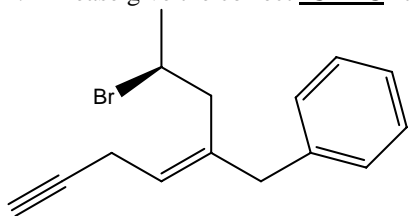


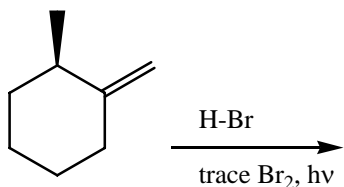
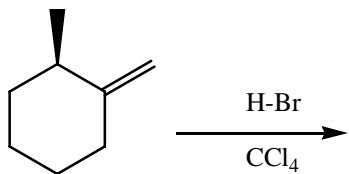
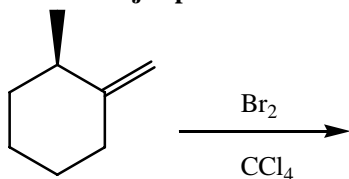
1. Please give the correct **IUPAC** name for the following compound (indicate E, Z, R, S, *cis* or *trans*, if needed). **3 pts**



2. Define each of the following: **6 pts**

- Regioselectivity-
- Enantiotopic hydrogens-
- Heterolytic cleavage

3. Predict the **major product** of each of the reactions below and show the **complete mechanism** for each reaction. **8 pts ea**



4. When 2-methyl propane is reacted with one mole of Cl_2 at 350°C two products are formed, but when 2-methyl propane is reacted with one mole of Br_2 at 350°C only one product is formed. **8 pts**
- Show the complete mechanism for bromination.
 - Show the products for each reaction (chlorination and bromination).
 - Calculate statistically the % of each halogenated product you would expect to form and state why bromination only yields one product vs. the statistical calculation.

a)

b)

c)

5. An unknown compound is analyzed by mass spectrometry. What is the molecular formula of the compound? **Show your work!**
8 pts

MS data

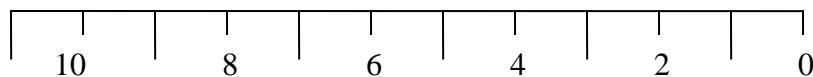
M/z	% of base
78	24 (M^+)
79	0.8 ($M+1$)
80	8.0 ($M+2$)

Natural Abundance of contributors to					
M+1			M+2		
com	hvy	%	com	hvy	%
^1H	^2H	0.016	^{16}O	^{18}O	0.2
^{12}C	^{13}C	1.11	^{32}S	^{34}S	4.4
^{14}N	^{15}N	0.38	^{35}Cl	^{37}Cl	32.5

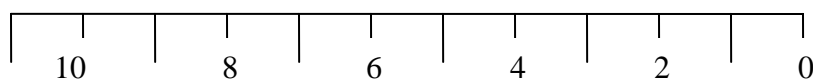
(%=# of hvy atoms per 100 common atoms)

6. Draw an H-NMR spectrum for each of the following compounds. Indicate each peak using single vertical lines showing the splitting (*e.g.*, a quartet would be shown as 4 vertical lines whose heights are 1:3:3:1) and estimate the chemical shift of each peak. **8 pts**

$\text{CH}_3\text{CH}_2\text{OCHO}$

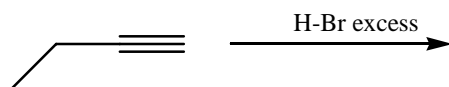
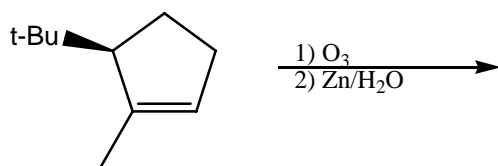
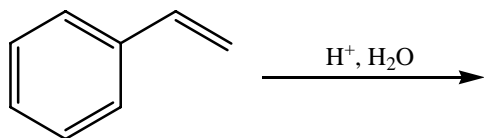
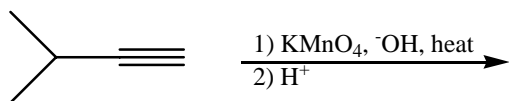
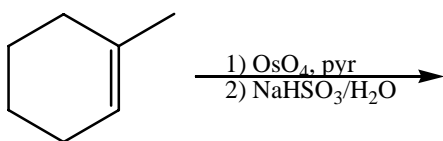
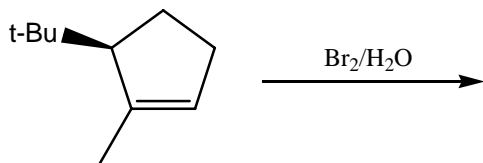
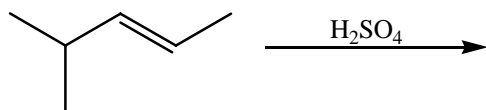


(para) $\text{CH}_3\text{C}_6\text{H}_4\text{OCH}_3$
[p-methoxy methyl benzene]

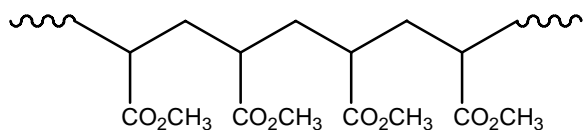


24 total

7. Predict the major product(s) in the following reactions: **3 pts each**



8) Indicate the repeat unit within the following polymer chain and then draw the monomer from which it came. **3 pts**



9. Spectroscopy

A. (8 points) Write the structure of the unknown compound that gives the data shown.

Molecular formula: $C_{12}H_{18}$

Calculate IHD =

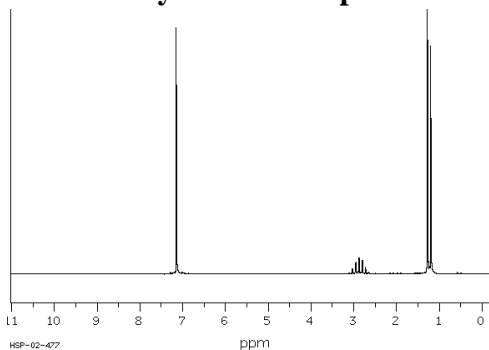
The molecular ion (parent ion) in the mass spectrum would be expected at m/z =

Given 1H -NMR data, indicate which groups and how many are at each peak:

a 7.1 ppm, 4 H, broad singlet

b 2.3 ppm, 2 H, septet

c 1.3 ppm, 12 H, doublet



The ^{13}C -NMR shows just four peaks, two in the aromatic region and two in the aliphatic region. What is the correct structure of the compound based on the ^{13}C -NMR?

B. (8 points) Write the structure of the unknown compound that gives the data shown.

Molecular formula: $C_8H_{18}O_2$

Calculate IHD =

The IR spectrum does NOT show any peaks in the range $3200-3600\text{ cm}^{-1}$ nor in the range $1600-1800\text{ cm}^{-1}$. Indicate what you conclude from these data.

Given 1H -NMR data, indicate which groups and how many are at each peak:

a 5.2 ppm, 1 H, quartet

b 3.3 ppm, 2 H, quartet

c 2.3 ppm, 3 H, doublet

d 1.7 ppm, 3 H, triplet

e 1.5 ppm, 9 H, singlet