

Enzymes

5 questions · 43 marks

Answer all questions. The marks available are shown against each part. Every question is taken unaltered from a past paper; the source is noted beneath it.

1. 1 Describe the induced-fit model of enzyme action **and** how an enzyme acts as a catalyst. 8 marks

[3 marks]

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2. 2 Scientists investigated the action of the enzyme ATP synthase. They made reaction mixtures each containing:

- ATP synthase
- buffer (to control pH)
- substrates.

One of the substrates required in these reaction mixtures is inorganic phosphate (Pi).

Tick (✓) **one** box to show which other substrate the scientists must add to the reaction mixtures to produce ATP.

[1 mark]

Adenine

☐

Adenosine diphosphate

☐

Glucose

☐

Ribose

☐

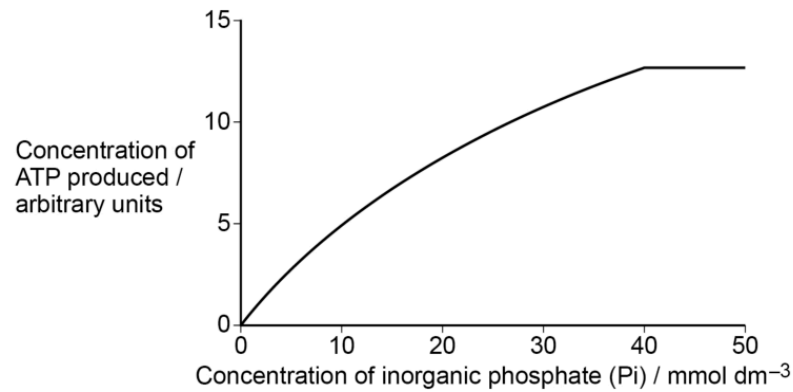
3

The scientists investigated the effect of concentration of inorganic phosphate (Pi) on ATP synthase activity.

After 2 minutes, they stopped each reaction and then measured the concentration of ATP.

Figure 1 shows the scientists' results.

Figure 1



Suggest and explain a procedure the scientists could have used to stop each reaction.

[2 marks]

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4

Explain the change in ATP concentration with increasing inorganic phosphate concentration.

[2 marks]

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— AQA 7402/1 Biology · June 2021 · Paper 1, Question 1

2.

1

Name **two** enzymes involved in the semi-conservative replication of DNA.

[2 marks]

8 marks

1

2

2

Sometimes, damage occurs during DNA replication. One enzyme involved in repairing damage to DNA is called ATR.

ATR works as follows.

- ATR phosphorylates other enzymes involved in repairing DNA.
- ATR **also** phosphorylates substrates required to repair DNA.

When ATR phosphorylates other enzymes, these enzymes become able to bind to their substrates.

Use your knowledge of enzyme structure to suggest why.

[2 marks]

3

The enzyme-catalysed reactions activated by ATR only occur if the substrates have been phosphorylated.

Use your knowledge of energy changes in enzyme-catalysed reactions to suggest why.

[1 mark]

4

Sometimes, a mutagenic agent causes DNA to break. A different enzyme called ATM binds to the broken DNA. This leads to the activation of a protein coded for by a tumour suppressor gene. The effect of ATM binding is to stop cell division until DNA is repaired.

A mutation could result in a person having non-functional forms of the gene that produces ATM.

What can you predict about the possible effects of having a non-functional form of ATM?

[3 marks]

— AQA 7402/3 Biology · June 2017 · Paper 3, Question 5

3.

1

Describe how a **non-competitive** inhibitor can reduce the rate of an enzyme-controlled reaction.

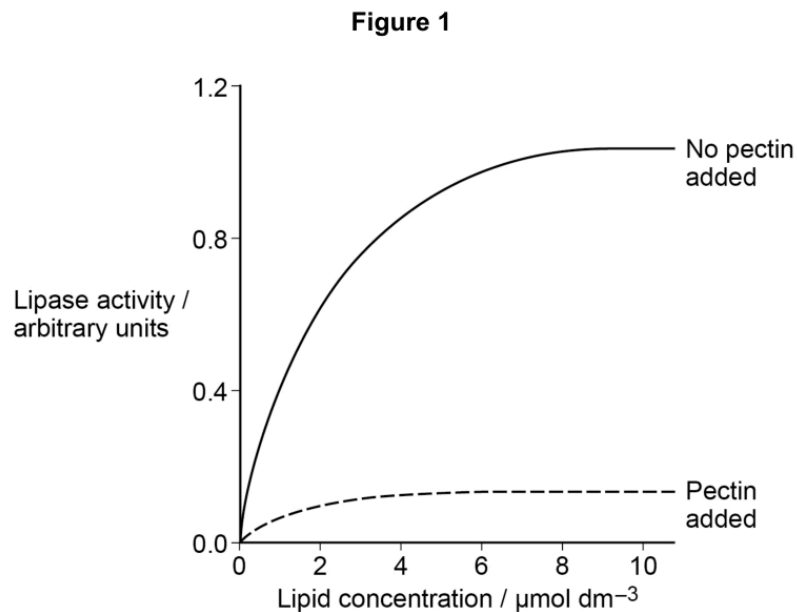
8 marks

[3 marks]

Pectin is a substance found in some fruit and vegetables.

A scientist investigated the effect of pectin on the hydrolysis of lipids by a lipase enzyme.

His results are shown in **Figure 1**.



2

The scientist concluded that pectin is a non-competitive inhibitor of the lipase enzyme.

Use **Figure 1** to explain why the scientist concluded that pectin is a **non-competitive** inhibitor.

[1 mark]

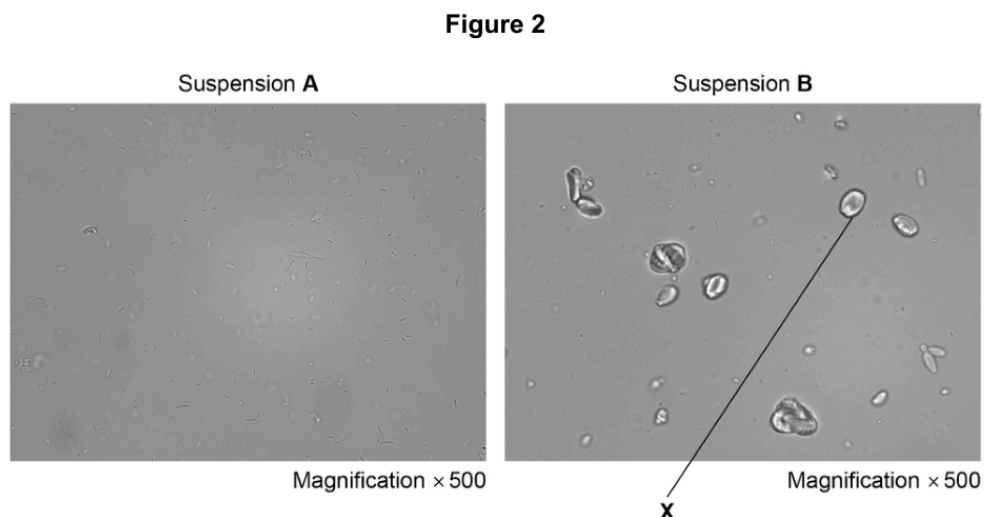
The scientist also found that pectin stops the action of bile salts. He prepared two suspensions:

- suspension **A** – lipid and bile salts
- suspension **B** – lipid, bile salts and pectin.

He did **not** add lipase to either suspension.

He observed samples from the suspensions using an optical microscope.

Figure 2 shows what he saw in a typical sample from each suspension.



3

Calculate the maximum length of the large lipid droplet marked **X** in **Figure 2**.

Using a ruler with millimetre intervals always includes an uncertainty in the measurement. Use the uncertainty in your measurement to determine the uncertainty of your calculated maximum length.

You can assume there is no uncertainty in the magnification.

[2 marks]

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Maximum length = µm

Uncertainty of your calculated maximum length = µm

4

No large lipid droplets are visible with the optical microscope in the samples from suspension **A**.

Explain why.

[2 marks]

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— AQA 7402/1 Biology · June 2019 · Paper 1, Question 1

4.

Two enzymes, **P** and **Q**, are proteins with quaternary structure which catalyse the same reaction, but they have different amino acid sequences.

9 marks

1

Define the **quaternary structure** of a protein.

[1 mark]

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2

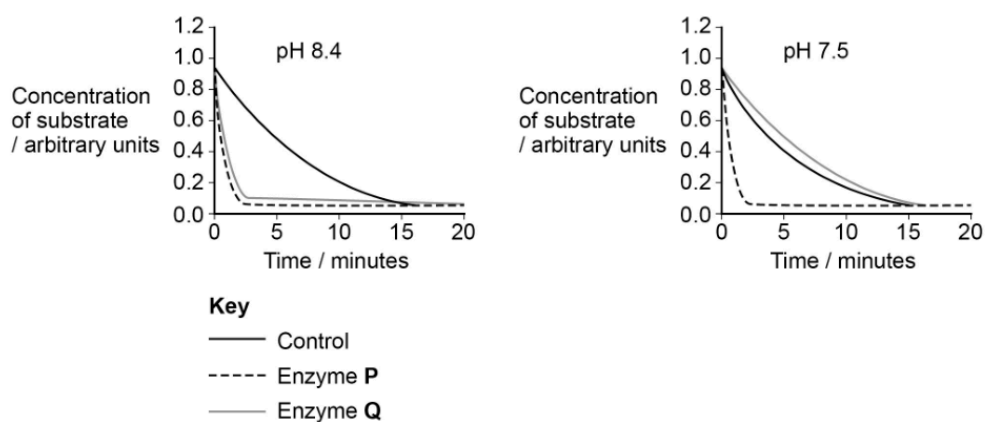
Explain how two enzymes with different amino acid sequences can catalyse the same reaction.

[2 marks]

Scientists investigated the effect of pH 8.4 and pH 7.5 on the activity of enzymes **P** and **Q**.

Figure 8 shows their results.

Figure 8



3

Describe what the scientists should place in the control tubes in this investigation.

[3 marks]

4

Give **three** conclusions you can make from **Figure 8**.**[3 marks]**

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— AQA 7402/1 Biology · 2022 · Paper 1, Question 5

5.

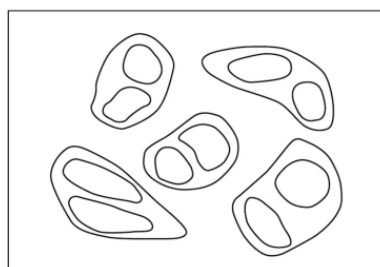
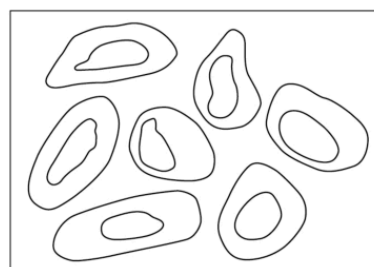
1

Scientists investigated a drug called MiTMAB as a treatment for cancer. MiTMAB inhibits cytokinesis.

10 marks

Figure 8 shows drawings of cancer cells seen with an optical microscope from a:

- sample treated with MiTMAB
- control sample.

Figure 8**A****B**

The cells in drawing **A** can be identified as those treated with MiTMAB.

Explain why.

[2 marks]

2

MiTMAB acts as a non-competitive inhibitor of an enzyme called dynamin.

Suggest how MiTMAB can cause dynamin to become inactive.

[3 marks]

When active, dynamin has **two** functions:

- it stimulates cytokinesis
- it inhibits cell death.

The scientists treated actively growing cultures of cancer cells with MiTMAB.

They incubated:

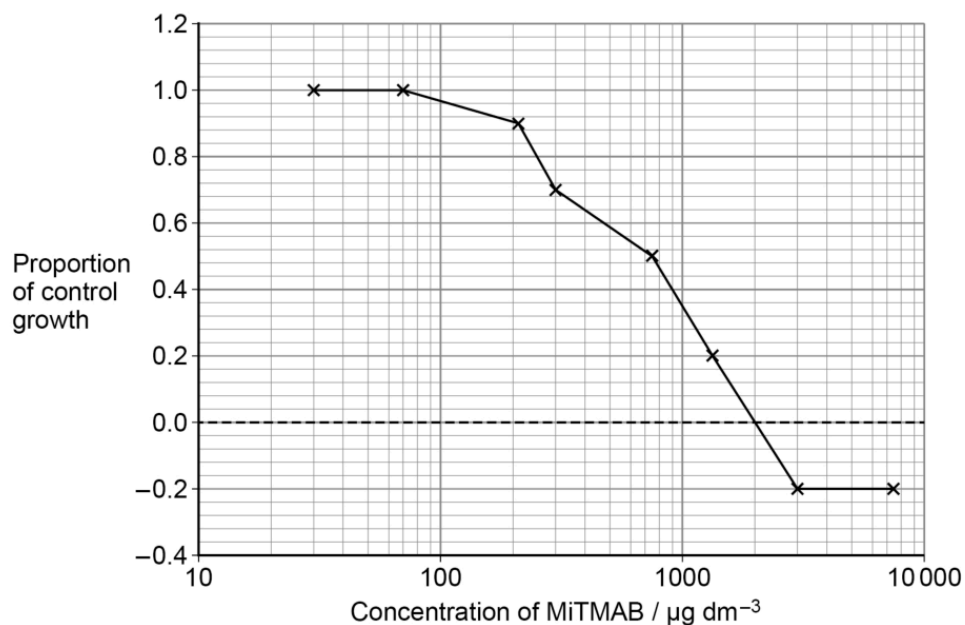
- one sample of 2500 cells without MiTMAB as a control
- eight samples, each with 2500 cells and a different concentration of MiTMAB.

After 72 hours, the scientists measured the number of cells in each sample.

Figure 9 shows the scientists' results.

A negative value for proportion of control growth means that fewer than 2500 cells were counted after 72 hours.

Figure 9



3

Use all the information given to explain the results shown in **Figure 9**.

[3 marks]

[2 marks]

μg
