PROTEINS: ENZYME INHIBITORS

1. a) A competitive inhibitor is one which competes with the substrate for the active site on the enzyme, and gets in the way of the reaction you want. In this case, malonate ions have a similar shape to succinate ions, and the same groups to bind to the active site with. Once a malonate ion is attached, no reaction is actually possible, because one of the CH_2 groups which are necessary for the reaction is missing – it just blocks the active site.

   b) The bonds between the inhibitor and the active site aren't permanent, and the inhibitor will eventually break away again, leaving the active site free. What attaches to the active site is just chance, and if you increase the concentration of the substrate (in this example, succinate ions), there is more chance of it attaching to the active site than the malonate ions. So at higher concentrations, the effect of the inhibitor is swamped out.

2. a) Non-competitive inhibitors don't attach at the active site, but somewhere else on the protein chain which makes up the enzyme. If the effect of this is to change the way the protein chain folds so that the shape of the active site changes, then the substrate can't attach, and the reaction can't happen.

   b) Non-competitive inhibition is non-reversible. Once the inhibitor binds to the protein chain it doesn't come off again and so the active site is permanently changed.

   c) Heavy metal ions such as Ag^+ or Hg^{2+} can affect the way the protein folds because they can interfere with SH groups in the amino acid residue cisteine. These side groups are responsible for the formation of -S-S- bridges between the chains. These ions can replace the -S-H group by, for example, -S-Ag and prevent the bridges from forming, and can also disrupt existing bridges. If this happens in such a way that the shape around the active site is changed, then you have an example of non-competitive inhibition.