**Topic 5. Enzymes**

**Define the term *catalyst***

A catalyst is a substance that increases the rate of a chemical reaction and is not changed by the reaction

**Define *enzymes***

Enzymes are proteins that function as biological catalysts

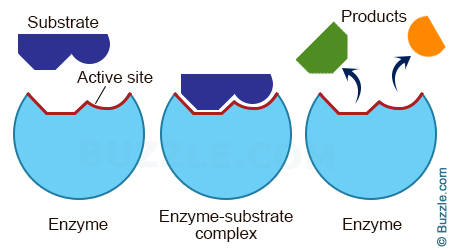
**Describe why enzymes are important in all living organisms in terms of reaction speed necessary to sustain life**

**Describe enzyme action with reference to the complementary shape of an enzyme and its substrate and the formation of a product**

**Explain enzyme action with reference to the active site, enzyme-substrate complex, substrate and product**

**Explain the specificity of enzymes in terms of the complementary shape and fit of the active site with the substrate**

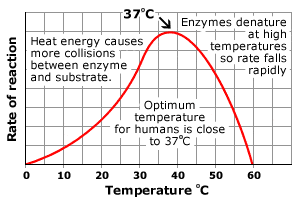
Their action relies on their shape, as their substrate molecule (s) fit into their active site as in the lock & key hypothesis:

[](http://www.google.com/url?sa=i&rct=j&q=&esrc=s&frm=1&source=images&cd=&cad=rja&docid=FtlKxZ5S2gwZQM&tbnid=iJft1vgeBfqZpM:&ved=0CAUQjRw&url=http://www.buzzle.com/articles/how-do-enzymes-work.html&ei=lI9eUuRsj_OtB5vNgJAL&bvm=bv.54176721,d.bmk&psig=AFQjCNHIT9IJxX7I1r-2jKUVKlQCF7cClA&ust=1382014490250021)

**Investigate and describe the effect of changes in temperature and pH on enzyme activity**

**Explain the effect of changes in temperature on enzyme activity in terms of kinetic energy, shape and fit, frequency of effective collisions and denaturation**

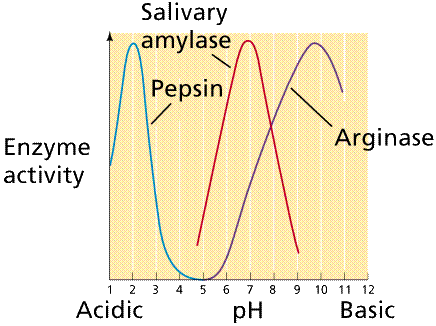
***Effect of temperature on enzymes***

[](http://www.google.com.my/url?sa=i&rct=j&q=effect+of+temperature+on+enzyme+activity&source=images&cd=&cad=rja&docid=tKTUSoAGMOTRDM&tbnid=eb2Uvy1CR2CGIM:&ved=0CAUQjRw&url=http://www.bbc.co.uk/schools/gcsebitesize/science/add_ocr_pre_2011/homeostasis/importancerev4.shtml&ei=MJuYUeTaHMLorAfy1YAI&bvm=bv.46751780,d.bmk&psig=AFQjCNGjCABUnhlxaa5LQa9A2BOutpRDBw&ust=1369041905423008)

* As temperature increases, the chance of chance of substrate molecules and enzymes colliding also increases, so the rate of reaction goes up.
* This continues to an optimum (best) temperature for an enzyme. For most human enzymes the optimum temperature is 37oC (body temperature).
* Above this temperature, the bonds holding the enzyme together start to break so it changes shape
* This deforms the active site, so enzyme and substrate cannot fit together – the enzyme has been denatured. Most enzymes **denature** above 50oC.

**Explain the effect of changes in pH on enzyme activity in terms of shape and fit and denaturation**

***Effect of pH on enzymes***

[](http://www.google.com.my/url?sa=i&rct=j&q=effect+of+ph+on+enzyme+activity&source=images&cd=&cad=rja&docid=YRACkwCWX0w9WM&tbnid=GiSVa-D2y-WlXM:&ved=0CAUQjRw&url=http://www.emc.maricopa.edu/faculty/farabee/biobk/biobookenzym.html&ei=t5-YUYHHHYb-rAekrYDwBg&bvm=bv.46751780,d.bmk&psig=AFQjCNFaYnejxAFgZctYmuVW9S4CMu5ROw&ust=1369043172634045)

* The pH of a solution is how acidic or alkaline it is.
* Most human enzymes have an optimum pH of 7 (neutral). Some exceptions:

Pepsin, a protease in the stomach has an acidic optimum (pH2);

Lipase in the duodenum has an alkaline optimum (pH 9)

Salivary amylase in the mouth prefers a slightly-acidic pH of 6.8.

* Extreme of pH affect the shape of enzymes, denaturing them.