



BIOLOGY 2020

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: D

Explanation:

Catalysts speed up reactions by lowering the activation energy and can be used more than once hence D is correct

Question 2

Answer: B

Explanation:

A is incorrect as enzymes don't purify products. D may be true in some circumstances but not all. C is incorrect as permanently altering an enzyme may stop it functioning.

Question 3

Answer: C

Explanation:

Activation energy is the energy required to start the reaction not the energy held in the bonds, so A and B are incorrect. The reaction cannot be catabolic as the energy of the products would be lower, so D is incorrect. The products have higher energy levels than the reactants, so bonds have been formed

Question 4

Answer: C

Explanation:

Hot water will denature the enzymes due to the high temperatures meaning the detergent will not be effective.

Question 5

Answer: C

Explanation:

C is correct as temperature influences the amount of collisions between a substrate and active site. The speed of a reaction increases as the temperature increases

Question 6

Answer: A

Explanation:

In the lock and key model, the active site does not change shape unlike the induced fit model active site which changes to fit the substrate. B, C and D all refer to changing shape

Question 7

Answer: A

Explanation:

For an enzyme active site to be inhibited the molecule must have a complementary shape to the active site. B, C and D do not include complementary shapes

Question 8

Answer: C

Explanation:

Irreversible inhibitors permanently change the shape of the active site and don't allow it to be returned to the complementary shape of the substrate.

Question 9

Answer: D

Explanation:

Competitive inhibitors work by blocking active sites but not forming a permanent attachment, making them complementary in shape to the active site. As competitive inhibitors act to block active sites they are more effective at low enzyme levels and high inhibitor levels. Folic acid is the product of the reaction so does not directly impact the effectiveness of the inhibitor

Question 10

Answer: C

Explanation:

Trypsin has an optimal pH of 8 and so changes the shape of the active site above and below this pH affecting its activity

Question 11

Answer: D

Explanation:

Referencing the graph both enzymes denature above 80°C. The bacterial enzyme would not be denatured at 50°C rather reactions would slow down and stop due to fewer collisions

Question 12

Answer: C

Explanation:

The number of active sites is a limiting factor as reactions can only occur when active sites are available. If all active sites are full the rate cannot increase

Question 13

Answer: B

Explanation:

Unloaded means that the carrier molecules are not carrying energy, electrons or protons.

Question 14

Answer: C

Explanation:

Loaded forms are ATP, NADPH and NADH

Question 15

Answer: D

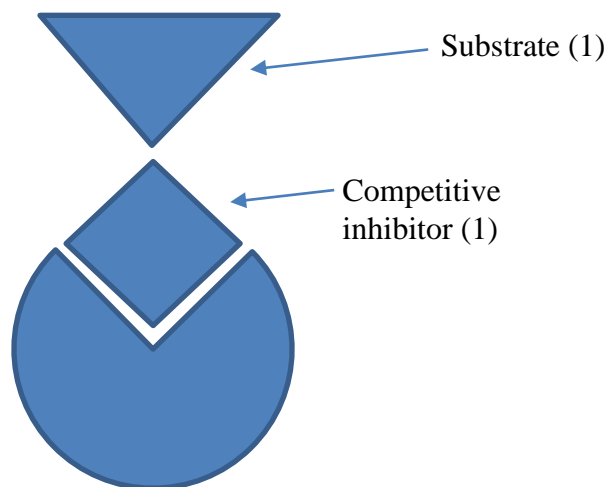
Explanation:

A is incorrect as NADPH moves to the light independent stage, B is incorrect as ADP cannot drop off electrons, C is incorrect as NADH is not used in glycolysis.

SECTION B: Short-answer questions

Question 1

- a.** Induced fit model (1) The active site changes shape to fit the substrate. (1) Lock and Key model (1) The substrate fits the active site with no change of shape. (1) 4 marks
- b.** Catalyse means to increase the rate of a chemical reactions (1) without being used up in the reaction by lowering activation energy (1) 2 marks
- c.** No (1) if enzyme 2 were denatured the substrate from 1 would not be able to be converted to substrate 2 (1). Without substrate 2, enzyme 3 would not be able to make the final product (1) 3 marks
- d.** Non-competitive inhibitors act by changing the shape of the active site (1) stopping substrates from matching the specific active site shape (1) by attaching to another part of the enzyme 2 marks
- e.** Reversible inhibitors can be disassociated from the enzyme (1) which irreversible inhibitors attach and cannot be removed (1) 2 marks
- f.** .



Complementary shapes of substrate to active site (1)

3 marks

Question 2

- a.** Denature means to break the bonds in a molecule such as an enzyme so it is no longer functional 1 mark
- b.** Enzymes and proteins in the blood would denature (1) and would become nonfunctional affecting the body's metabolism (1) 2 marks

- c. No (1) Above the optimal temperature the enzyme denatured (1) below the optimal temperature collisions between the enzyme active site and the substrate slow down but the active site does not denature (1)

3 marks

Question 3

a.

Loaded coenzyme	Unloaded coenzyme	What is carried
ATP	ADP +Pi	Electrons
NADH	NAD+	Hydrogen
NADPH	NADP	Hydrogen/protons

Could also include FAD or acetyl CoA

6 marks

- b. Coenzymes assist the functioning of enzymes usually by attaching to active sites and improving efficiency of reactions (1) Cycling occurs as the coenzymes are not used up in reactions and act as carriers between reactions(1)

2 marks

Total 45 marks