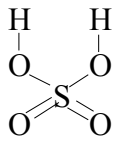
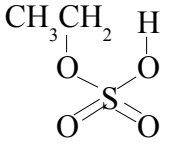
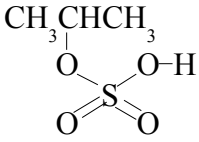
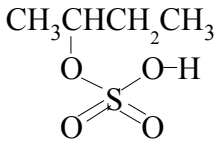
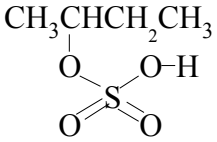
ALKENES: REACTIONS WITH SULPHURIC ACID

1. a)  (There is no reason why you couldn't rotate this through 90° if you want to.)

   b)  (As long as everything is joined up correctly, it doesn't matter how you arrange the atoms in space – see below for a minor change in the other examples to make them clearer. You could, for example, have the CH_3CH_2-O- in a straight line.)

   c) 

   d) 

   e) 

   (In the last two examples, it is equally correct if you have flipped the carbon chain over left-to-right so that the HSO_4 group is attached to the third carbon rather than the second. Make sure, though, that it is attached to CH and not CH_2. Carbon must always form 4 bonds. If you got part (e) wrong, you are forgetting about Markovnikov.)

2. a) Pass the ethene into concentrated sulphuric acid to make ethyl hydrogensulphate. Dilute it with water and distil off the ethanol.

   b) In the reaction between propene and concentrated sulphuric acid, the HSO_4 group attaches to the central carbon atom. This is a result of Markovnikov's Rule – the hydrogen will attach to the carbon with the most hydrogens on already. An alcohol is produced when the HSO_4 group is replaced by OH, and so you can only produce propan-2-ol.

   (Actually, if you want to be precise, there will be a small percentage of the sulphuric acid which adds on the "wrong" way, and so you can get a small amount of propan-1-ol, but it wouldn't be a sensible way of doing it. This is commonly true for these sorts of additions – Markovnikov tells you about how the majority of the reaction happens, and we tend to ignore the small proportion of the reaction adding the "wrong" way around. What is happening is that the "right" (Markovnikov) reaction is a lot faster than the "wrong" one so you get much more of the product according to Markovnikov.)