1) acetylene, sp C-H bond is shorter than sp3 C-H bond.
2) a) optically active  
   b) cis/trans isomers
3) 

The product is formed via the allyl carbocation intermediate.

4) Homolytic cleavage of the C-Br bond can occur to form a stable allyl radical and a bromine radical. The bromine radical can recombine with either side of the allyl radical to form the original product and also the 1-bromo-2-butene (cis and trans). The trans form is drawn below.

5) 
   a) 
   b)
6. a)

\[ \text{C} = \text{Cl} \quad \xrightarrow{\text{Cl}_2} \quad \text{Cl} - \text{Cl} \quad \xrightarrow{\text{NaNH}_2, \text{NH}_3} \quad \text{H} = \text{Cl} \quad \xrightarrow{\text{HCl} \quad 1\text{eq.}} \]

b) not on this exam.