Neap:

BIOLOGY VCE UNITS 3&4
DIAGNOSTIC TOPIC TESTS 2017

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

TOTAL 40 MARKS (45 MINUTES)

Student's Name: _____ Teacher's Name: _____

Directions to students

Write your name and your teacher's name in the spaces provided above.
Answer all questions in the spaces provided.

SECTION A – MULTIPLE-CHOICE QUESTIONS

Instructions for Section A

Choose the response that is **correct** or that **best answers** the question.
A correct answer scores 1; an incorrect answer scores 0.
Marks will **not** be deducted for incorrect answers.
No marks will be given if more than one answer is completed for any question.
Unless otherwise indicated, the diagrams in this booklet are **not** drawn to scale.

Question 1

Repressor proteins regulate the production of protein by binding to the

A. promotor region of the gene preventing RNA polymerase from functioning.
B. operator region of the gene preventing RNA polymerase from functioning.
C. RNA polymerase preventing it from binding to the promotor region of the gene.
D. DNA polymerase preventing it from binding to the promotor region of the gene.

Question 2

In order for a gene to be transcribed, RNA polymerase must be able to bind to the gene's

A. regulator region.
B. promotor region.
C. operator region.
D. repressor region.

Question 3

In *E. coli*, the lac genes are expressed when lactose is present as

A. RNA polymerase binds to the operator region.

B. the repressor binds to the promotor region.

C. lactose binds to the repressor protein.

D. DNA polymerase binds to the promotor region.

Question 4

Gene expression is often suppressed by the end product

A. acting as a regulator.

B. acting as a promotor.

C. not being expressed.

D. being over-expressed.

Question 5

Proteins that block the movement of RNA polymerase along a gene are called

A. operons.

B. activators.

C. promotors.

D. repressors.

Question 6

Above a certain substrate concentration, the enzyme molecules become saturated and the rate of reaction reduces.

Which of the following would increase the rate of reaction under these conditions?

A. an increase in enzyme concentration

B. a decrease in temperature

C. an increase in substrate concentration

D. reaction has reached its maximum and can go no faster, no matter what is added

Question 7

Which of the following actions will not affect the shape of the active site of an enzyme?

A. boiling the enzyme/substrate mixture

B. freezing the enzyme/substrate mixture

C. adding a non-competitive inhibitor to the enzyme/substrate mixture

D. changing the pH of the enzyme/substrate mixture

Question 8

Anabolic reactions

A. are not enzyme-catalysed.

B. always occur in the nucleus.

C. result in the synthesis of a molecule.

D. do not require a substrate.

Question 9

Enzymes catalyse biochemical reactions by

A. providing energy to speed up the rate of reaction.

B. lowering the energy of activation for a reaction.

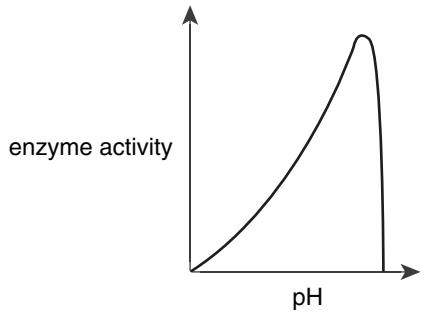
C. changing the direction of equilibrium.

D. changing endergonic into exergonic reactions.

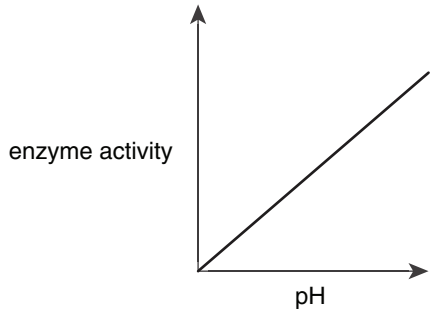
Question 10

Which of the graphs below shows the way in which enzyme activity changes with pH?

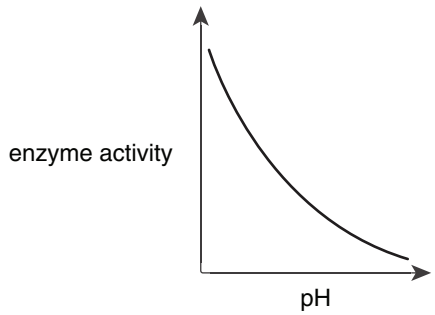
A.



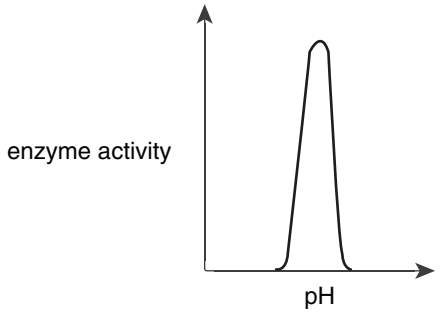
B.



C.



D.



SECTION B – SHORT-ANSWER QUESTIONS

Instructions for Section B

Answer **all** questions in the spaces provided. Write using blue or black pen.
Unless otherwise indicated, the diagrams in this booklet are **not** drawn to scale.

Question 1 (5 marks)

a. If a pea plant has the alleles which code for pink petal colour, but these alleles are prevented from being expressed, what colour will the pea plant petals be? 1 mark

_____

b. Name the enzyme that is being prevented from functioning in the pea plant. 1 mark

_____

c. Describe how the pink colour allele is being prevented from being expressed. 1 mark

_____

_____

d. How could the pink colour be produced in this pea plant? 1 mark

_____

_____

e. Discuss the need for gene regulation in organisms. 1 mark

_____

_____

Question 2 (2 marks)

What is the difference between catabolic and anabolic reactions? Give an example of each type or reaction.

_____

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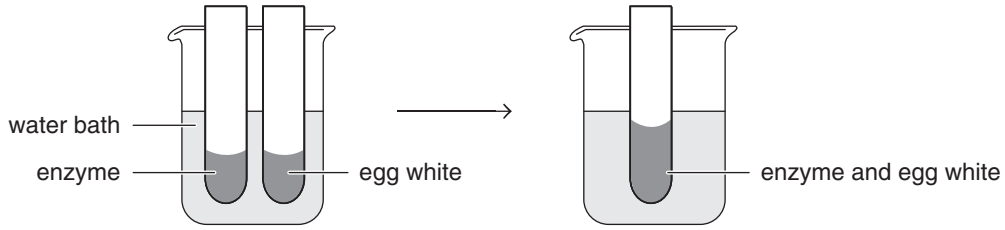
_____

Question 3 (4 marks)

An experiment was set up to investigate the effect of temperature on the activity of a protein-digesting enzyme.

The apparatus shown in the diagram was set up at a particular temperature. After five minutes, the enzyme was added to the egg white, the tube was shaken and then returned to the water bath. At first the solutions were cloudy because of the egg white protein present. The time for the solution to become clear was recorded. The experiment was repeated at different temperatures.



The results are shown in the table below.

Temperature °C	5	15	25	40	50	60
Time for cloudiness to disappear in minutes	16	10	5	1	2	still cloudy

a. At which temperature did the enzyme work most rapidly? 1 mark

_____

b. Why were the test tubes kept in the water bath for five minutes before mixing? 1 mark

_____

_____

c. The mixture at 60°C remained cloudy and did not go clear.
Explain why this was the case and if the enzymes could be reused? 2 marks

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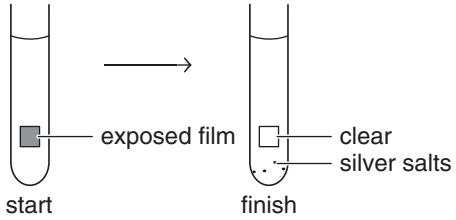
Question 4 (4 marks)
Exposed photographic film has black silver salts bonded to it by a thin layer of gelatin (a protein). In an investigation into the digestion of gelatin by the enzyme trypsin the end point is shown by the clearing of the film, as in the diagram below.



Seven test tubes, each with a different buffered pH solution and 1 cm^3 of 0.5% trypsin solution, were placed in a water bath at 35°C for five minutes. Small pieces of exposed film were simultaneously placed into each test tube and the time taken for the film to clear was noted.

pH	Time taken to clear in minutes
6.0	30
6.5	20
7.0	13
8.0	5
9.0	8
9.5	20
10.0	35

a. What is the optimum pH for trypsin? 1 mark

_____

b. What control(s) would be required for this experiment? 1 mark

_____

c. What would have happened to the 'time taken to clear' had the experiment been carried out at 70°C? Explain your answer. 1 mark

_____

_____

_____

d. Using your knowledge of the structure of enzymes, explain the pattern of results obtained for this experiment. 1 mark

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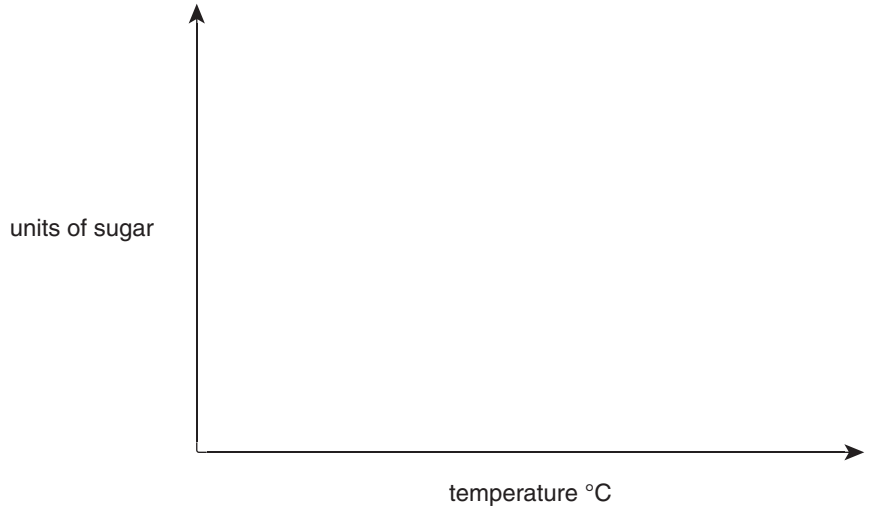
Question 5 (8 marks)

The following results were obtained from an experiment in which saliva was mixed with a starch suspension. Samples of the mixture were kept in water baths at different temperatures for fifteen minutes. At the end of this time, the samples were analysed to find out how much sugar has been produced in each. The results are given below.

Temperature °C	0	10	20	30	40	50	60	70	80
Units of sugar	12	36	65	90	90	60	30	4	2

a. Plot a graph of these results on the axes below, drawing a smooth curve through the points. Label the axes as shown. 2 marks



b. What kind of substance must be present in the saliva to break down the starch into sugar? 1 mark

_____

c. At which temperature is the most sugar produced? 1 mark

_____

d. Why is very little sugar formed when the saliva and starch mixture are kept at a very high temperature? 2 marks

_____

_____

e. What other factors besides temperature would affect the amount of sugar produced from a starch and saliva mixture? 1 mark

_____

_____

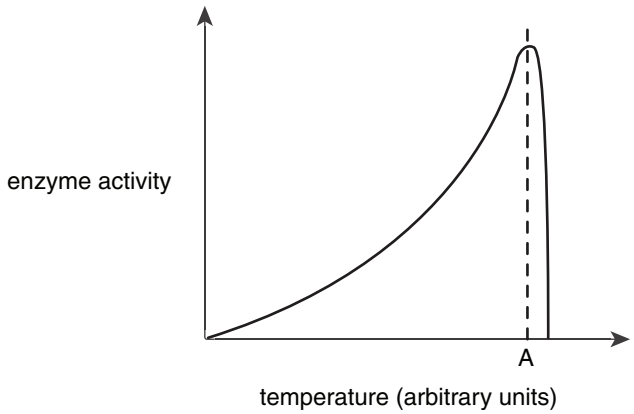
f. Can saliva break down any substances other than starch? Explain your answer. 1 mark

_____

_____

Question 6 (7 marks)

Below is a graph showing how enzyme activity changes with temperature.



a. For most mammalian enzymes, what is the temperature at A? 1 mark

_____

b. Explain the shape of the graph. 2 marks

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_____

c. Referring to the graph, explain how food is preserved by refrigeration. 2 marks

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_____

d. In order to store vegetables, such as carrots, for long periods, they are first 'blanched' (boiled for a few seconds) and then deep frozen.

Referring to the graph, explain how this method works. 2 marks

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