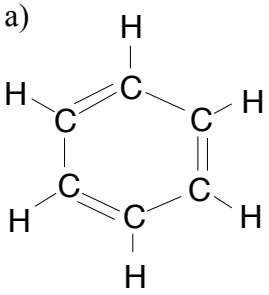
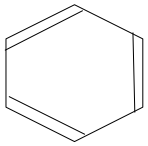
THE KEKULÉ STRUCTURE FOR BENZENE

1. a)



It doesn't matter where you put the double and single bonds as long as they alternate. By chance, I drew these structures differently from the ones on the Chemguide page. Think of the molecule as being rotated slightly. You must get used to seeing these drawn in either version.

b)



2. The Kekulé structure shows three double bonds. You would expect them all to react the same as the one in ethene, adding bromine atoms all around the ring. Because this doesn't happen, it suggests that benzene doesn't have normal double bonds, and so the Kekulé structure is misleading.

3. Carbon-carbon double bonds are shorter than carbon-carbon single ones. The Kekulé structure would therefore be an irregular hexagon.

4. a) During any reaction, energy is used to break bonds and energy is released when new ones are made. In cyclohexene, you are having to break one of the two bonds between the carbon atoms, and the bond between the hydrogen atoms in the H_2 molecule that the cyclohexene is reacting with.

   Then you make two new carbon-hydrogen bonds.

   In the middle compound, cyclohexa-1,3-diene, you have twice as many carbon-carbon double bonds, and so have to break and make exactly twice as many bonds as you do with cyclohexene. You would therefore expect to get twice the value of the energy change.

   b) Real benzene is a lot lower on the energy diagram than the Kekulé structure predicts. That means that it is a lot more (152 kJ mol^{-1} more) energetically stable than if would be if it had the Kekulé structure. Obviously, the Kekulé structure must be wrong.