

Biological Molecules – AS Biology P1

1. No.2

0 2 . 1

Table 2 contains information on the digestion of two biological molecules.

Complete Table 2.

[4 marks]

Table 2

Biological molecule	Enzyme	Name of bond hydrolysed	Product of digestion
Starch	Amylase	Glycosidic	Maltose
Dipeptide	Dipeptidase	Peptide	Amino acids.

A student investigated starch digestion by mixing starch with a solution of the enzyme used to digest starch.

The student did a biochemical test for **protein** when starch digestion was completed.

0 2 . 2

Describe a biochemical test to show the presence of protein.

[2 marks]

Add biuret solution to the sample.
 A positive test is indicated by purple colour produced.

0 2 . 3 The student's test for protein was positive.

Explain why.

[2 marks]

Enzymes are proteins in nature. They only speed up the rate of the reaction but do not get used up in the reaction.

0 2 . 4 An enzyme's turnover number (k_{cat}) is the number of substrate molecules converted into product molecules by one enzyme molecule in 1 second. It is determined using this equation.

$$k_{\text{cat}} = \frac{\text{Maximum rate of enzyme-controlled reaction} / \mu\text{mol dm}^{-3} \text{ s}^{-1}}{\text{Enzyme concentration} / \mu\text{mol dm}^{-3}}$$

A scientist investigated the action of a protease enzyme. The scientist prepared a reaction mixture with a protease concentration of $0.0118 \mu\text{mol dm}^{-3}$. The k_{cat} for the protease is 110 substrate molecules per second.

Use this information and the formula to calculate the maximum rate of the protease-controlled reaction.

Give your answer to 3 significant figures.

Show your working.

[2 marks]

$$110 = \frac{\text{Maximum rate}}{0.0118}$$

$$\text{Maximum rate} = k_{\text{cat}} \times \text{Enzyme}$$

$$= 110 \times 0.0118$$

$$= 1.298 \quad \text{Answer } 1.30 \quad \mu\text{mol dm}^{-3} \text{ s}^{-1}$$

$$\approx 1.30$$

2. No.8

0 8 . 1

A non-competitive inhibitor decreases the rate of an enzyme-controlled reaction.

Explain how.

[3 marks]

A non-competitive inhibitor binds to the enzyme at a site other than the active site. This causes a change in the enzyme's tertiary structure, altering the shape of the active site. As a result, the substrate is no longer complementary to the active site, so fewer enzyme-substrate complexes form.

0 8 . 2

A scientist investigated the hydrolysis of the protein casein.

The scientist:

- mixed a solution of a protease enzyme with a solution of casein
- then measured the casein concentration in the mixture at intervals
- controlled all relevant variables appropriately.

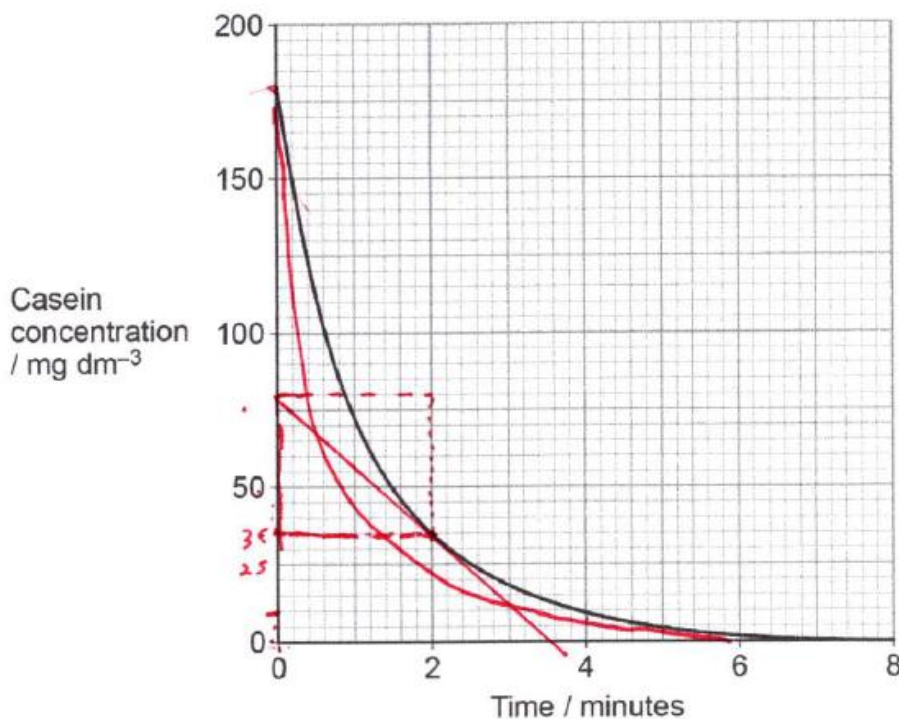
For this investigation, identify:

[2 marks]

the independent variable Time of measurementthe dependent variable Casein concentration

0 8 . 3 Figure 10 shows the scientist's results.

Figure 10



Use Figure 10 to determine the rate of casein hydrolysis at 2 minutes.

Show how you obtained your answer.

[2 marks]

$$\begin{aligned} \text{at 2 min} &= 35 \text{ mg dm}^{-3} \\ \text{Rate} &= \text{at 0 min} = 80 \text{ mg dm}^{-3} \\ \text{Change} &= \frac{80 - 35}{2 - 0} = \frac{55}{2} = 27.5 \end{aligned}$$

Answer 27.5 mg dm⁻³ min⁻¹ mg dm⁻³ minute⁻¹

0 8 . 4 The scientist repeated the investigation but increased the temperature to the optimum temperature for this protease.

Sketch a line on Figure 10 showing the results you predict if the investigation is repeated at the optimum temperature for the protease.

[2 marks]