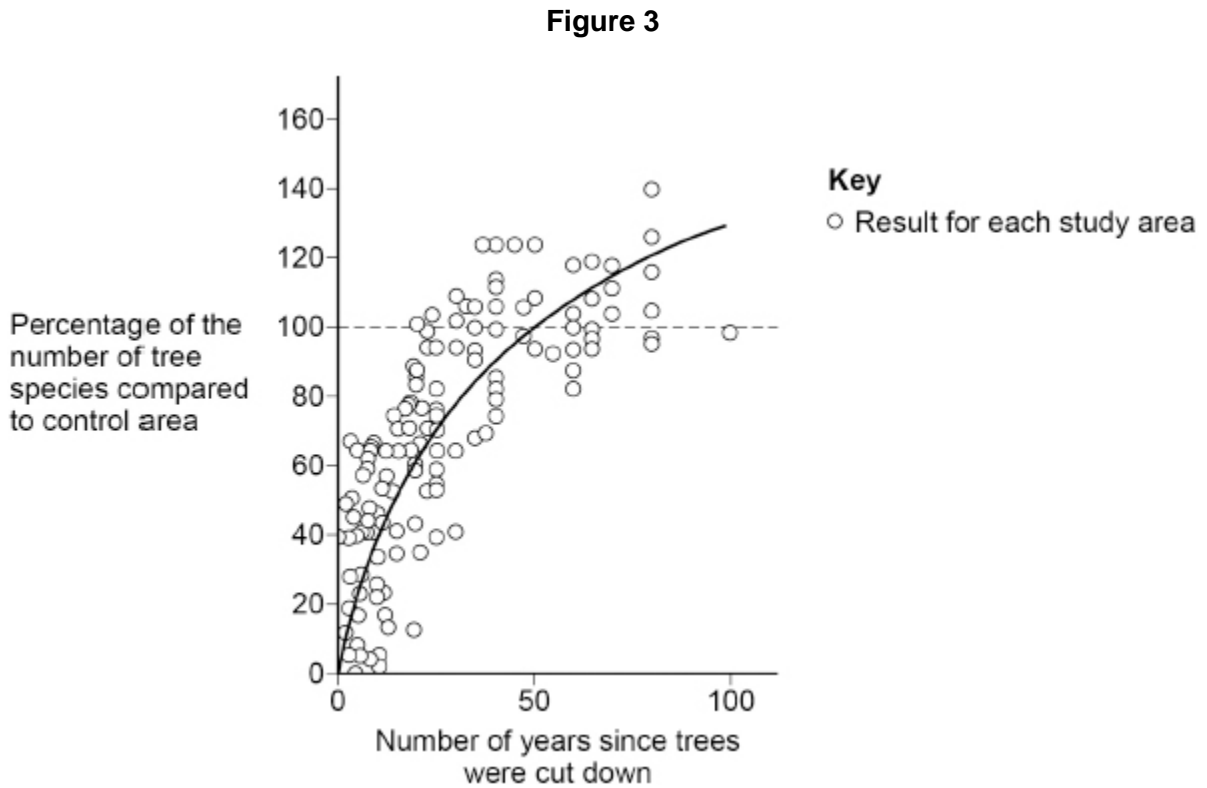
Large areas of tropical rainforest have been cut down during the last 100 years so crops can be grown.

Scientists studied the regeneration of different areas of tropical rainforest.

The scientists:

- investigated areas of rainforest that had been cut down at different times during the previous 100 years
- recorded the number of tree species that re-grew in each area
- compared each area with a control area next to it. The control areas were undisturbed rainforest which had never been cut down.

Figure 3 shows the scientists' results.



(c) The values plotted in **Figure 3** are percentages of the results for the control areas.

Explain why the scientists presented their results as **percentages**.

(2)

During the 100 years, the biodiversity of trees in the regenerating rainforest increases.

(d) Give **one** other conclusion you can make from **Figure 3**.

(1)

(e) Give **two** reasons why an increase in the diversity of trees in the rainforest leads to an increase in animal diversity.

1 _____

2 _____

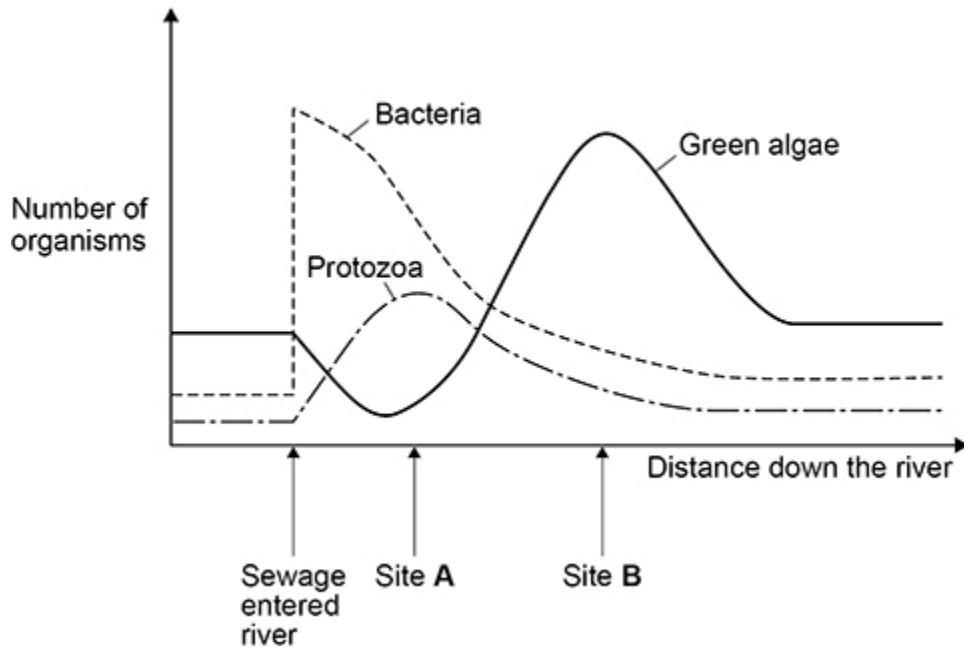
(2)

(Total 11 marks)

3. Rivers are sometimes polluted with untreated sewage.

Figure 1 shows some changes that occurred when untreated sewage entered a river.

Figure 1



- (a) Which type of organism had the most rapid increase in numbers when sewage entered the river?

Tick (✓) **one** box.

Bacteria

Green algae

Protozoa

(1)

- (b) Protozoa are single-celled organisms.

Describe **two** ways **Figure 1** shows that the protozoa in the river feed on bacteria.

1 _____

2 _____

(2)

- (c) When sewage enters a river, the concentration of dissolved oxygen decreases.

The decrease in oxygen concentration is caused by organisms in the water.

What process in living organisms uses oxygen?

(1)

- (d) As the numbers of green algae in the river increase, the concentration of dissolved oxygen increases.

Explain why the concentration of dissolved oxygen increases.

(2)

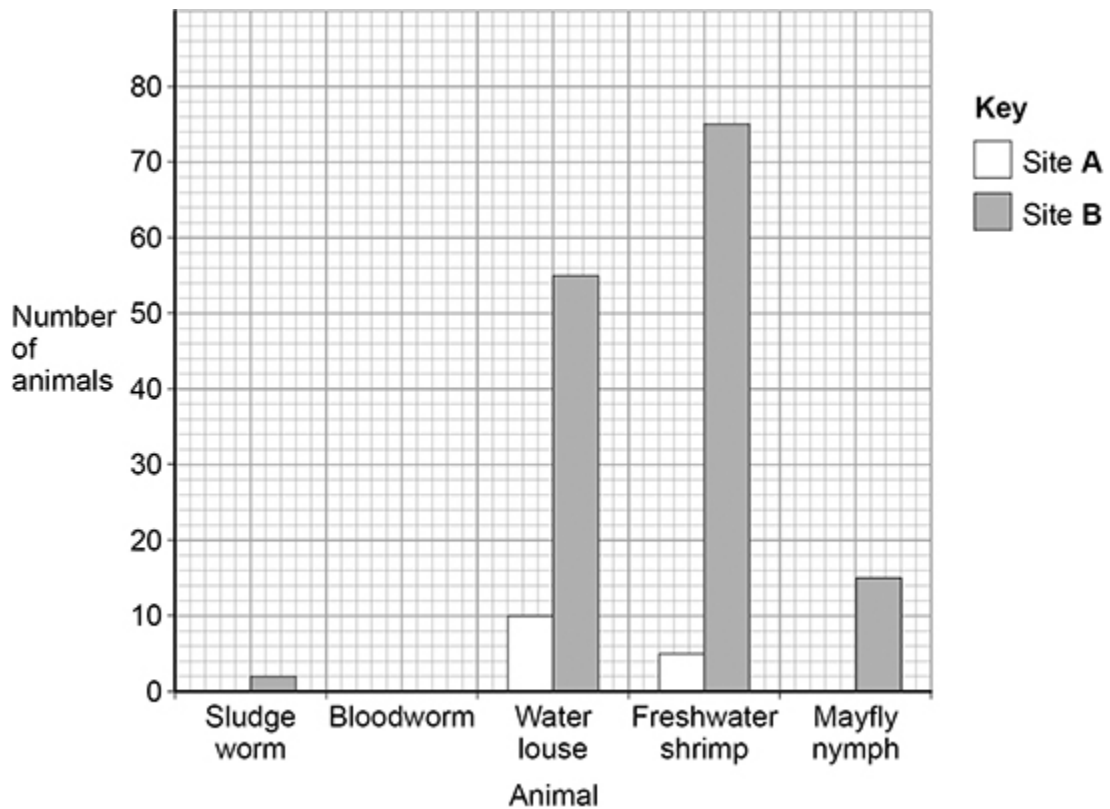
Scientists counted the numbers of five different animals in the river at sites **A** and **B**, shown in **Figure 1** above.

The table below shows the results.

Animal	Number of animals	
	Site A	Site B
Sludge worm	80	2
Bloodworm	36	8
Water louse	10	55
Freshwater shrimp	5	75
Mayfly nymph	0	15

Figure 2 shows some of the data from above table.

Figure 2



(e) Complete **Figure 2**.

You should use data from above table for the sludge worm and the bloodworm.

(2)

(f) The concentration of oxygen in the water at site **A** is much lower than at site **B**.

- Sludge worms live in places which have a low concentration of oxygen.
- Mayfly nymphs need a high concentration of oxygen.

Give evidence from the table above for the difference in oxygen concentration at sites **A** and **B**.

Refer to sludge worms and to mayfly nymphs in your answer.

(2)
(Total 10 marks)

4.

Earthworms:

- live in soil
- feed on dead and decaying plant matter
- have soft, moist skin
- exchange gases through their skin.

(a) Give **two** abiotic factors and **two** biotic factors that could affect the size of an earthworm population.

Abiotic factors

1 _____

2 _____

Biotic factors

1 _____

2 _____

(4)

(b) Name **three** harmful substances that could cause water pollution.

Do **not** refer to plastic or to litter in your answer.

1 _____

2 _____

3 _____

(3)

(c) Describe how substances that pollute air and water could be harmful to humans and other living organisms.

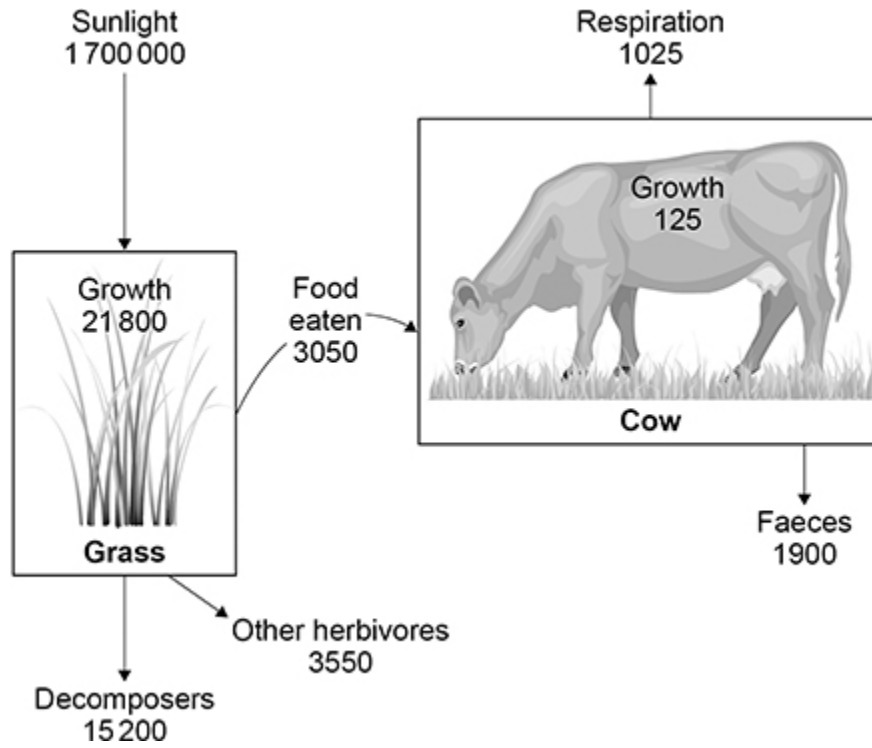
(6)

(Total 10 marks)

Figure 2 shows the flow of energy through a food chain.

The numbers are in kilojoules/m²/year.

Figure 2



(d) The cow is more efficient than the grass at converting energy.

The energy conversion efficiency of the cow is 4.098%.

Calculate how many times more efficient the cow is at converting energy than the grass.

The equation for energy conversion efficiency is:

$$\text{energy conversion efficiency} = \frac{\text{energy used for growth}}{\text{energy input}} \times 100$$

Give your answer to 3 significant figures.

Number of times (3 significant figures) = _____

(5)

(e) It is more energy-efficient to rear cows indoors than to rear cows outdoors.

Give **two** reasons why.

1 _____

2 _____

(2)

(f) Suggest **two** possible disadvantages of rearing cows indoors.

1 _____

2 _____

(2)

(Total 13 marks)

Mark schemes

1.

- (a) **Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.

4–6

Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.

1–3

No relevant content

0

Indicative content

- microorganisms / bacteria / fungi (cause decay)
- (named) enzyme used in decay / digestion
- digestion **or** large molecules to small molecules

- respiration by microorganisms
- production / release of carbon dioxide
- carbon dioxide is released into the air

- carbon dioxide taken in by stomata / leaves
- carbon dioxide used in photosynthesis
- making glucose / sugar / starch / cellulose / other named example

- release of nitrate (ions) into the soil
- nitrate (ions) taken in (by roots)
- nitrate (ions) taken in by active transport
- nitrate (ions) for making amino acids / proteins / DNA / other named example

For **Level 2**, the response needs to refer to both breakdown and use of nitrogen and carbon compounds

- (b) any **one** from:

- use more temperatures
- measure pH at smaller time intervals
- use a data logger (for continuous monitoring)
- measure pH at same time of day
- same type of milk

allow example, such as same fat content of milk

- repeat (at each temperature) and calculate a mean **or** repeat (at each temperature) and eliminate anomalies
- cover / uncover all beakers

ignore same pH probe / meter

ignore extend beyond 4 days

ignore age of milk

1

(c) points for days 1, 2 and 3 correctly plotted
allow a tolerance of $\pm \frac{1}{2}$ small square
allow 2 correct plots from days 1, 2 and 3 for 1 mark
*do **not** accept an incorrect plot for day 0 / 4*

correct curved line of best fit
ignore line joined point to point with straight lines
ignore extrapolation
*do **not** accept a single straight line*

(d) tangent drawn to the 15 °C curve at 2 days
*do **not** accept if there is an incorrect tangent at 2 days*

$$\frac{6.5 - 4.5}{4}$$

allow a tolerance of $\pm \frac{1}{2}$ small square

0.5

$$\frac{0.5}{0.3} = 1.67$$

allow any number of decimal places
allow answer to student's incorrectly calculated rate divided by 0.3
*do **not** accept if a unit is given*

(e) enzymes more active **or** more bacteria produced
allow enzymes work more quickly
ignore enzymes work better

lipids broken down more quickly
allow fats broken down more quickly

fatty acids produced more quickly (which changes pH)

ignore glycerol

do **not** accept incorrect products of lipid breakdown, eg amino acids or glycogen

alternative route

allow more (kinetic) energy (at higher temperature) (1)

molecules move faster

or more (successful) collisions

or lipids broken down more quickly (1)

fatty acids produced more quickly (which changes pH)

(1)

1

[17]

2.

(a) (0 to 6h):

in the dark so (only) respiration occurs

allow no / limited light so (only) respiration occurs

allow night(time) so (only) respiration occurs

1

(respiration) produces carbon dioxide

1

(8 to 12h):

in the light so photosynthesis (rate) is faster than respiration (rate)

allow in the light so more photosynthesis than respiration

allow day(time) so more photosynthesis than respiration

do not accept no respiration

1

idea of net / overall uptake of carbon dioxide

allow uptake of carbon dioxide by photosynthesis is greater / faster than output by respiration

1

ignore reference to animals

(b) field of maize only takes in carbon dioxide for 6 months of the year (compared to all year)

allow maize takes in carbon dioxide for a shorter amount of time

1

(and) field of maize takes in less carbon dioxide per day than rainforest

1

answers must be comparative

allow converse argument

(c) for comparison 1

(because) different areas started with different numbers (of species)

*do **not** accept (because) different areas started with different numbers of trees*

1

(d) any **one** from:

- number of tree species increased rapidly at first
- the number of tree species increases more slowly later
- rate of increase of number of tree species decreases with time
- beyond about 50 years there were more tree species than in the original rainforest

ignore answers referring to numbers of trees unqualified
allow it takes 45 to 55 years for the forest to recover (the number of species)

- there was (great) variability of number of tree species from one study area to another at the same time

ignore biodiversity increases

1

(e) more / different types of food available

ignore more food available

1

more / different types of habitat / shelter **or** nest sites available

allow more / different habitats

1

[11]

3.

(a) bacteria 1

(b) any **two** from:

- bacteria increase **before** protozoa increase
or
when bacteria are high, protozoa increase
- as protozoa increase, bacteria decrease
- (after site **A**) as bacteria decrease, protozoa also decrease

*allow protozoa increase **after** bacteria increase*

allow when bacteria are low, protozoa are low

2

(c) (aerobic) respiration

*do **not** accept anaerobic respiration*

1

- (d) (algae carry out) photosynthesis 1
 (which) produces oxygen
allow algae produce oxygen 1
- (e) bars plotted correctly 1
allow a tolerance of $\pm \frac{1}{2}$ a small square
ignore column widths 1
 suitable shading 1
- (f) more sludge worms at **A** (than at **B**) 1
*allow fewer sludge worms at **B** (than at **A**)*
*allow high number of sludge worms at **A** and low number at **B*** 1
 no mayfly nymphs at **A** and mayfly nymphs present at **B**
*allow more mayfly nymphs at **B** (than at **A**)* 1
answers must be comparative 1

[10]

4.

- (a) **abiotic**
 any **two** from:
- water
allow moisture / humidity / rain(fall)
allow dryness
 - oxygen / air (in soil)
ignore carbon dioxide
 - pH (of soil)
allow acidity / alkalinity (of soil)
 - minerals / ions
allow salts
allow named example of an ion
ignore nutrients
 - temperature
 - size of soil particles **or** texture / type of soil
allow named examples of soil types
ignore space / toxins / weather

2

biotic

any **two** from:

- food

allow amount of dead / decaying matter (in soil)

ignore nutrients

- predators / consumers / carnivores

allow example – such as birds

- disease / pathogens / bacteria / fungi

allow microorganisms / microbes / parasites /

2

*if **no** other marks awarded allow **2** marks for **four** factors in reverse categories*

- (b) **Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.

5–6

Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.

3–4

Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.

1–2

No relevant content

0

Indicative content

- same concentration of chemical / **X** applied to the soil
- same volume / amount of chemical / **X** applied to the soil
- same size of area sampled – eg 1 m² or 0.25 m²
- use of a quadrat
- same time between application and collecting worms
- same time allowed for collecting worms after application

- each sample area selected randomly
- method of achieving randomness – eg random coordinates

- (collect and) count worms in each of areas **A** and **B**

- at least 5 repeats in each of areas **A** and **B**
- calculate mean (per unit area) **or** total for each of areas **A** and **B**
- compare means / totals for areas **A** and **B**

[10]

5.

(a) carbon dioxide **or** acidic gas(es)

allow other named example of acidic gas such as sulfur dioxide

allow chemical formula e.g. SO₂

allow carbon monoxide

allow particulates / smoke / soot

allow methane / CFCs

1

(b) any **three** from:

- fertiliser

allow nitrate / phosphate

- sewage

allow organic matter / faeces / urine / urea

- toxic chemicals

*allow a named toxic chemical such as mercury **or** sulfur dioxide **or** acid rain*

- herbicide

- fungicide

allow insecticide

allow oil

allow nuclear waste

allow other examples of water pollutants

if herbicide / fungicide / insecticide not given allow (named)

pesticide for 1 mark

3

(c) **Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.

4–6

Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.

1–3

No relevant content

0

Indicative content

air pollution:

(carbon dioxide **or** methane **or** greenhouse gases)

- global warming / climate change / traps heat
 - floods / fire / drought **or** ice caps melt **or** rise in sea level **or** extreme weather
 - loss of habitat / food
 - migration

(acidic gas / named – e.g. SO₂ / NO_x)

- damage to leaves so less photosynthesis
- damage to roots or alters ions in soil (/ e.g. phosphates / iron)
 - (so) less protein manufacture
- damage to lungs
 - breathing difficulties / bronchitis / asthma

(carbon monoxide)

- combines with haemoglobin
 - less oxygen carried (by haemoglobin / blood)

(particulates / 'soot')

- cover leaves **or** block light
 - less photosynthesis so less glucose made
- damage to lungs
 - breathing difficulties / bronchitis / asthma

water pollution:

(sewage)

- bacteria multiply
 - use oxygen in respiration
 - water animals cannot respire
 - pathogens in water

(fertiliser)

- algae multiply
 - (algae) block light so plants cannot photosynthesise
 - lack of oxygen for respiration – fish die

(toxic substances)

- damages / harms cells **or** bioaccumulation
 - interferes with metabolism – e.g. respiration / protein synthesis
- (plastics)
- entrap animals or causing internal damage if swallowed

(particles)

- block light
 - plants / algae cannot photosynthesise so less glucose made

(oil)

- damages birds' feathers
 - cannot fly so cannot find food **or** escape predators

(acid rain / acids)

- lowers pH of water
 - damages fish gills
 - bleaches coral

[10]

6.

(a) evaporation

allow vaporisation

(b) osmosis

allow diffusion
ignore absorption

1

(c) any **two** from:

- photosynthesis
- support

allow turgor
allow to fill vacuole
allow opening of stomata
allow to prevent wilting

- (solvent for) transport
allow (as a) solvent

or

translocation

or

for the transpiration stream

allow (as a) medium for chemical reactions
allow hydrolysis / digestion / breakdown of stored food
allow cooling
allow making cytoplasm

2

(d) *substitution*

$$\frac{21\,800}{1\,700\,000} \times 100$$

1

1.282(3529)

allow 1.28 or 1.3

1

comparative efficiency

$$\frac{4.098}{1.282}$$

1

3.196.....

allow an incorrectly calculated value for efficiency correctly substituted

1

significant figures

3.20

do not accept 3.2
do not accept if a unit is given

1

- (e) less energy lost as heat
allow less heat lost
allow less energy lost keeping warm
or *less energy for maintaining body temperature*

1

less energy lost in movement
ignore less movement

ignore less energy lost unqualified
ignore controlling diet

*do **not** accept energy used for respiration*
*do **not** accept energy produced / made / created*

1

- (f) any **two** from:

- increased spread of disease
- or**
- increased use of drugs / antibiotics (to reduce disease)
allow diseases spread (more) easily
- more antibiotics in meat / milk
 - (extra) cost of heating / lighting / food / drugs
allow (extra) energy used for heating / lighting
ignore (extra) cost unqualified
- or**
- aggressive behaviour (causing harm)
- 'emotional' stress reduces productivity
ignore cruelty / unethical
ignore need to clean out barns / sheds
ignore need to maintain / build barns

2

[13]