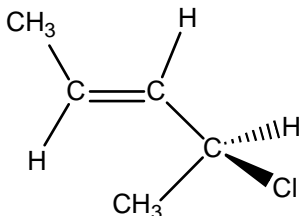


Alenes and Alkynes

Circle the letter corresponding to the best answer for questions 1 – 5.

1. What is the stereochemistry of the compound below?



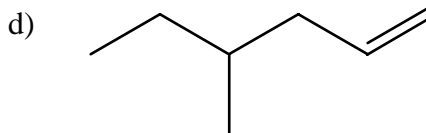
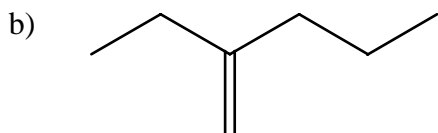
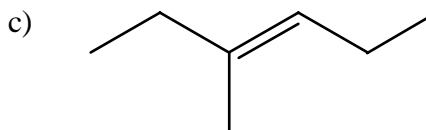
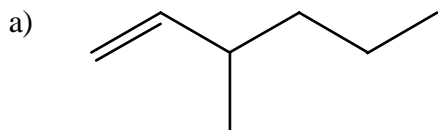
a) Z, 4R

b) E, 4R

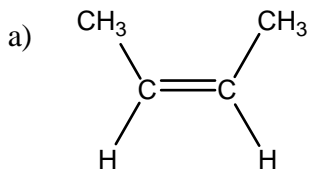
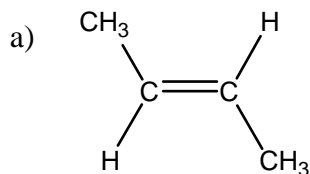
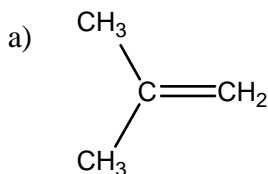
c) Z, 4S

d) E, 4S

2. Which of the following compounds is most stable?



3. Which of the following compounds is most stable?



a) They are equally stable

4. The pka of a terminal alkyne is approximately?

a) 18

b) 20

c) 25

d) 35

e) 44

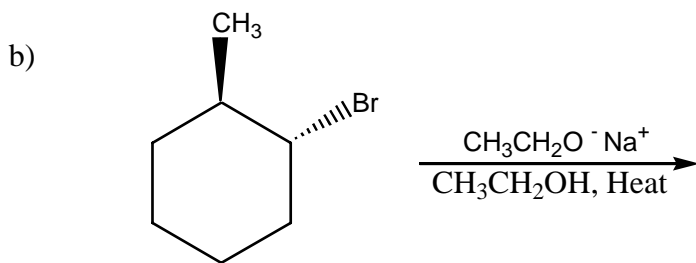
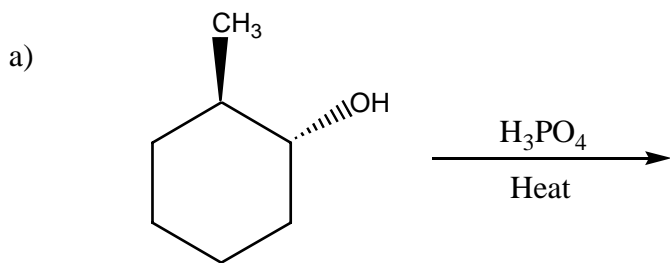
5. Acid – catalyzed dehydrations of secondary alcohols proceed via what kind of intermediate?

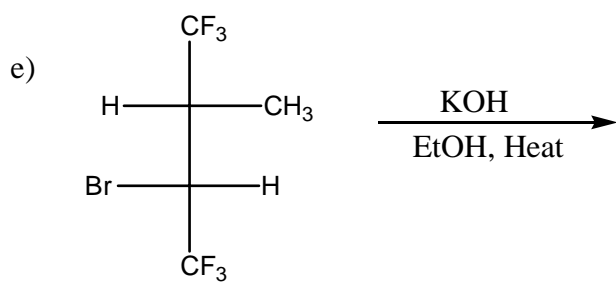
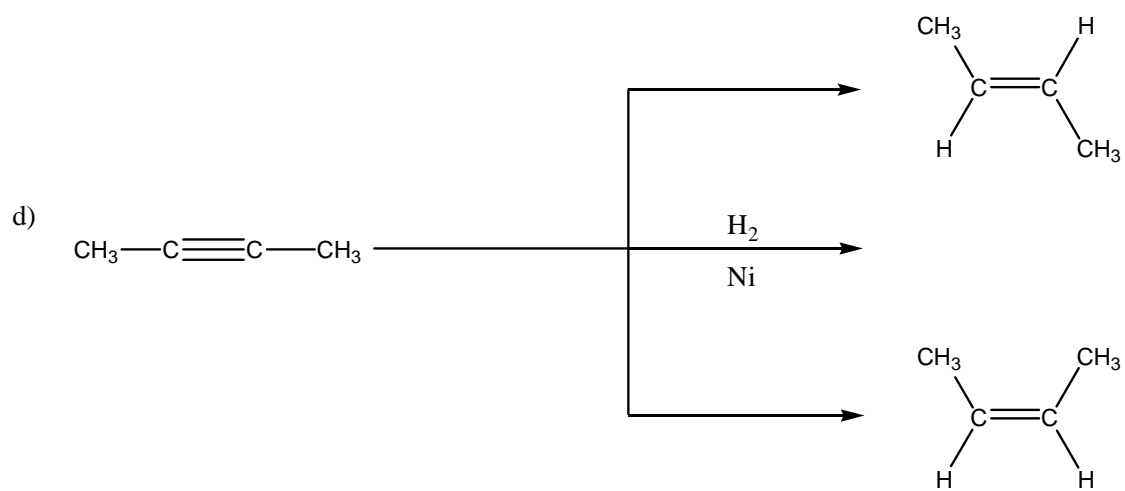
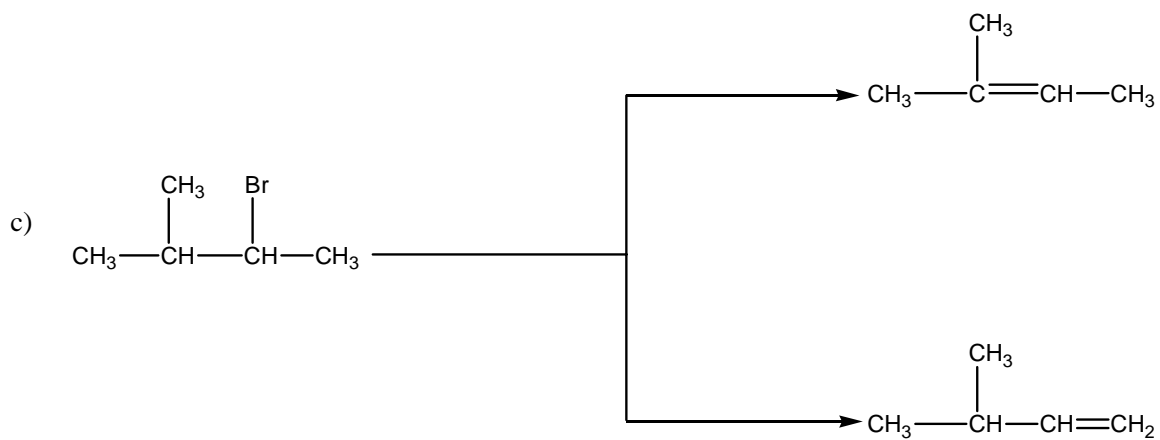
- a) carbanion
- b) carbocation
- c) free radical
- d) radical anion
- e) radical cation

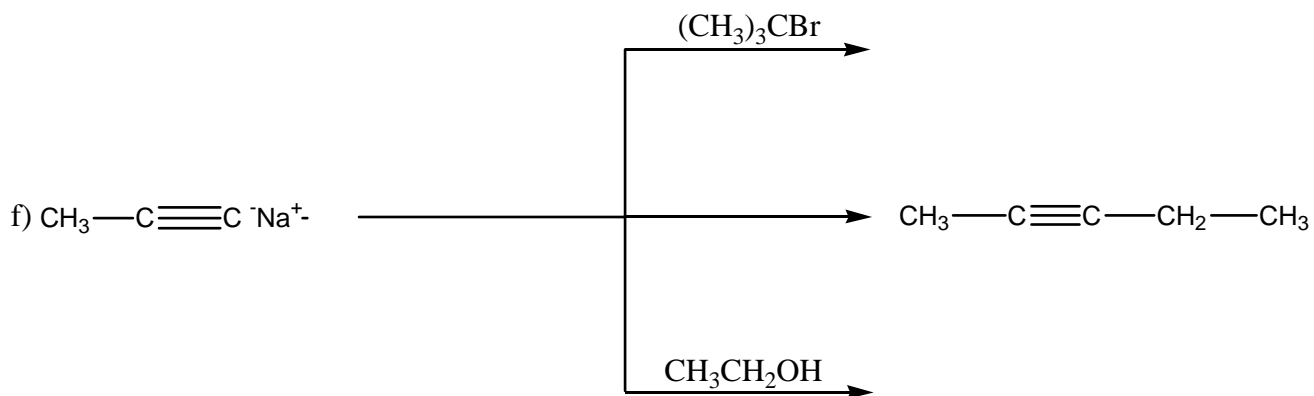
6. Caryophyllene has a molecular formula $C_{15}H_{24}$. Catalytic hydrogenation (H_2 , Pt) of caryophyllene yields a molecule with the formula $C_{15}H_{28}$. Assuming no triple bonds are present, caryophyllene has?

_____ double bonds
_____ rings

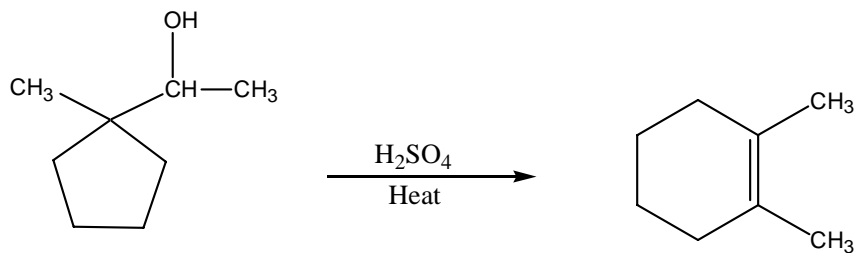
7. Complete the following reactions by providing either the major product or missing reagents:



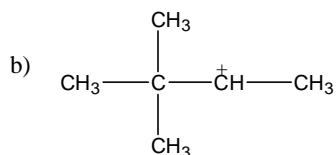
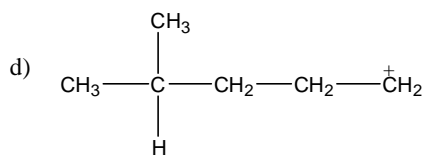
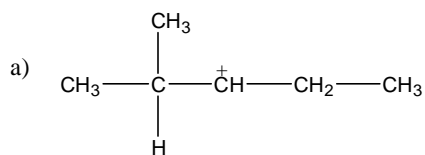




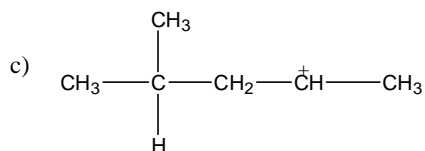
8. Using the curved – arrow formalism to show electron movement, provide a detailed (step – by – step) mechanism for the following reaction:



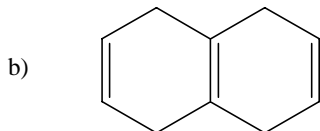
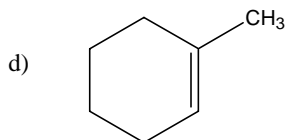
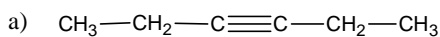
5. Which of the following cations would not undergo rearrangement?



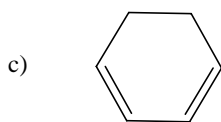
e) all of the above cations would undergo rearrangement



6. Which of the following compounds would give more than one product when subjected to ozonolysis followed by hydrolysis in the presence of zinc?



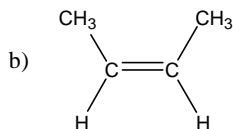
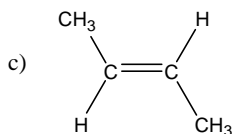
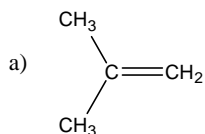
e) None of the above would give more than one product.



7. Which of the following is not an electrophile?

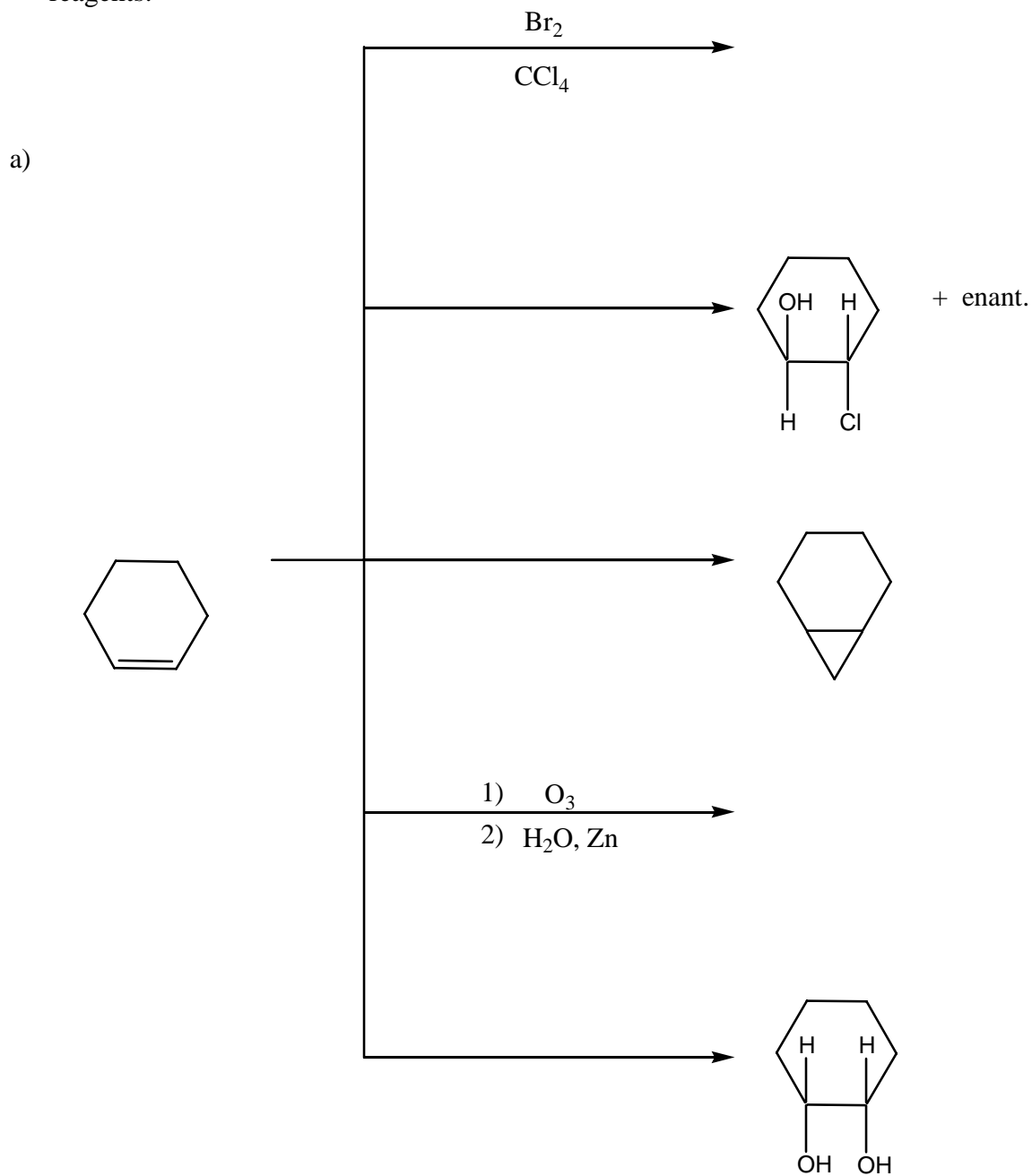
- a) H^+ b) NH_3 c) BF_3 d) Hg^{2+} e) BH_3

8. Which of the following alkenes would be most reactive towards acid – catalyzed hydration?

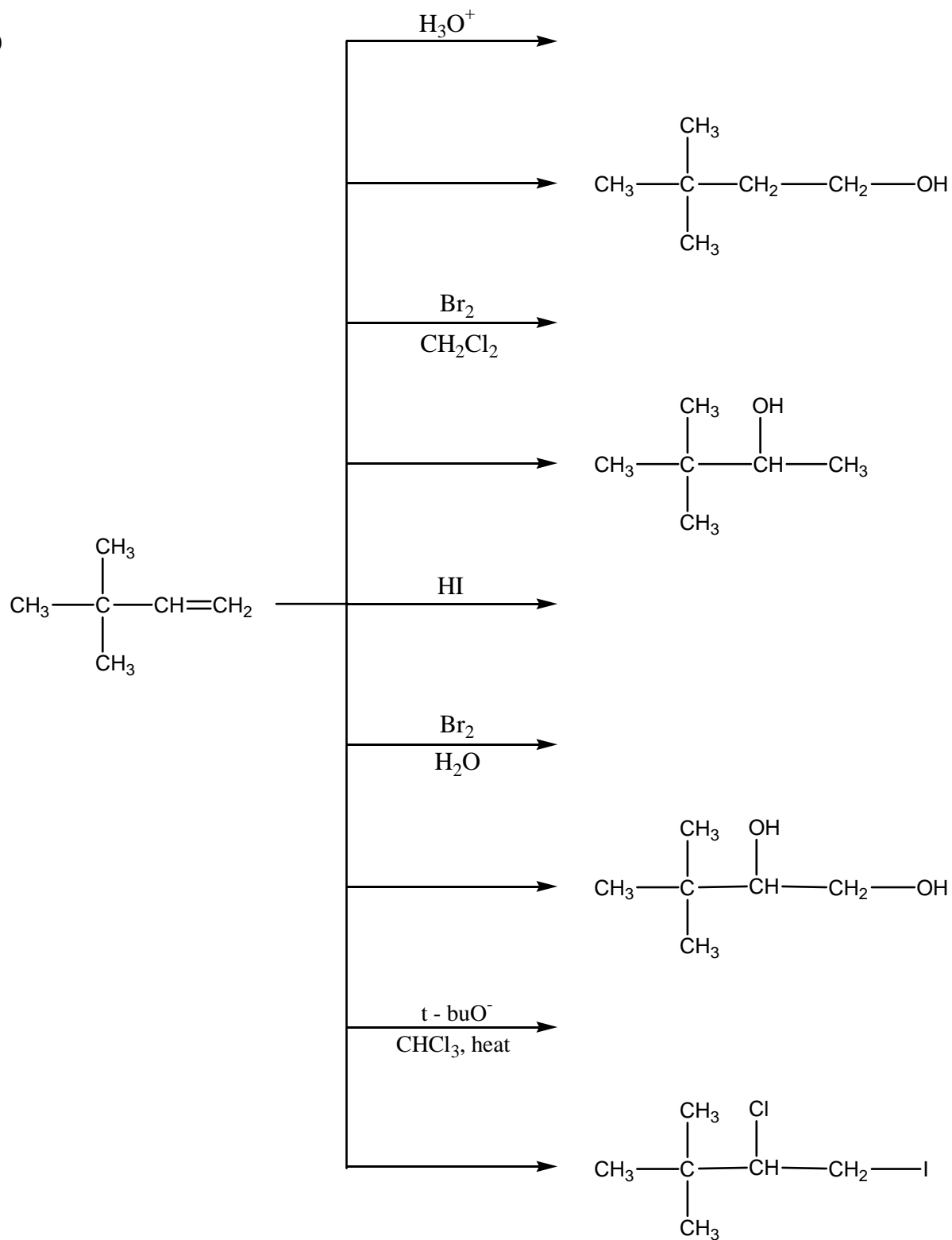


d) They are all equally reactive

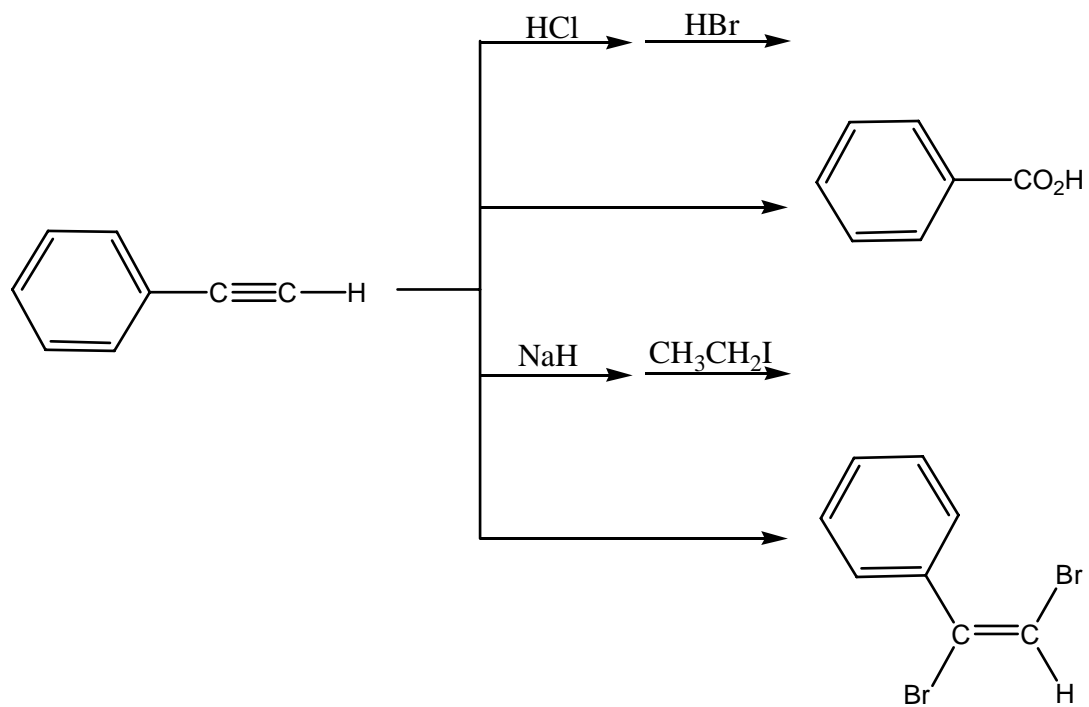
9. Complete the following reactions by providing either the major product or missing reagents:



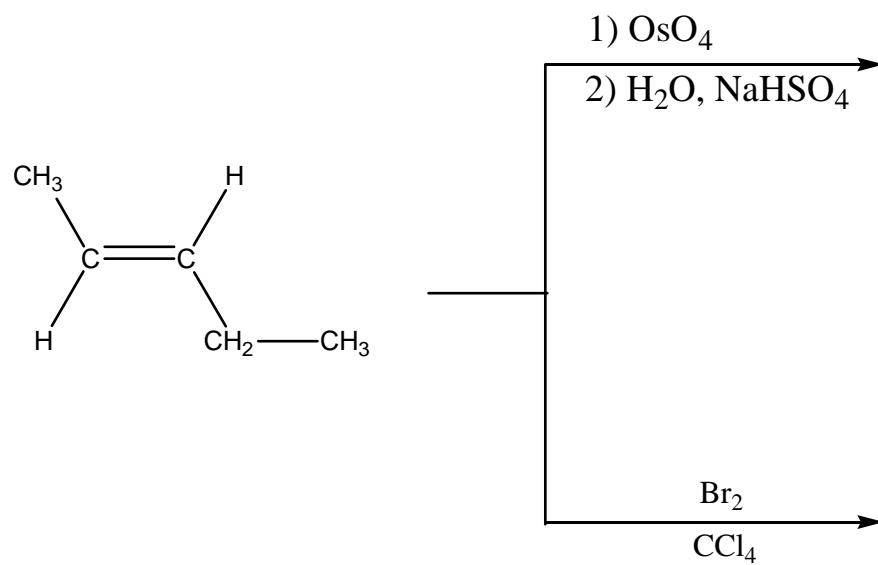
b)



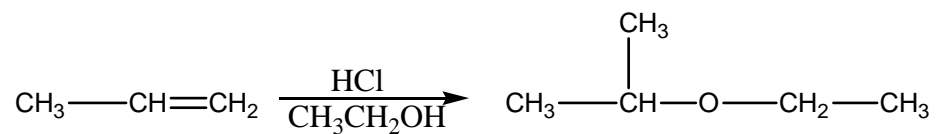
c)



d)



10. When propene is treated with hydrogen chloride in ethanol, one of the products of the reaction is ethylisopropylether.



Using the curved – arrow formalism to show electron movement, write a plausible mechanism (detailed, step - by – step) that accounts for the formation of this product.

11. Compound A, B and C all have the formula C_6H_{10} . All three compounds rapidly decolorize bromine in carbon tetrachloride. Compound C has an IR absorption (sharp, strong) at 3300 cm^{-1} , but compounds A and B do not. Compounds B and C both yield hexane when they are treated with hydrogen in the presence of a platinum catalyst. Under these conditions compound A gives a product with the formula C_6H_{12} . When A is oxidized with hot potassium permanganate the only organic product is $HO_2CCH_2CH_2CH_2CH_2CO_2H$. Similar oxidation of B gives only $CH_3CH_2CO_2H$ and C give only $CH_3CH_2CH_2CH_2CO_2H$. Provide the structures of A, B and C in the appropriate box below



Radical Reactions

Circle the letter corresponding to the **best** answer for questions 1 - 4.

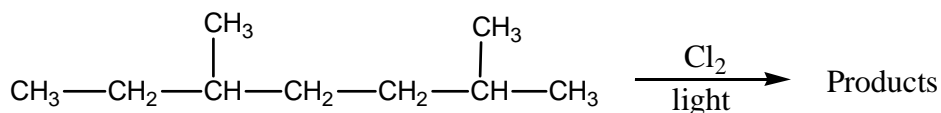
1. The hybridization of an alkyl radical is?

- a) sp b) sp² c) sp³ d) sp⁴

2. The geometry of a methyl radical is?

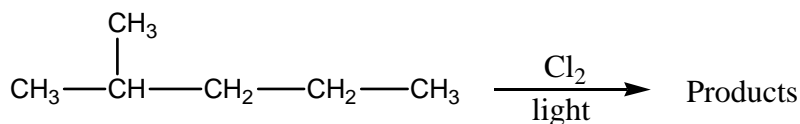
- a) tetrahedral d) linear
b) trigonal pyramid e) bent
c) trigonal planar

3. Ignoring stereoisomers, how many isomeric products are formed in a monochlorination of the compound below?



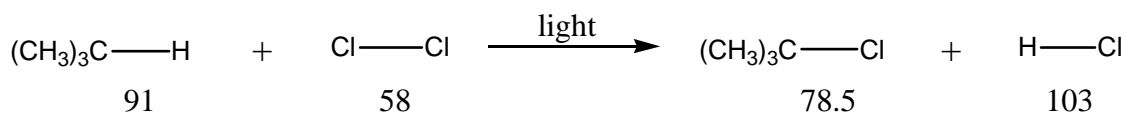
- a) 3 b) 4 c) 5 d) 6 e) 7 f) 8 g) 9

4. Including stereoisomers as separate compounds, how many isomeric products are formed in a monochlorination of the compound below?



- a) 5 b) 6 c) 7 d) 8 e) 9 f) 10

Consider the reaction below (with the indicated bond dissociation energies) in answering questions 5 and 6.



5. What is the overall ΔH for the reaction?

- a) + 58 b) - 32.5 c) + 32.5 d) - 57.5 e) + 181.5

6. What is the value of ΔH for the first propagation step?

- a) + 58.5 b) + 12.5 c) - 12.0 d) + 20.5 e) + 33.0

7. Which of the following statements is true when used to compare the reaction of chlorine with isobutene and the reaction of bromine with isobutene?

- a) Bromine is the more reactive and the more selective.
- b) Chlorine is the more reactive and the more selective.
- c) Bromine is the less reactive and the more selective.
- d) Chlorine is the less reactive and the more selective.
- e) None of the above is true.

8. Which of the following would not undergo rearrangement?

- a) $\text{CH}_3\text{---CH}_2\text{---CH}_2\text{---}\dot{\text{C}}\text{H}_2$
- b) $\begin{array}{c} \text{CH}_3 \\ | \\ \text{CH}_3\text{---CH---}\dot{\text{C}}\text{H---CH}_3 \end{array}$
- c) $\text{CH}_3\text{---CH}_2\text{---}\dot{\text{C}}\text{H---CH}_3$
- d) $\begin{array}{c} \text{CH}_3 \\ | \\ \text{CH}_3\text{---C---}\dot{\text{C}}\text{H}_2 \\ | \\ \text{CH}_3 \end{array}$
- e) All of the above

9. Which of the following radicals is most stable?

- a) $\begin{array}{c} \text{CH}_3 \\ | \\ \text{CH}_3\text{---CH---CH}_2\text{---}\dot{\text{C}}\text{H}_2 \end{array}$
- b) $\begin{array}{c} \text{CH}_3 \\ | \\ \text{CH}_3\text{---CH---}\dot{\text{C}}\text{H---CH}_3 \end{array}$
- c) $\begin{array}{c} \text{CH}_3 \\ | \\ \text{CH}_3\text{---}\dot{\text{C}}\text{---CH}_2\text{---CH}_3 \end{array}$
- d) $\begin{array}{c} \text{CH}_3 \\ | \\ \dot{\text{C}}\text{H}_2\text{---CH---CH}_2\text{---CH}_3 \end{array}$
- e) They are all equally stable

10. Consider the light – initiated chlorination of (R) - 2 – bromobutane followed by careful fractional distillation of all the products with the formula C₄H₈ClBr. How many fractions would be obtained and how many of these fractions would be optically active?

	<u>Total Fractions</u>	<u>Optically Active Fractions</u>
a)	3	3
b)	4	3
c)	5	5
d)	5	4
e)	5	3

11. Initiation of free radical reactions often involves?

- | | |
|--------------|---------------------|
| a) heat | d) a and b above |
| b) light | e) a, b and c above |
| c) peroxides | |

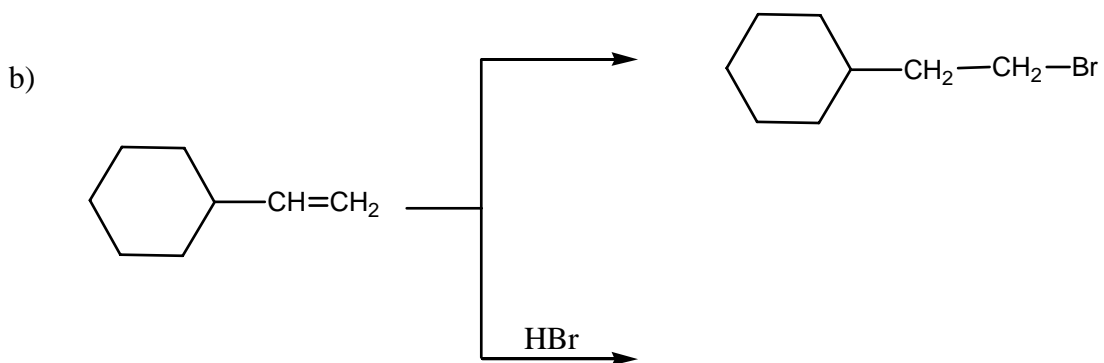
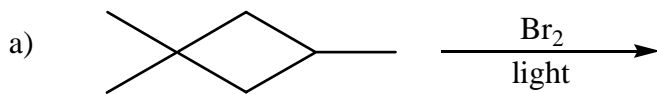
12. An example of a reaction having a free energy of activation of zero would be?

- a) $\text{Br}^\bullet + \text{Br}-\text{Br} \longrightarrow \text{Br}-\text{Br} + \text{Br}^\bullet$
- b) $\text{F}^\bullet + \text{CH}_4 \longrightarrow \text{HF} + \text{CH}_3^\bullet$
- c) $\text{CH}_3^\bullet + \text{CH}_3-\text{CH}_3 \longrightarrow \text{CH}_4 + \text{CH}_3-\text{CH}_2^\bullet$
- d) $\text{CH}_3^\bullet + \text{Cl}^\bullet \longrightarrow \text{CH}_3\text{Cl}$
- e) More than one of the above

14. Assume the relative reactions of 3°, 2° and 1° alkane hydrogens in free radical chlorination reactions are 5:3:1, respectively. Monochlorination of pentane should yield what percentage of 3 – chloropentane?

- a) 6 b) 16 c) 25 d) 33 e) 50

15. Complete the following reactions by providing either the major products or the missing reagents:



16. Using the curved – arrow formalism to show electron movement, provide a detailed (step – by – step) mechanism for the reaction below.

