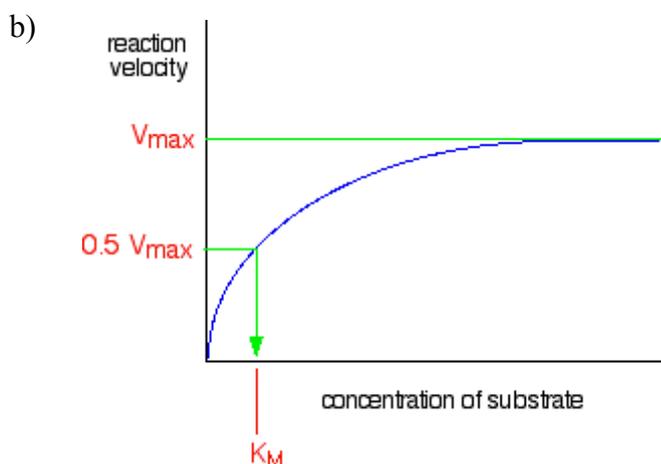
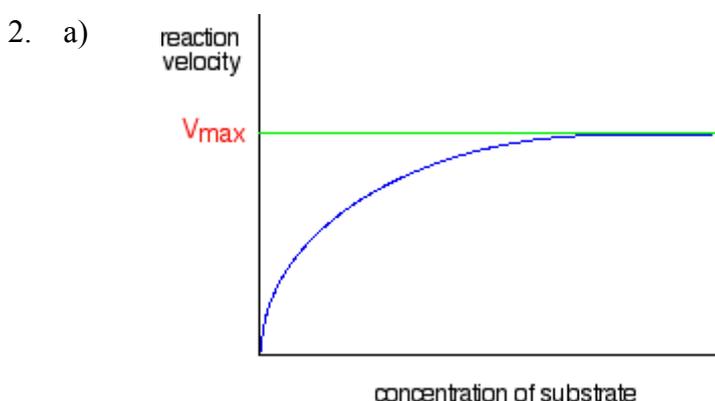


Chemguide – answers

PROTEINS: CHANGING CONDITIONS IN ENZYME CATALYSIS

1. At very low concentrations, increasing the concentration of the substrate increases the rate (“velocity”) of the reaction as you might expect. As you increase the concentration more, the increase in rate becomes less, and eventually the extra substrate has no effect at all on rate. You get a zero order reaction. This happens because, with increasing concentration, the enzymes are already working as fast as they can, and there are fewer and fewer enzyme molecules free to process the extra substrate. Therefore increasing the concentration of the substrate any further can make no difference.



- c) The one with the smaller value for K_M (3.0×10^{-4}). It is reaching half of its maximum velocity at a lower concentration of substrate.
3. At temperatures up to about 40°C , the rate increases with temperature for two reasons. The molecules are moving faster and so the substrate molecules come into contact with the enzyme more frequently. More importantly, increasing the temperature has a very big effect on the number of molecules interacting with the enzyme with energies greater than the activation energy for the reaction they undergo.

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Above about 40°C, the extra heat energy begins to cause break-down in the tertiary structure of the protein. The extra movement of the chains due to the heat breaks the intermolecular forces which give the enzyme its tertiary structure, and that obviously can result in the loss of the active site.

4. a) The hydrogen ions would be picked up by the COO^- groups to make COOH groups. That destroys the possibility of ionic bonds holding the substrate in the active site, and the enzyme won't function.
- b) Hydrogen ions would be removed from the NH_3^+ groups to leave NH_2 groups. That again destroys the possibility of ionic bonds holding the substrate in the active site.
- c) Ionic bonds between side-groups on the protein chain are also an important part of what holds the tertiary structure of the protein in place. If these are disrupted in the same way, the folding of the whole chain can be lost.