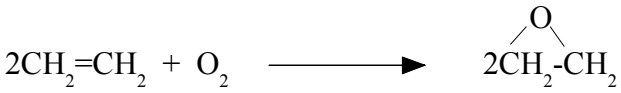
ALKENES: EPOXYETHANE

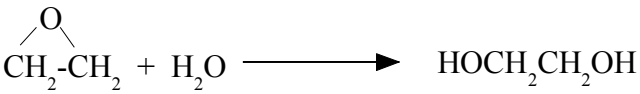
1. a)



b) The reaction is exothermic, and so the temperature will tend to rise. If the temperature rises too much, the ethene will simply burn in the oxygen.

c) The bond angles in the ring are only about 60°. The overlap between the carbon and oxygen orbitals isn't as good as if the angles were more normal (about 109.5° for single bonds), and there will be repulsion between the bonding pairs of electrons. All of this adds strain to the ring which is released if epoxyethane reacts with something. Epoxyethane is therefore very reactive.

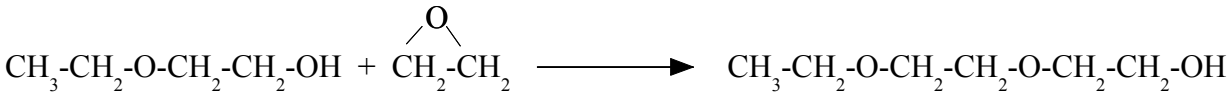
2. a)



The product is ethane-1,2-diol.

b) As an antifreeze in cars, and in the manufacture of polyesters such as poly(ethylene terephthalate).

3. a) The product contains an alcohol group at the right-hand end (as drawn), and alcohols react with epoxyethane.



(You need to take great care with this! If you had problems (not unlikely!) compare this with the equation given in the question, and see how the chain has grown. When you have done it, count all the atoms to make sure you haven't mis-written something.)

b) $CH_3CH_2(OCH_2CH_2)_3OH$

You can write it out in full if you want to, but you are much less likely to make a mistake if you simply notice that every time you get this reaction, the chain simply lengthens by an extra OCH_2CH_2.

c) (i) $CH_3(CH_2)_{10}OH$

(ii) As non-ionic surfactants (detergents)