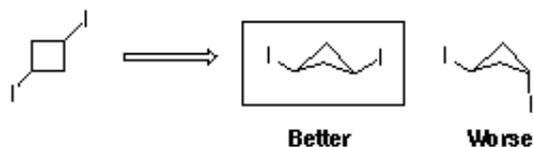
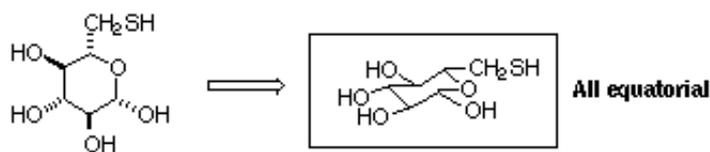
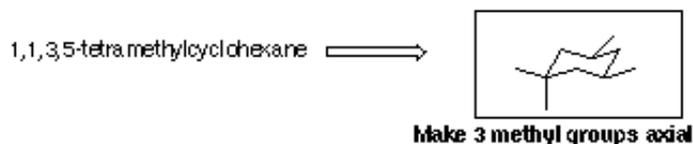
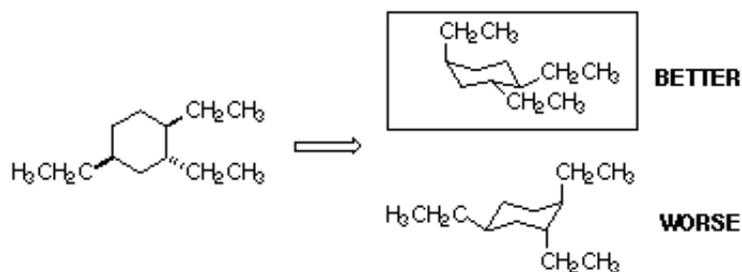
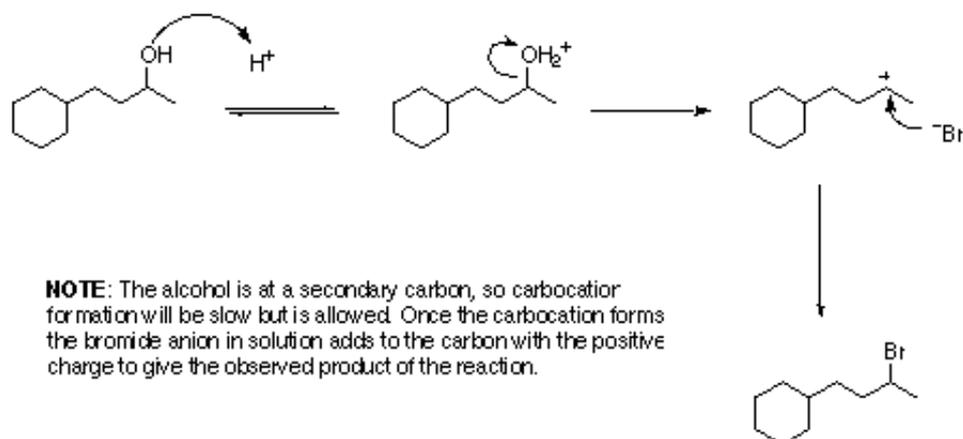


Question 1:

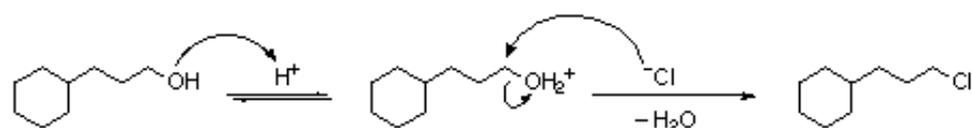


## Question 2

a) Mechanism is an  $S_N1$  reaction:

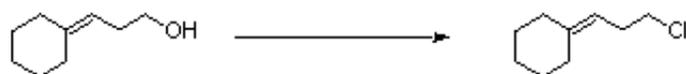


b) Mechanism is an  $S_N2$  reaction:

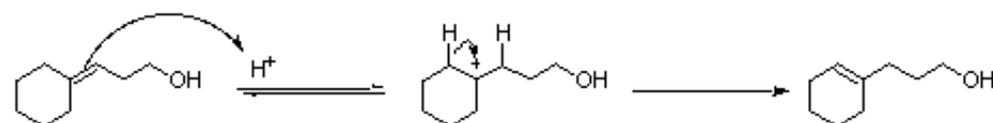


**NOTE:** Since the alcohol is a *PRIMARY* alcohol, it will get protonated but it *CANNOT* ionize to form a carbocation (remember that primary carbocations are not stable). Instead, the protonated alcohol hangs around until a chloride ion displaces the water from the carbon.

### Question 3: Perform the following transformation:



**Answer:** Use Thionyl Chloride and Pyridine ( $\text{SOCl}_2/\text{C}_5\text{H}_5\text{N}$ ) to perform the transformation without disrupting the double bond. If you use protic acid ( $\text{HCl}$ ), you risk the following:



We can reversibly protonate the double bond under forcing conditions.

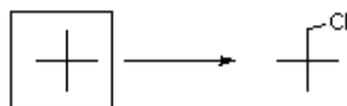
#### NOTE: IMPORTANT!!!!

You may notice that the  $3^\circ$  carbocationic intermediate looks like it can also be trapped with residual chloride ion to give a molecule at the tertiary carbon. I think this will also happen as a side effect from using  $\text{HCl}$  as an acid.

### Question 4:

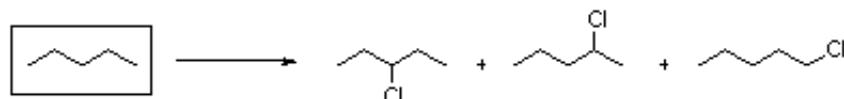
**Photochemical Chlorination Problems:** Use free-radical chemistry to chlorinate isomers of pentane ( $\text{C}_5\text{H}_{12}$ ).

a) Monochlorination giving only one possible product:



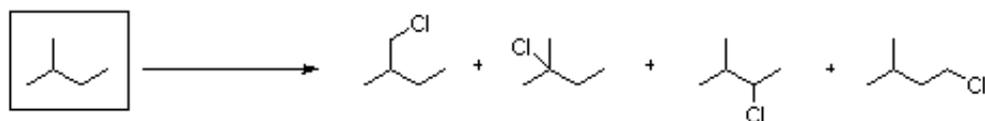
**Neopentane** gives just one product, since all 12 hydrogens are equivalent.

b) Monochlorination giving three possible products:



**n-Pentane** gives three products, since it has three different types of hydrogens.

c) Monochlorination giving four possible products:



**Isobutane** has four different types of hydrogens, giving four products.

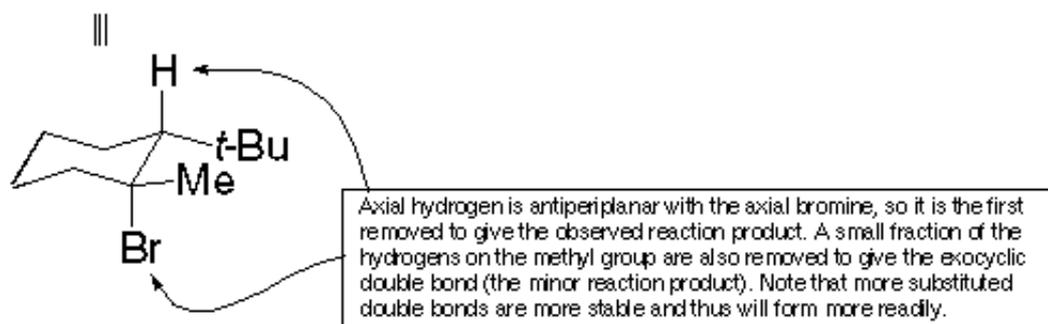
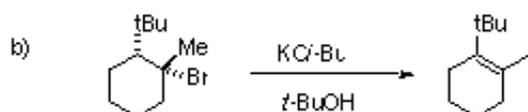
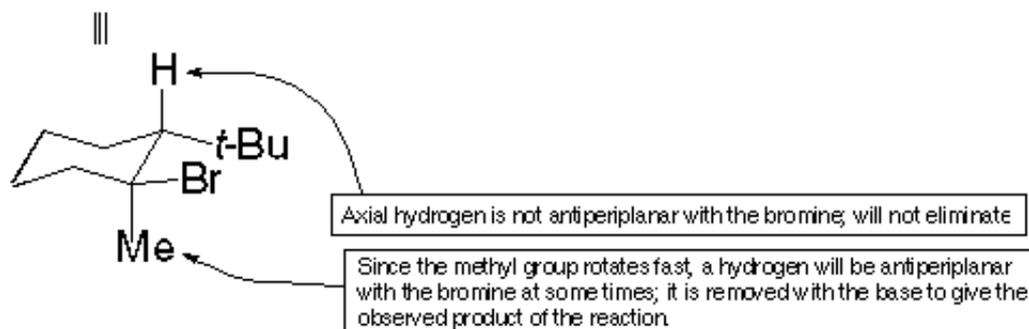
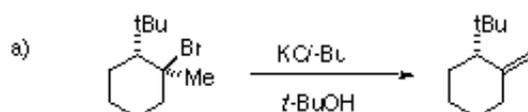
d) Dichlorination giving two possible products:



**Neopentane** gives only two possible products when two chlorines are added.

## Question 5

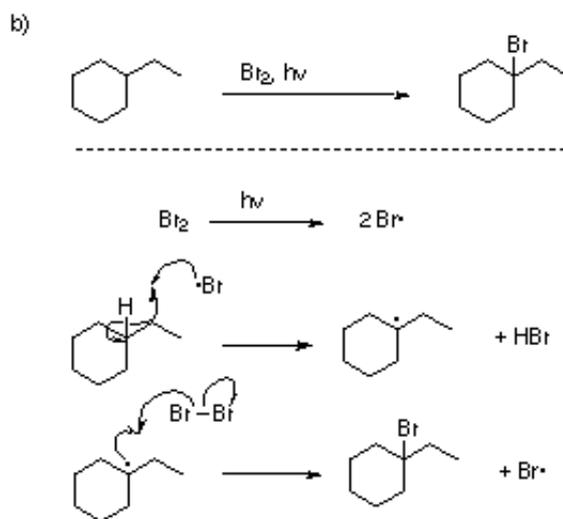
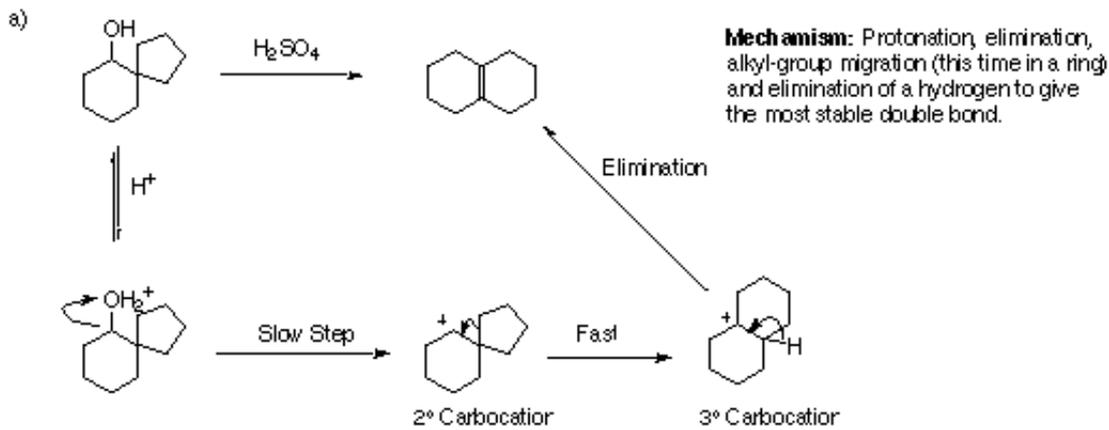
Explain by mechanisms the elimination of the cyclohexyl bromides below:



**E2** elimination proceeds with a strong base (we have one, potassium *tert*-butoxide). The hydrogen that will be removed must be antiperiplanar with the halogen.

## Question 6

SHOW THE MECHANISMS:



**RADICAL CHAIN MECHANISM** Light breaks the labile Br-Br bond; the bromine radicals abstract the 3° hydrogen on the molecule; the resulting carbon radical reacts with bromine molecules to give the product and bromine radicals to continue the chain. The H-Br bond is weak enough to give high selectivity for abstraction of 3° hydrogens over all other hydrogens.