

3.2 Factors that Affect Enzyme Action

Question Paper

Course	CIE A Level Biology (9700) exams from 2022
Section	3. Enzymes
Topic	3.2 Factors that Affect Enzyme Action
Difficulty	Hard

Time allowed: 10

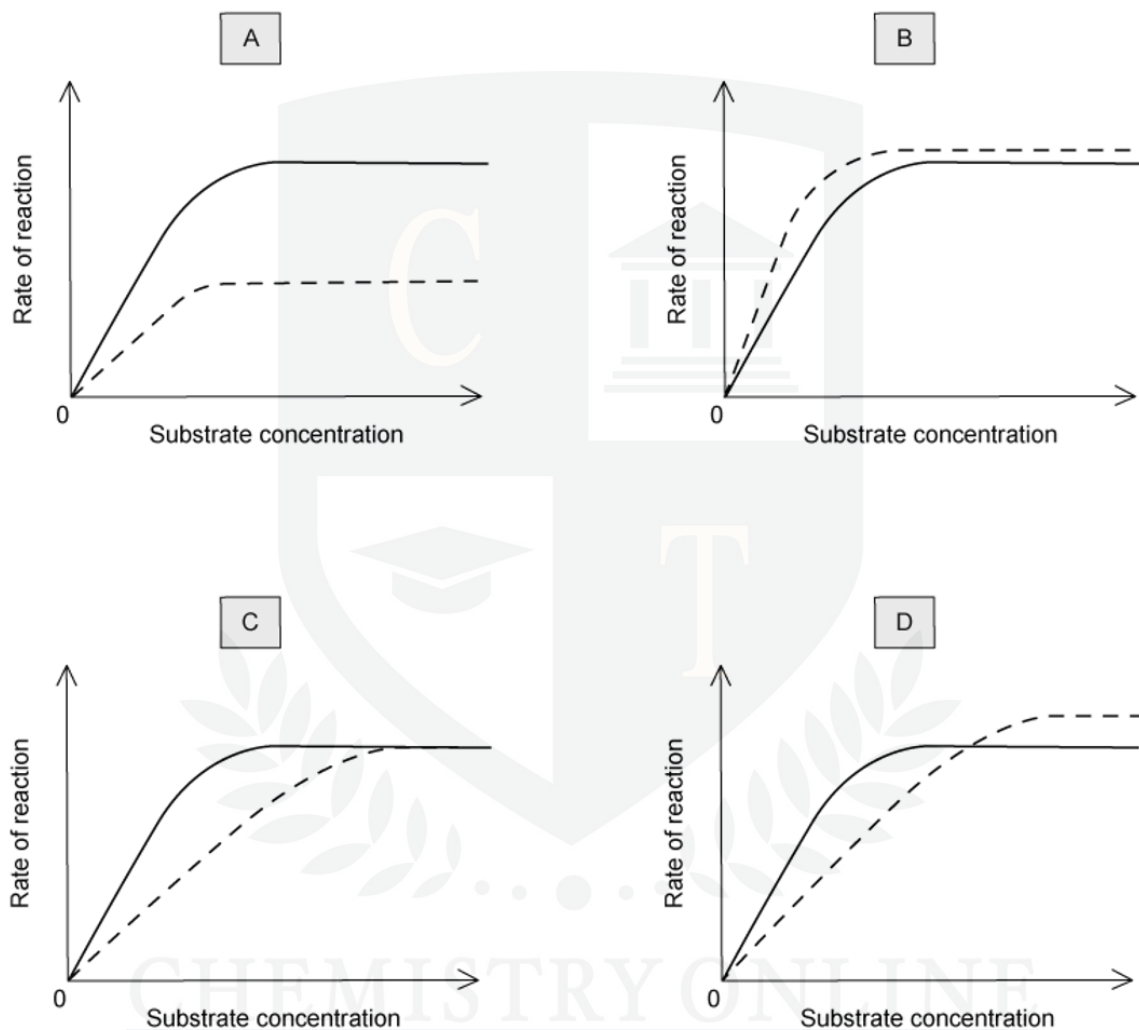
Score: /10

Percentage: /100

Question 1

The graphs show the rate of reaction of an enzyme-catalyzed reaction.

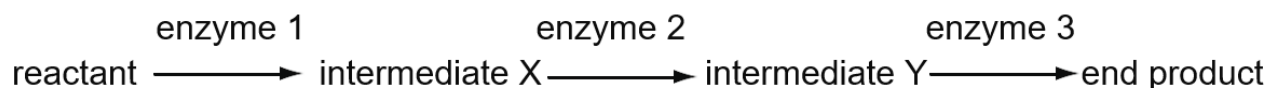
Which graph shows the effect of increasing the concentration of the substrate both with and without a competitive inhibitor?



[1 mark]

Question 2

This diagram shows a metabolic pathway occurring in an organelle. The speed of this metabolic pathway is self-regulating as the end product acts as a competitive inhibitor to enzyme 2



What would you not expect to occur when adding additional end product to the organelle?

- A** enzyme 2 activity would decrease
- B** amount of intermediate Y would decrease
- C** amount of reactant would increase
- D** amount of intermediate X would increase

[1 mark]

CHEMISTRY ONLINE
— TUITION —

Question 3

Ethylene glycol is a colourless and odourless type of alcohol found in many household products. People sometimes drink ethylene glycol mistakenly (or on purpose as a substitute for ethanol), however drinking it can cause profound shock, organ failure, and even death.

Ethylene glycol itself is not toxic, rather the products it gets broken down into. The same enzyme in the body that normally breaks down ethanol into harmless products is also responsible for the hydrolysis of ethylene glycol. This is due to ethylene glycol having a similar structure to ethanol. Accordingly, the treatment for someone who has ingested ethylene glycol is a large dose of ethanol.

Which statement explains why this unusual treatment works?

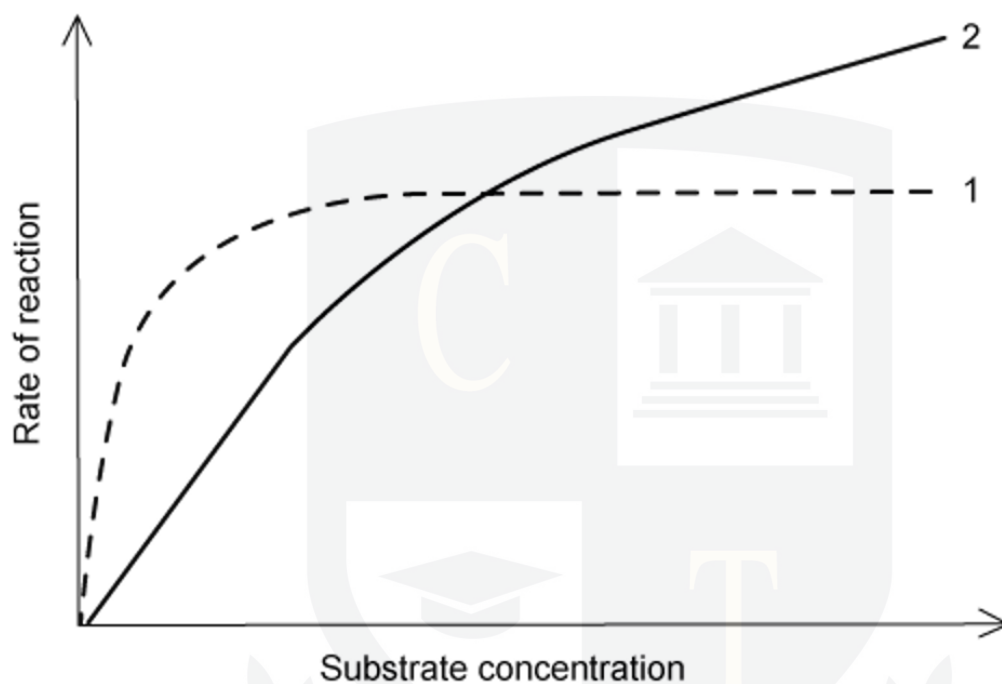
- A** Ethanol binds near the active site on the enzyme and alters its shape
- B** Ethanol denatures the enzyme
- C** Ethanol is more likely to bind to the active site of the enzyme
- D** Ethanol acts as a pain killer

[1 mark]

CHEMISTRY ONLINE
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Question 4

K_m is the concentration of substrate which permits the enzyme to achieve half V_{max} . An enzyme with a high K_m requires a greater concentration of substrate to achieve V_{max} .



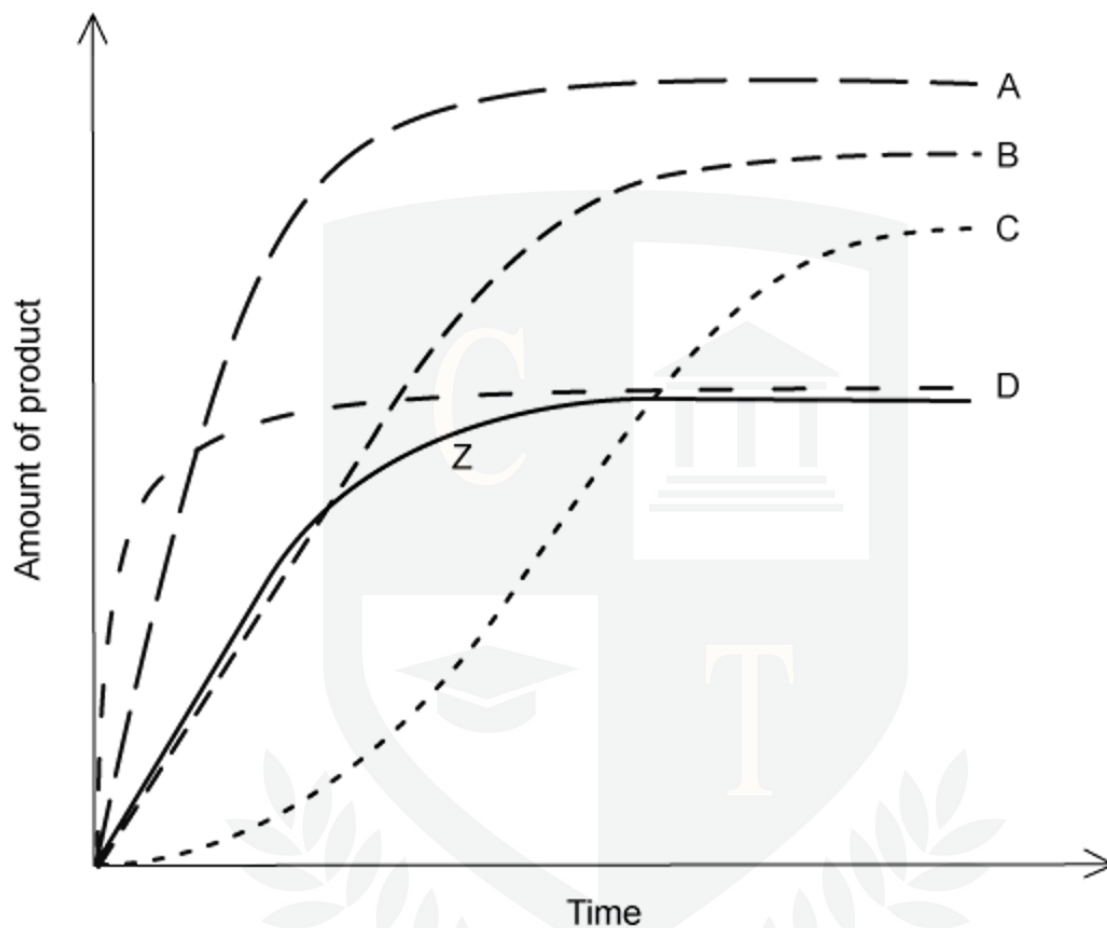
Which of the following statements is correct?

- A** Enzyme 1 has the lower K_m and therefore a greater affinity to its substrate.
- B** Enzyme 1 has the higher K_m and therefore a greater affinity to its substrate.
- C** Enzyme 2 has the lower K_m and therefore a greater affinity to its substrate.
- D** Enzyme 2 has the higher K_m and therefore a greater affinity to its substrate.

[1 mark]

Question 5

The curve **Z** shows the activity of catalase at 25 °C. Curves **A**, **B**, **C** and **D** show the effect of different conditions on the activity of catalase.

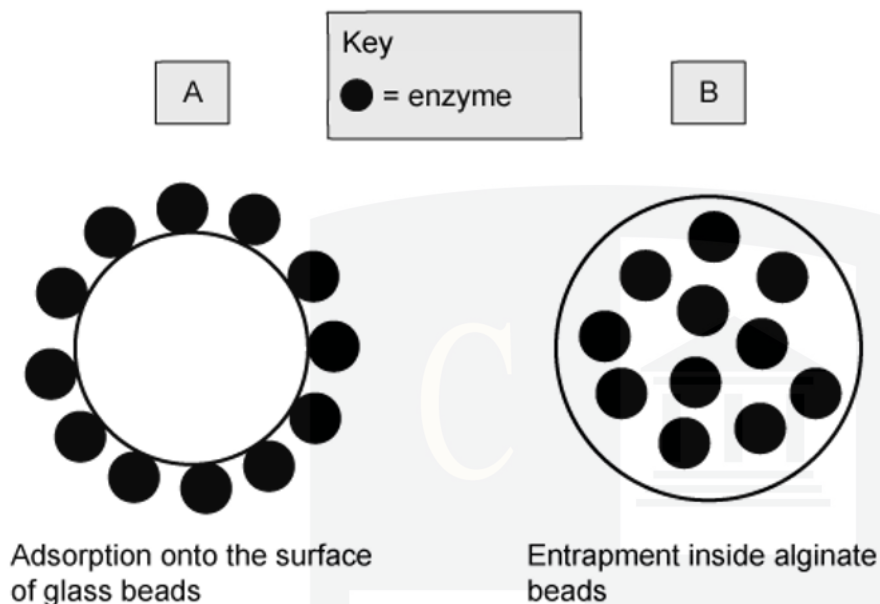


Which curve shows the effect of increasing the temperature by 10 °C and adding additional substrate?

[1 mark]

Question 6

Enzymes can be immobilized in various ways. The diagram below shows two different ways of immobilization:



Immobilised lactase enzymes are used to make milk digestible for lactose intolerant people. A student carried out an investigation to compare the activity of the enzyme lactase that had been immobilised in the two different ways shown.

A 500 cm^3 solution containing 50 mg cm^{-3} of lactose was poured through a column containing the immobilised enzyme. The solution containing the products was collected and the concentration of glucose measured.

The student collected the following data:

	method of immobilisation	
	A	B
time for solution to pass through column / seconds	36	28
glucose concentration of end solution / mg cm^{-3}	20	14

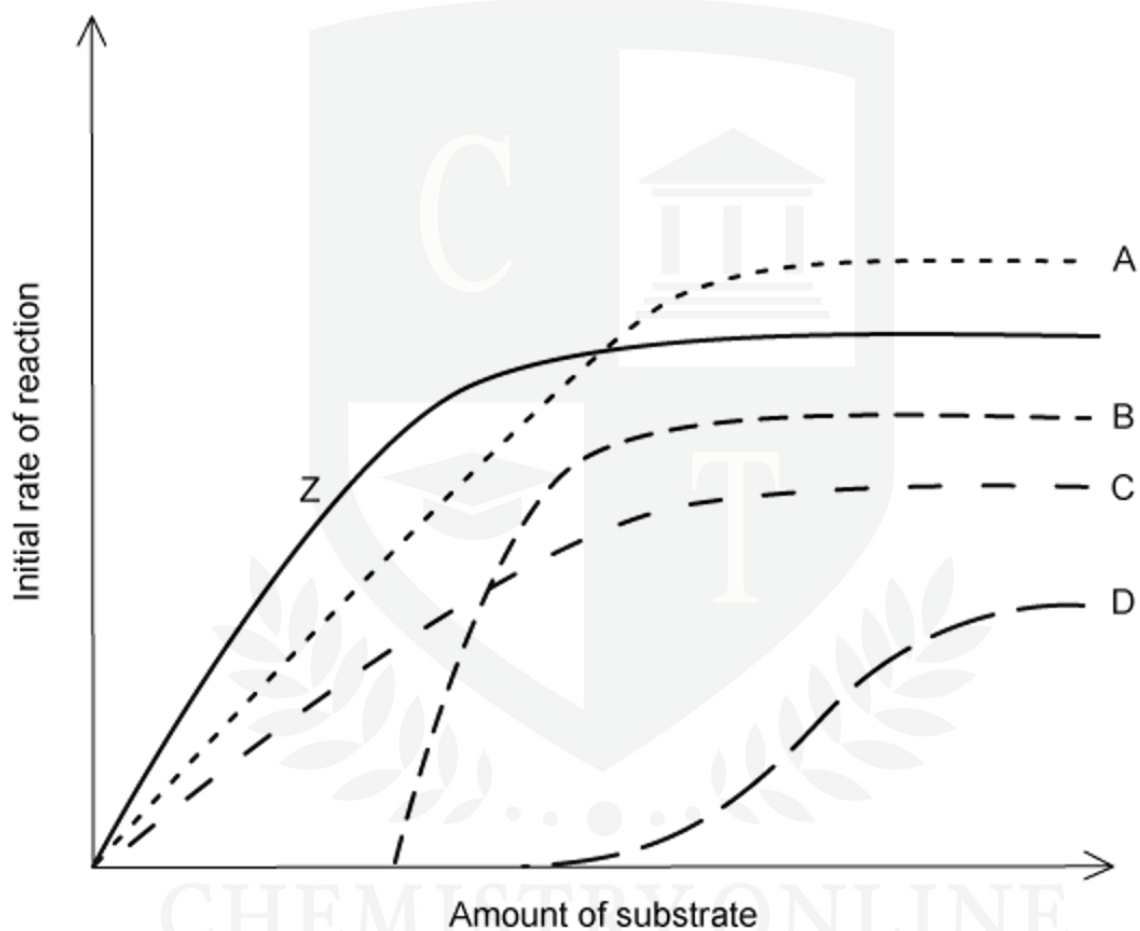
What was the rate of glucose production in method **A** in $\text{mg cm}^{-3} \text{ min}^{-1}$ rounded to two significant figures?

- A 33
- B 33.33
- C 0.55
- D 0.56

[1 mark]

Question 7

In the graph, **Z** represents the relationship between the initial rate of reaction of an enzyme and the concentration of its substrate under optimal conditions and without an inhibitor.

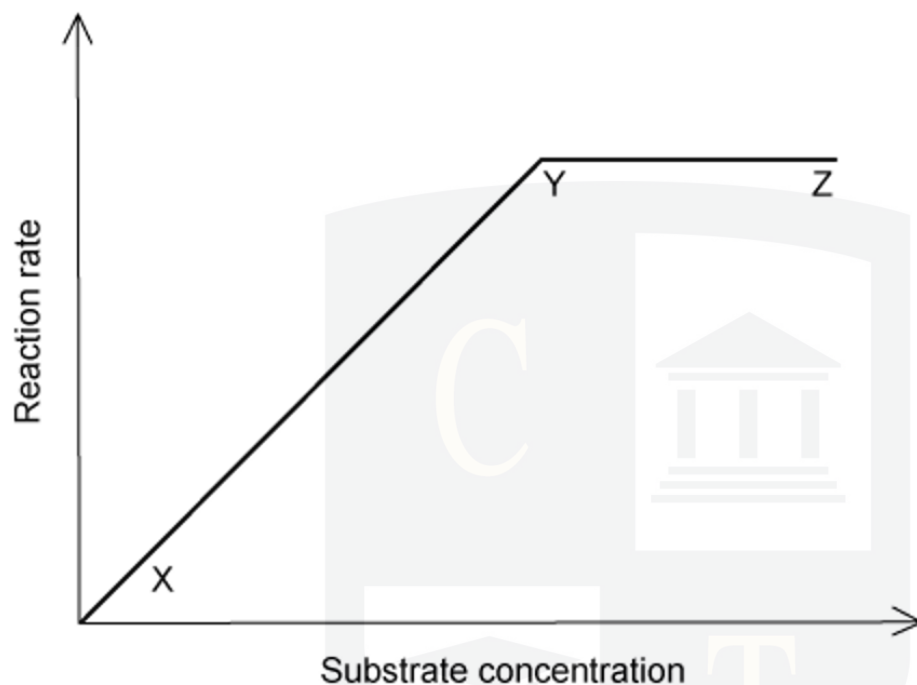


Which curve would represent the same experiment carried out in the presence of a low concentration of a non-competitive inhibitor?

[1 mark]

Question 8

The graph shows the effect of substrate concentration on the rate of an enzyme-controlled reaction. The enzyme concentration is constant.



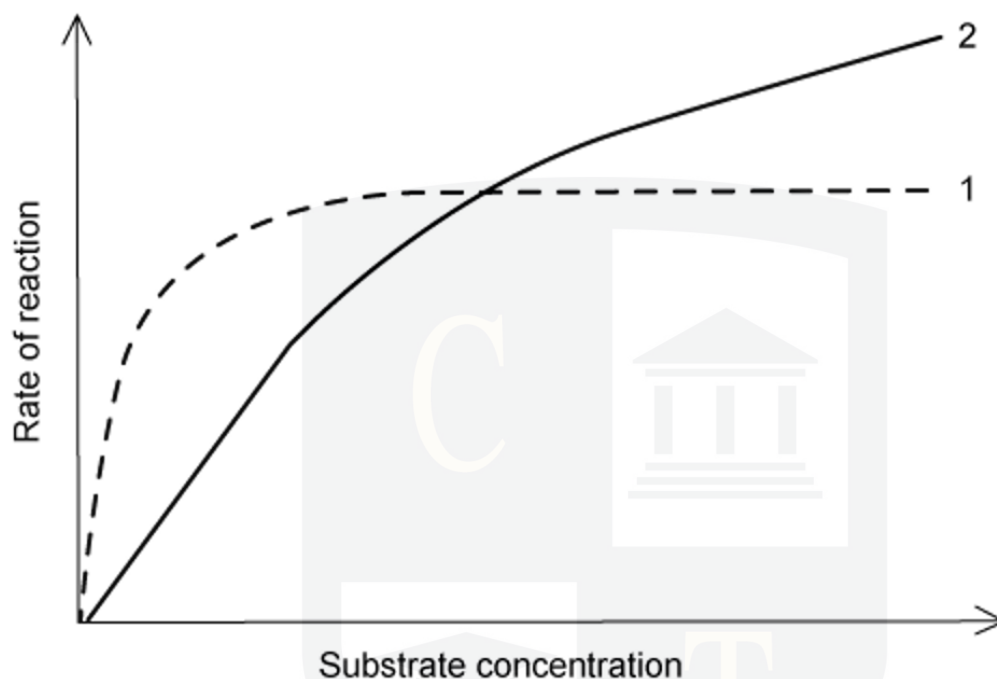
Which statement about the graph is correct?

	Between X and Y	Between Y and Z
A	Enzyme is limiting rate	Enzyme is limiting rate
B	Enzyme is limiting rate	Substrate is limiting rate
C	Substrate is limiting rate	Enzyme is limiting rate
D	Substrate is limiting rate	Substrate is limiting rate

[1 mark]

Question 9

K_m is the concentration of substrate which permits the enzyme to achieve half V_{max} .



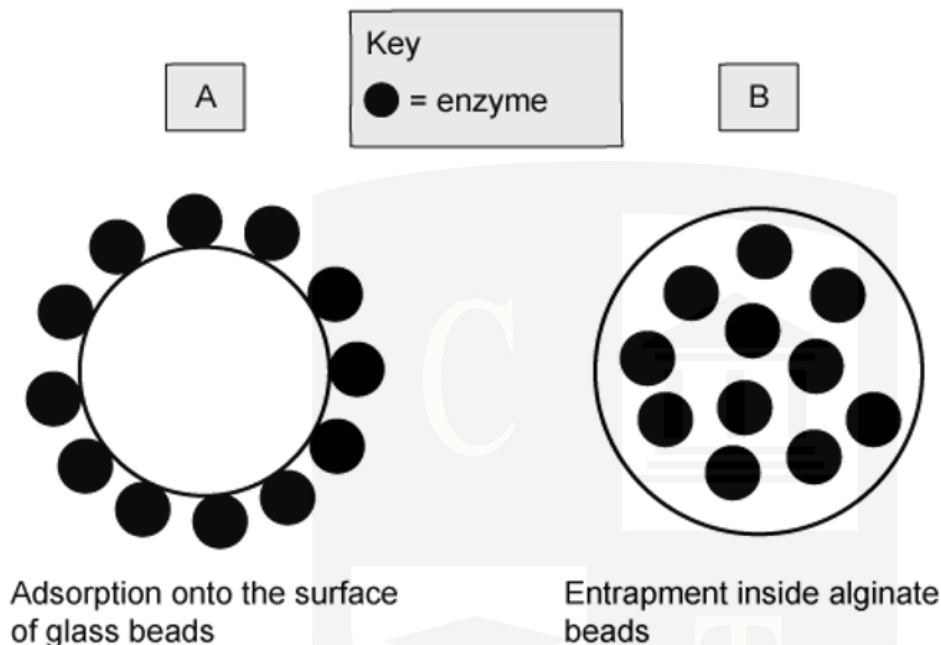
Which of the following statements is incorrect?

- A Enzyme 2 has a greater affinity for its substrate than enzyme 1
- B Enzyme 1 reaches its V_{max}
- C The K_m value of enzyme 2 is greater than the K_m value of enzyme 1
- D At low substrate concentration enzyme 1 has the faster rate of reaction

[1 mark]

Question 10

Immobilised lactase enzymes are used to make milk digestible for lactose intolerant people. A student carried out an investigation to compare the activity of the enzyme lactase that had been immobilised in the two different ways shown below:



A 500 cm³ solution containing 50 mg cm⁻³ of lactose was poured through a column containing the immobilised enzyme. The solution containing the products was collected and the concentration of glucose measured:

	method of immobilisation	
	A	B
time for solution to pass through column / seconds	36	28
glucose concentration of end solution / mg cm ⁻³	2.0	1.4
rate of glucose production / mg sec ⁻¹	0.055	0.05

Assuming the mass of glucose is equal to half the initial lactose concentration (i.e. 1 mg of glucose indicates the hydrolysis of 2 mg of lactose), how much lactose could be hydrolysed by method **B** in an hour with unlimited starting solution?

- A** 180 mg
- B** 360 mg
- C** 1.4 mg
- D** 2.8 mg

[1 mark]

