



BIOLOGY 2017

Unit 3

Key Topic Test 4 – Structure and regulation of biochemical pathways

Recommended writing time*: 45 minutes

Total number of marks available: 45 marks

SOLUTIONS

SECTION A: Multiple-choice questions (1 mark each)

Question 1

Answer: B

Explanation:

Without the presence of enzymes, the reactions necessary to sustain life would require higher temperatures in order to proceed at the required speed.

Question 2

Answer: A

Explanation:

The part of the enzyme where the substrate binds is called the active site.

Question 3

Answer: B

Explanation:

A represents the substrate, B represents the enzyme, C represents the product and D represents the reaction being catalysed (in this case a catabolic reaction)

Question 4

Answer: A

Explanation:

A represents the substrate, B represents the enzyme, C represents the product and D represents the reaction being catalysed (in this case a catabolic reaction).

Question 5

Answer: C

Explanation:

A represents the substrate, B represents the enzyme, C represents the product and D represents the reaction being catalysed (in this case a catabolic reaction)

Question 6

Answer: D

Explanation:

Enzymes are biological catalysts which are composed mainly of protein.

Question 7

Answer: A

Explanation:

From the graphs the enzyme works best at a temperature of 35°C and a pH of 8.

Question 8

Answer: C

Explanation:

ATP is composed of adenine and ribose and has three phosphate groups attached.

Question 9

Answer: A

Explanation:

The formation of ATP from ADP and P_i is a reversible reaction and requires energy. This product then provides the energy required to drive cellular processes.

Question 10

Answer: B

Explanation:

NADH is an electron carrier and carries electrons to the different stages of cellular respiration.

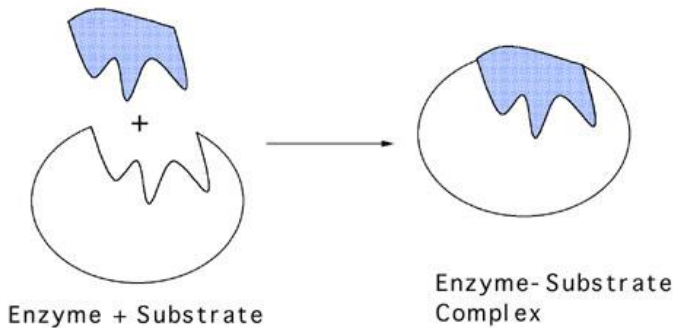
SECTION B: Short-answer questions

Question 1

- a. Induced fit is where the binding of the substrate molecule to the enzyme molecule induces a change in the shape of the active site so that it becomes complimentary to the substrate molecule (1 mark). The lock and key model states that the active site of the enzyme is complimentary in shape to the substrate (1 mark).

2 marks

b.



2 marks

- c. A change in the shape of the enzyme will affect the shape of the active site and therefore the binding of the substrate (1 mark). This will decrease function of the enzyme (1 mark).

d.

- substrate specific
- biological catalysts
- re-usable
- temperature and pH dependent

4 marks

Total 10 marks

Question 2

- a. 40°C

1 mark

- b. At 100°C the tertiary structure is denaturing (1 mark) it is unfolding from its 3-dimensional structure (1 mark)

2 marks

c. Competitive inhibition:

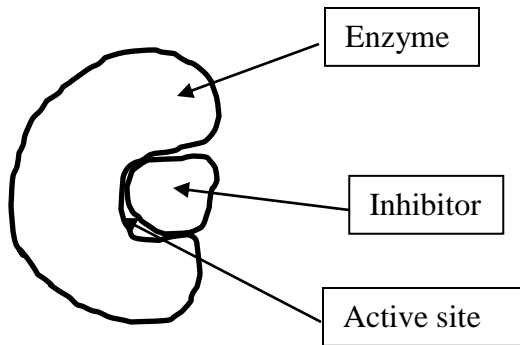


Diagram shows the inhibitor binding to the active site of the enzyme.

1 mark

Non-competitive inhibition:

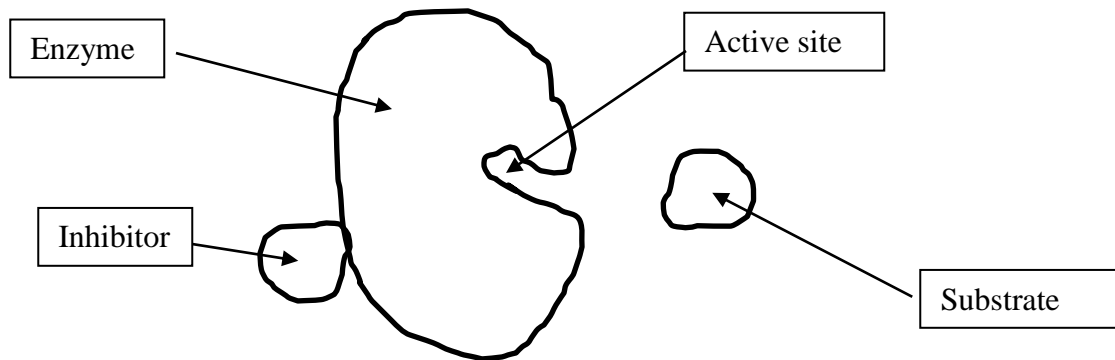


Diagram shows inhibitor binding to site other than the active site

1 mark

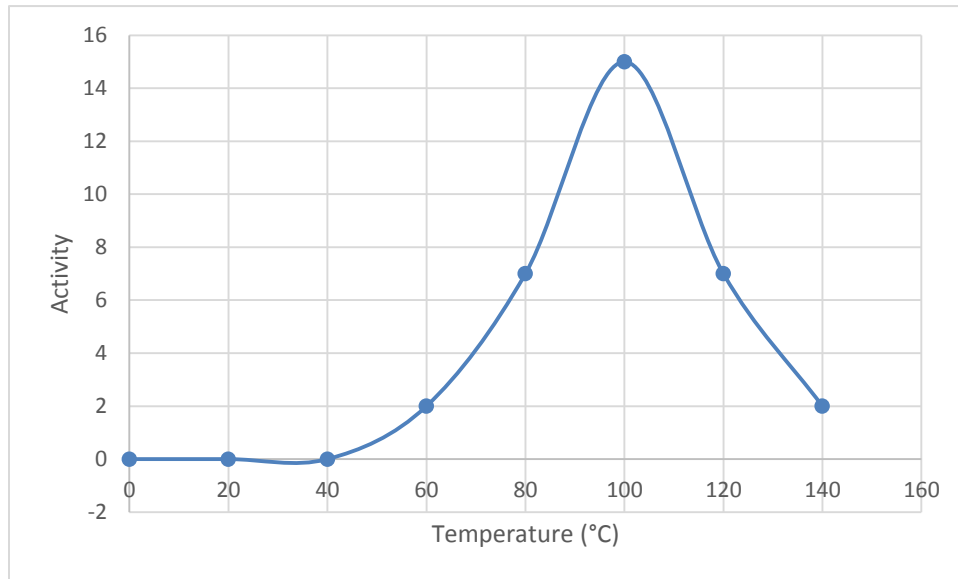
The changed shape of the active site is shown

1 mark

Labels correct on both diagrams

1 mark

d.



Axes labelled correctly

1 mark

Units correct

1 mark

Data plotted correctly

1 mark

e. substrate concentration and pH

2 marks

Total 12 marks

Question 3

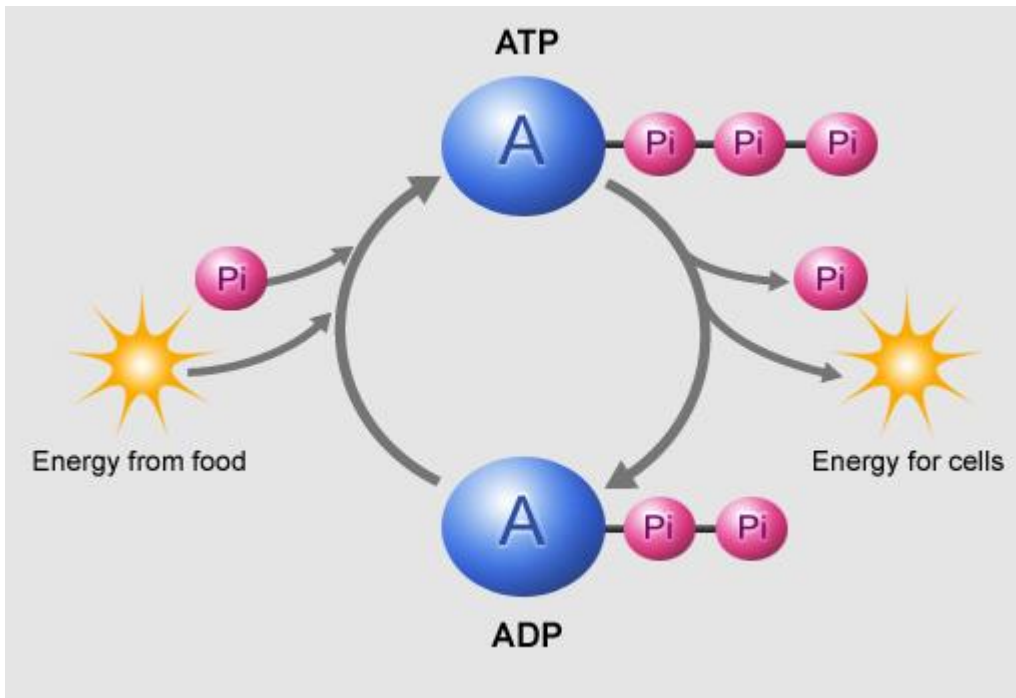
a. ATP = loaded form and ADP = unloaded form (1 mark). ATP provides the energy for cellular processes (1 mark).

NADH = loaded form and NAD^+ = unloaded form (1 mark). NADH acts as a shuttle for electrons during cellular respiration (1 mark).

NADPH = loaded form and NADP^+ = unloaded form (1 mark). NADPH acts as an electron carrier during photosynthesis (1 mark).

6 marks

b.



2 marks

c.

i. mitochondria

ii. NAD^+/NADH

iii. ATP

1 + 1 + 1 = 3 marks

d. Competitive inhibition (1 mark) as it binds directly to the active site of the enzyme and competes with oxygen (1 mark).

2 marks

Total 13 marks