

GCSE Biology

Worksheet: Decomposition

TIME 35 min	TOTAL 31 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Decomposition

NAME	CLASS	DATE
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- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

A student investigated the effect of temperature on the rate of decay of milk. The student added lipase solution to a mixture of milk, sodium carbonate solution and phenolphthalein indicator, and timed how long it took for the pink colour to disappear.

At 25 °C, the pink colour disappeared after 500 s.

0 1 . 1

Calculate the rate of reaction at 25 °C using:

rate = $1000 \div \text{time in seconds}$

.....

.....

.....

Rate =

[1 mark]

0 1 . 2

The pink colour disappears because the pH falls.

Explain why the pH falls.

.....

.....

[1 mark]

0 2

A student is investigating the effect of temperature on the rate of decay of fresh milk. Milk, sodium carbonate solution (an alkali) and phenolphthalein indicator are mixed in a test tube, and lipase solution is added. The enzyme lipase breaks down the fat in milk into fatty acids and glycerol. The mixture starts pink, and the student records the time taken for it to turn colourless as the fatty acids lower the pH. The test is carried out in water baths at 20 °C, 30 °C, 40 °C and 50 °C.

0 2 . 1

Write a hypothesis for this investigation, including scientific reasoning to justify your prediction.

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[2 marks]

0 2 . 2

Identify the independent and dependent variables. Give **one** variable that should be controlled, and explain why.

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.....

.....

[3 marks]

0 3

A student investigated the effect of temperature on the rate of decay of milk. The student added lipase solution to a mixture of milk, sodium carbonate solution and phenolphthalein indicator, and timed how long it took for the pink colour to disappear.

At 15 °C, the pink colour disappeared after 80 s.

0 3 . 1

Calculate the rate of reaction at 15 °C using:

rate = $1000 \div \text{time in seconds}$

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.....

.....

Rate =

[1 mark]

0 3 . 2

The pink colour disappears because the pH falls.

Explain why the pH falls.

.....

.....

[1 mark]

0 4

Students investigated the effect of temperature on the rate of decay of fresh milk. They mixed milk, sodium carbonate solution and phenolphthalein indicator in a test tube, and then added lipase solution. They timed how long it took for the pink colour to disappear as the pH fell.

0 4 . 1

What is the independent variable in this investigation?

.....

.....

.....

.....

[1 mark]

0 4 . 2

What is the dependent variable?

.....

.....

[1 mark]

0 4 . 3

Give **two** control variables.

.....

.....

.....

.....

[2 marks]

0 4 . 4

Phenolphthalein indicator solution is flammable.
Give **one** way to reduce the risk from this hazard.

.....

.....

[1 mark]

0 4 . 5

Why does the pH of the mixture fall as the milk decays?

.....

.....

[1 mark]

0 5

A gardener made a compost heap from grass cuttings. The gardener measured the temperature in the centre of the heap every 2 days. Table 1 shows the results.

Table 1

Time in days	Temperature in the centre of the heap in °C
0	14
2	29
4	40
6	50
8	45
10	42

0 5 . 1

Calculate the mean rate of increase in temperature between day 0 and day 6.

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.....

.....

.....

Mean rate = °C per day

[2 marks]

0 5 . 2

Explain why the temperature in the centre of the heap increased.

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.....

.....

[2 marks]

0 5 . 3

The temperature fell after day 6.
Suggest **one** reason why.

.....

.....

[1 mark]

0 6

A student investigated the effect of temperature on the rate of decay of milk. The student added lipase solution to a mixture of milk, sodium carbonate solution and phenolphthalein indicator, and timed how long it took for the pink colour to disappear.
At 40 °C the student repeated the experiment three times. The times were 198 s, 189 s and 180 s.

0 6 . 1

Calculate the mean time.

.....

.....

.....

Mean time = s

[1 mark]

0 6 . 2

Calculate the rate of reaction at 40 °C using the mean time and:
rate = $1000 \div \text{time in seconds}$
Give your answer to 3 significant figures.

.....

.....

.....

Rate =

[1 mark]

0 6 . 3

Explain why the student repeated the experiment and calculated a mean.

.....

.....

[1 mark]

0 7

A student investigated the effect of temperature on the rate of decay of fresh milk.

- The student put 10 cm^3 of milk, 8 cm^3 of sodium carbonate solution and six drops of phenolphthalein indicator into a test tube. The mixture was pink.
- The test tube and a tube of lipase solution were placed in a water bath at $20\text{ }^\circ\text{C}$ for 10 minutes.
- The student added 2 cm^3 of the lipase solution to the milk mixture, started a stop-clock and timed how long it took for the pink colour to disappear.

The student repeated the experiment at different temperatures. Table 2 shows the results.

Table 2

Temperature in $^\circ\text{C}$	Time taken for pink colour to disappear in s	Rate of reaction ($1000 \div \text{time}$)
10	625	1.6
20	310	X
30	160	6.3
40	95	10.5
50	240	4.2

0 7 . 1

Explain why the mixture became colourless.

.....

.....

.....

.....

[2 marks]

0 7 . 2

Calculate value X in Table 2. Give your answer to 1 decimal place.

.....

.....

.....

X =

[1 mark]

0 7 . 3

Explain why the tubes were left in the water bath for 10 minutes before the lipase was added.

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.....

[1 mark]

0 7 . 4

Explain why the rate of reaction was lower at 50 °C than at 40 °C.

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.....

.....

[2 marks]

0 7 . 5

Give **one** reason why it is difficult to measure the time accurately in this investigation. Suggest an improvement.

.....

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.....

.....

[2 marks]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Biology · Worksheet: Decomposition · 31 marks

Question 1 (2 marks)

01.1 [1 mark]

Answer: 2

- $1000 \div 500 = 2$ (1)
-

01.2 [1 mark]

- lipase breaks down the fat in the milk into fatty acids (and glycerol), which lower the pH (1)
-

Question 2 (5 marks)

02.1 [2 marks]

- a suitable hypothesis, e.g. 'as the temperature increases from 20 °C to 40 °C the time taken for the mixture to turn colourless will decrease, but it will increase again at 50 °C' (1)
- with reasoning, e.g. because at higher temperatures the lipase and fat molecules move faster and collide more often, so fat is broken down faster; above the optimum temperature the lipase is denatured (the shape of its active site changes) (1)

Notes: Allow a simpler hypothesis, e.g. 'the higher the temperature, the faster the milk will decay', with matching reasoning about enzyme activity.

02.2 [3 marks]

- independent variable: temperature (of the water bath) (1)
- dependent variable: time taken for the mixture to turn from pink to colourless (or the rate, $1000 \div \text{time}$) (1)
- control, e.g. the volume of milk, the volume and concentration of the lipase solution, or the volume and concentration of the sodium carbonate solution — these must be kept the same at every temperature because they also affect the time taken, so any difference could then not be linked to temperature alone (1)

Notes: For the third mark allow any sensible control variable with a matching reason.

Question 3 (2 marks)

03.1 [1 mark]

Answer: 12.5

- $1000 \div 80 = 12.5$ (1)

03.2 [1 mark]

- lipase breaks down the fat in the milk into fatty acids (and glycerol), which lower the pH (1)
-

Question 4 (6 marks)

04.1 [1 mark]

Answer: Temperature

- temperature (1)

04.2 [1 mark]

- the time taken for the pink colour to disappear / for the pH to fall (1)
-

04.3 [2 marks]

- volume of milk (1)
- volume / concentration of lipase solution (1)
- volume / concentration of sodium carbonate solution (1)
- number of drops of phenolphthalein (1)
- type of milk, e.g. the same fat content (1)

Any 2 of the points above.

04.4 [1 mark]

- keep it away from naked flames / do not use a Bunsen burner near it (1)
- heat the tubes in a water bath rather than with a flame (1)

Any 1 of the points above.

04.5 [1 mark]

- lipase breaks down fat (lipids) in the milk into fatty acids (and glycerol), and the fatty acids lower the pH (1)
-

Question 5 (5 marks)

05.1 [2 marks]

Answer: 6 °C per day

- $(50 - 14) \div 6$ (1)
- 6 (°C per day) (1)

05.2 [2 marks]

- microorganisms (decomposers) decay the waste and respire (1)
- respiration transfers energy to the surroundings as heat, and the heap insulates its centre so the heat is not lost quickly (1)

05.3 [1 mark]

- the oxygen in the heap was used up, so aerobic respiration slowed down (1)
- the material that decays most easily had been used up (1)
- the high temperature killed some of the microorganisms / denatured their enzymes (1)

Any 1 of the points above.

Question 6 (3 marks)

06.1 [1 mark]

Answer: 189 s

- $(198 + 189 + 180) \div 3 = 189$ (s) (1)

06.2 [1 mark]

Answer: 5.29

- $1000 \div 189 = 5.29$ (1)

Notes: An answer of 5.291 (not given to 3 significant figures) scores 0 marks. Allow ECF from the mean time.

06.3 [1 mark]

- to reduce the effect of random errors / an unusual result, so the mean is closer to the true value / the results are more repeatable (1)
-

Question 7 (8 marks)

07.1 [2 marks]

- lipase breaks down fat / lipids in the milk into fatty acids (and glycerol) (1)
 - the fatty acids lower the pH, so the indicator changes from pink to colourless (1)
-

07.2 [1 mark]

Answer: 3.2

- 3.2 (1)
-

07.3 [1 mark]

- so that the milk mixture and the lipase reached the temperature of the water bath before the reaction started (1)
-

07.4 [2 marks]

- the lipase / enzyme was denatured / the shape of the active site changed (1)
 - (so) the fat / substrate no longer fits the active site (1)
-

07.5 [2 marks]

- the colour change is gradual / it is hard to judge exactly when the pink colour has gone (1)
 - use a pH probe / pH meter (with a data logger) / compare with a colour standard (1)
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