



ENZYMES

Questions on Units 3.8 – 3.12 on Enzymes

- 1 (a) Explain the difference between the *lock and key theory of enzymes* and the *induced-fit hypothesis*

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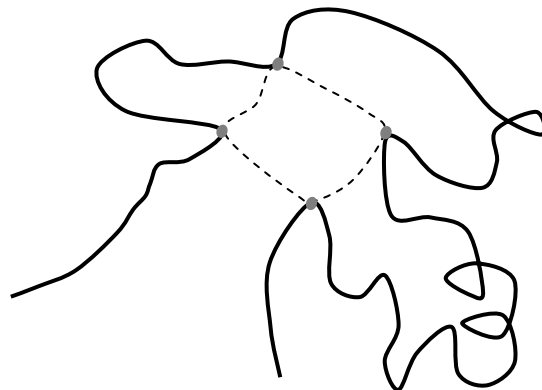
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(3 marks)

- (b) The diagram shows an enzyme, enzyme A.



- (i) Annotate the diagram to identify the following:

amino acid, active site

(2 marks)

- (ii) Enzymes are *globular proteins*. Explain what this means.

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(2 marks)

(iii) What can we say about the shape of the substrate for enzyme **A**?

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(1 mark)

(c) The purpose of enzyme **A** is to catalyse the conversion of starch into maltose. Explain why enzyme **A** will be unable to catalyse the conversion of a protein into amino acids.

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(3 marks)

Total: 11 marks

- 2 (a) Complete the following passage by filling in the blanks with the correct terminology.

Increasing the temperature condition in a reaction will the reaction rate, up to a certain point. If the temperature is too high, usually for most enzymes at °C, the enzyme will lose its structure, as the weak hydrogen bonds begin to break, and the enzyme will eventually becoming unable to function.

Another factor affecting enzyme action is pH. Similarly to temperature, having a pH that is too low or too high will cause the shape of the to change, so the enzyme becomes useless. This is because the bonds which hold together the enzyme's structure are mainly hydrogen bonds and bonds, which both form due to their electronegativity, and anything too acidic (which has many H⁺ ions) will be attracted to the negative areas, and anything too basic (which has little H⁺ ions) will be attracted to the positive parts. Generally speaking, the pH for enzymes tends to be around pH7.

(7 marks)

- (b) The concentration of enzymes and the concentration of substrate are two factors which also affect the rate of enzyme action.

- (i) Explain the term substrate.

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(2 marks)

- (ii) Describe the relationship between the concentration of enzymes and reaction rate.

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(3 marks)

(iii) With regard to the effect on rate of reaction, explain what would happen in each of the following scenarios:

the substrate in a solution is in excess;

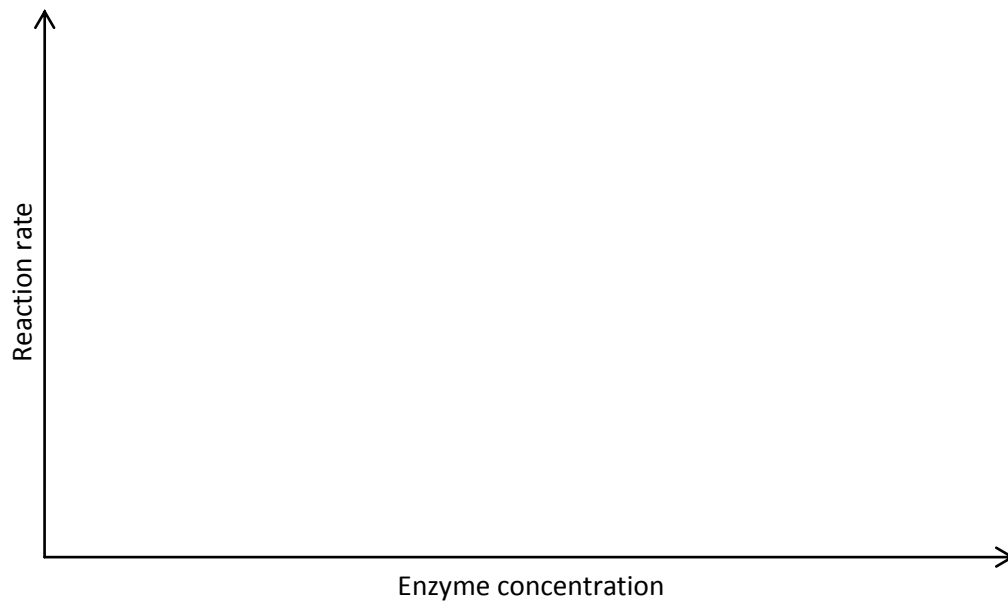
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the enzymes in a solution are in excess;

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(4 marks)

(d) Below are a pair of axes plotting reaction rate against enzyme concentration.



Use the axes to sketch a line of best fit to show the relationship for the following:

(i) an experiment to measure reaction rate where the amount of substrate is kept constant (1 mark)

(ii) an experiment to measure reaction rate where the increase in substrate concentration is exponentially growing (1 mark)

(e) Identify the limiting faction in part (d)(i)

Total: 19 marks

3 Enzyme *inhibition* can involve a competitive inhibitor or a non-competitive inhibitor.

(a) Explain the process of enzyme inhibition, referring to both competitive and non-competitive inhibitors.

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(3 marks)

(b) Explain the difference between a permanent and a non-permanent inhibitor.

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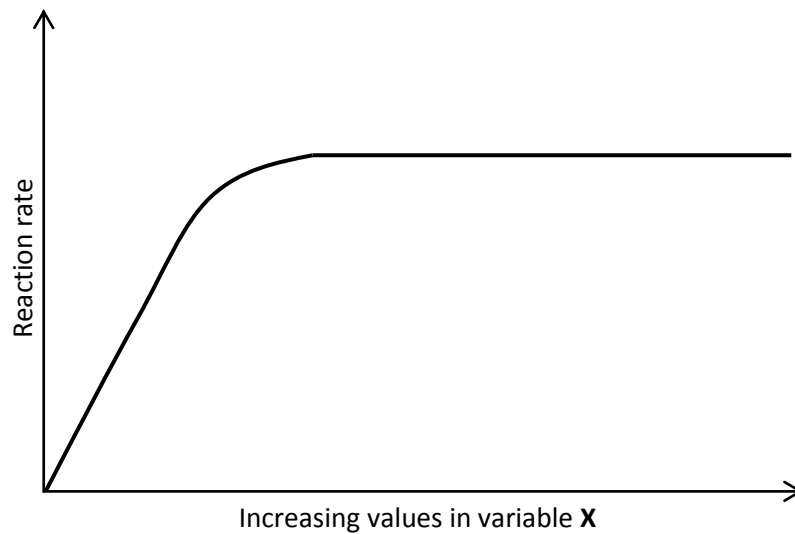
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(2 marks)

(c) The graph below shows the reaction rate for an enzyme, affected by variable X.



(i) The line shows the effect of variable **X** on reaction rate, *without* an inhibitor.

Plot the line which shows the effect of variable **X** on reaction rate *with* a fixed concentration of competitive inhibitor. Label this line as line **Y**.

(1 mark)

(ii) Plot the line which shows the effect of variable **X** on reaction rate with a fixed concentration of a non-competitive permanent inhibitor. Label this line as line **Z**.

(1 mark)

(iii) Using the line already present on the graph for you, suggest what variable **X** might be.

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(1 mark)

(iv) Suggest an explanation for your answer to part (iii).

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(2 marks)

(d) For your course you will have studied **one** type of poison.

Use the space to below to explain the effect of one named poison on the human body.

Name of poison:

Effect of poison:

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(5 marks)

Total: 15 marks

4 Many enzymes rely on *cofactors* to function.

(a) Explain the following terms:

(i) enzyme cofactor;

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(2 marks)

(ii) coenzyme;

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(2 marks)

(iii) prosthetic group.

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(2 marks)

(b) Give an example of where a prosthetic group is necessary for life.

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(2 marks)

(c) In some enzyme-controlled reactions, certain types of ion are required for reactions to take place. One enzyme, carbonic anhydrase, requires one such ion.

(i) State the function of carbonic anhydrase.

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(1 mark)

(ii) State the type of ion which is necessary for carbonic anhydrase to function.

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(1 mark)

(d) A disease known as **pellagra** can develop when there is a deficiency of the vitamin B₃ in the diet.

Explain why pellagra can lead to having respiratory problems.

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(3 marks)

Total: 13 marks