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## **BIOLOGY VCE UNITS 3&4 DIAGNOSTIC TOPIC TESTS 2017**

### **TEST 2: GENE STRUCTURE AND REGULATION AND STRUCTURE AND REGULATION OF BIOCHEMICAL PATHWAYS**

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#### **SUGGESTED SOLUTIONS AND MARKING SCHEME**

#### **SECTION A – MULTIPLE-CHOICE QUESTIONS**

**Question 1            A**

Repressor proteins stop the gene from being expressed, hence they bind to the promotor site to stop RNA polymerase from being able to traverse along the gene.

**Question 2            B**

For the gene to be expressed, RNA polymerase must be able to move along the gene from the promotor region.

**Question 3            C**

Lactose binds to the repressor protein changing the shape of the repressor protein so it can no longer bind to the promotor region of the gene.

**Question 4            A**

The protein products of gene expression can be used to regulate the gene, as once it is in excess, it switches off the gene acting as a regulatory protein.

**Question 5            D**

Repressors are repressing the gene from being expressed, hence they are preventing RNA polymerase from functioning.

**Question 6            A**

Adding more enzyme will allow the reaction rate to increase as there would be more active sites available to catalyse the reaction.

**Question 7            B**

Freezing the enzyme inhibits its functioning as the rate of collisions between molecules is low, but does not change the shape of the active site so when the temperature is returned to optimum it will still function.

**Question 8**      **C**

All reactions require a substrate, however only some reactions occur in the nucleus. Anabolic reactions are the building up of complex substances from simpler ones.

**Question 9**      **B**

Enzymes reduce the activation energy needed to start the reaction, therefore the reaction can proceed at a faster rate.

**Question 10**      **D**

Each enzyme has an optimum pH at which it functions best. As you move away from this specific pH, the enzyme rapidly denatures as is shown in graph D.

**SECTION B – SHORT-ANSWER QUESTIONS**

**Question 1** (5 marks)

- a. colourless 1 mark  
*Note: Also accept white.*
- b. RNA polymerase 1 mark
- c. A repressor protein has bound to the promotor region of the gene. 1 mark
- d. The pink colour could be produced by removing the repressor from the promotor region of the gene. 1 mark
- e. Genes are regulated to save energy, nutrients and time. 1 mark

**Question 2** (2 marks)

Catabolic reactions break down complex substances into simpler ones.

*For example:*

enzyme activity on food 1 mark

Anabolic reactions build up from simple substances to complex substances.

*For example:*

photosynthesis 1 mark

*1 mark each for both explanation and example.*

**Question 3** (4 marks)

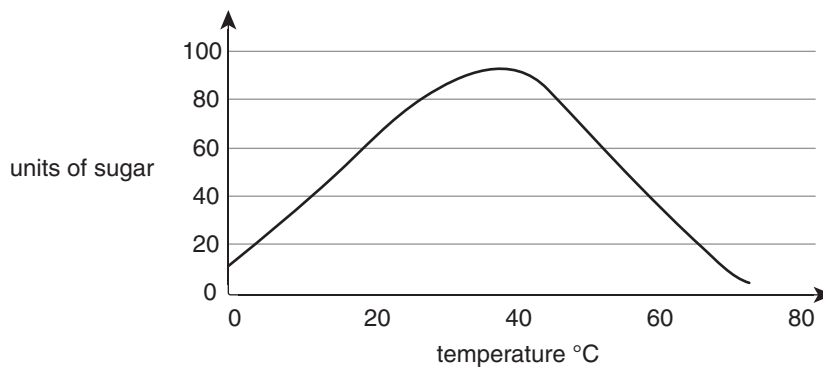
- a. 40°C 1 mark
- b. to ensure the correct temperature had been reached and had affected the enzyme 1 mark
- c. The enzymes has denatured changing the shape of the active site so it can no longer bind to the substrate and catalyse the reaction. 1 mark  
No, the enzyme cannot be reused as denaturing is permanent. 1 mark

**Question 4** (4 marks)

- a. pH 8 1 mark
- b. a test tube at each pH that does not contain any enzyme 1 mark
- c. The time to clear would have increased and may not have cleared at all as the enzyme would have denatured. 1 mark
- d. As pH 8 is the optimum, it has the shortest time to clear. It is at this pH that the enzyme substrate complex fits most efficiently. The further from this optimum pH 8, the less efficiently the enzyme substrate complex is formed, as the active site of the enzyme is being changed due to denaturing. This leads to an increase in the time to clear. 1 mark

**Question 5** (8 marks)

- a. activity of saliva on starch to produce sugar



- 2 marks
- b. enzyme/salivary amylase 1 mark
- c. 30°C–40°C 1 mark
- d. The enzyme has denatured changing the shape of the active site so it can no longer bind to the substrate to catalyse the reaction. 1 mark
- e. how much starch (substrate) is present 1 mark
- f. No, enzymes are specific to the one substrate reaction. 1 mark

**Question 6** (7 marks)

- a. 36°C–37°C 1 mark
- b. The enzyme activity increases until the optimum temperature is reached. 1 mark  
After this, the enzyme is denatured, so enzyme activity ceases. 1 mark
- c. At lower temperatures enzymes are inhibited from functioning. 1 mark  
Keeping food at low temperatures increases their shelf life as reactions are slower. 1 mark
- d. Blanching denatures the enzymes, as above 65°C there are no units of sugar produced, 1 mark  
vegetables can then be stored without cellular activity. 1 mark