Chemguide – answers

ALKENES: MAKING ALKENES

1. a) Catalyst

   b) Pass the alcohol vapour over heated aluminium oxide.

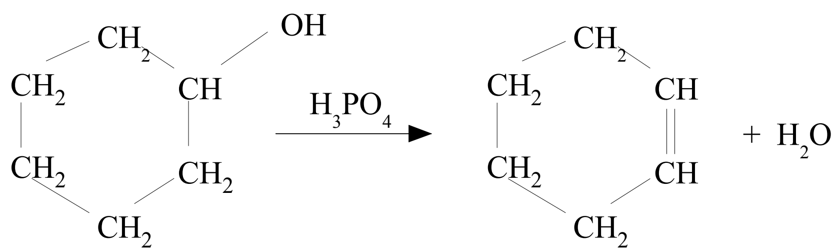
   c) $CH_3CH_2CH_2OH \xrightarrow{Al_2O_3} CH_3CH=CH_2 + H_2O$

2. a) Heat the ethanol with an excess of concentrated sulphuric acid at 170°C.

   b) Carbon dioxide and sulphur dioxide. The concentrated sulphuric acid is an oxidising agent and oxidises some of the ethanol to carbon dioxide, and is itself reduced to sulphur dioxide in the process.

   c) Phosphoric(V) acid isn't an oxidising agent.

   d)

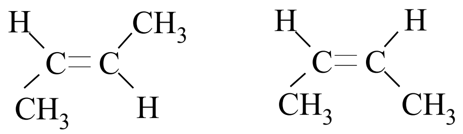


It doesn't matter where you put the -OH group, but your double bond must be consistent with wherever you put it. It should go from the carbon with the original -OH group to one of the next door carbon atoms which will now have one fewer hydrogens attached.

3. a) $CH_3CH_2CH=CH_2$

   That is the only possibility. There can't be any geometric isomers because these need two different groups at each end of the double bond, and in this case there are two identical hydrogens at one end. If you aren't sure about this, look at the Chemguide page about geometric isomerism (link from the page that you have just visited).

   b) $CH_3CH_2CH=CH_2$



The first possibility removes the -OH and a hydrogen from the end carbon atom. In this case, if you remove water from the two middle carbon atoms, you end up with two different groups (a methyl group and a hydrogen) at each end of the double bond. That gives you the possibility of cis and trans forms.

c) If you remove the -OH and a next door hydrogen atom, you will only end up with $CH_3CH_2CH{=}CHCH_3$. (If you remove the hydrogen from the other side of the -OH group, you get exactly the same molecule, but just flipped over end-to-end.) But be careful! If you draw the bond angles properly around the C=C, you will find that you could get geometric isomers: