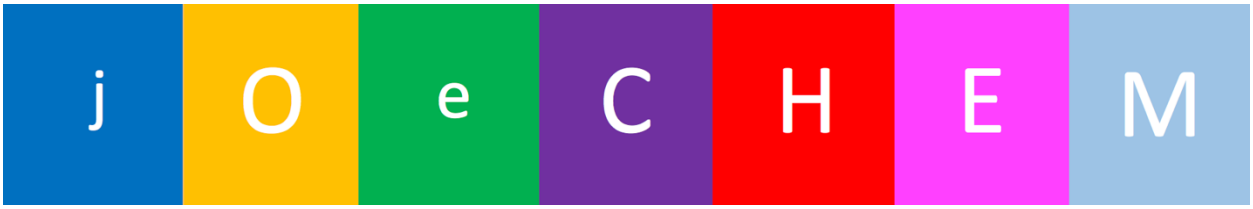
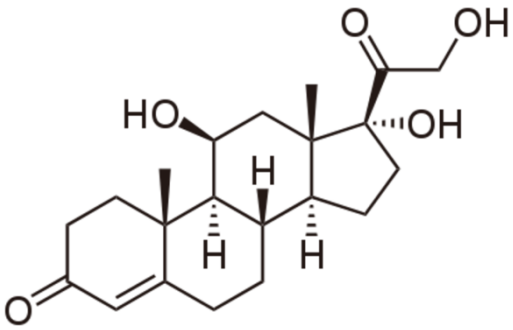
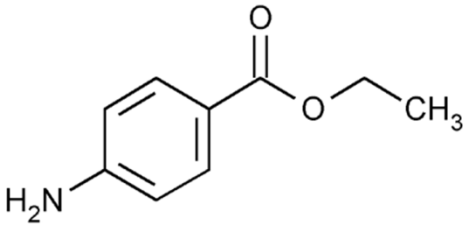
Organic Chemistry I

Exam 1

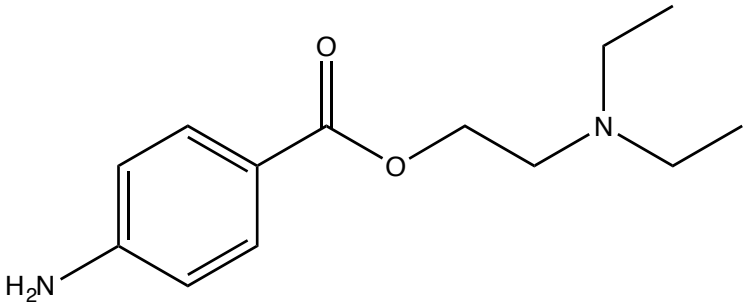


1.) The structures of the stress hormone cortisol (left) and the topical painkiller benzocaine (right) are given below. Identify ***AT LEAST*** 5 functional groups ***between*** the 2 molecules.





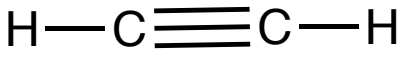
2.) The anesthetic drug procaine is depicted below. Given the structure, count the total number of BOTH ***carbons*** and ***hydrogens***.



# of Hydrogens: _____

# of Carbons: _____

3.) Given the Lewis Structure of acetylene below (the common name for ethyne, remember?), draw an orbital diagram, illustrating all orbital overlaps, both sigma and pi. Label each orbital with its appropriate hybridization (e.g. a C-H bond in CH_4 would be a sigma bond, with an s orbital from the H overlapping with a sp_3 orbital from the C).



4.) Draw the Lewis Structure of the following molecules given below. Then, draw at least ***ONE*** resonance structure for each molecule. Include formal charges

a.) Azide ion N_3^- (hint: skeleton structure is NNN)

b.) Sulfate ion SO_4^{2-} (hint: S is central atom)

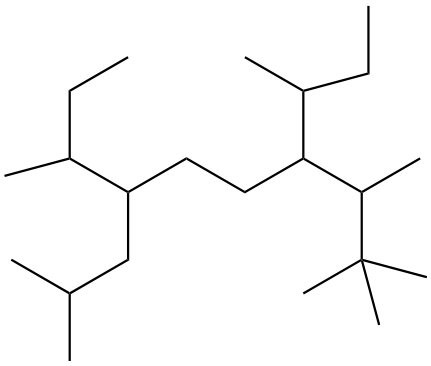
c.) Referencing the structures drawn in part b.), provide a **BRIEF** explanation as to why H_2SO_4 is a strong acid (wordy, long answers will result in a point deduction—this is a short answer).

5.) Given the following IUPAC names, draw the correct structure in bond-line form.

a.) 4-isopropyl-3,3,5-trimethyloctane

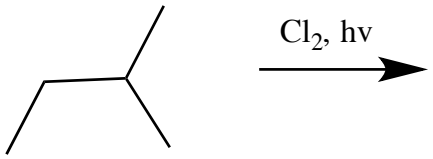
b.) 5-(2-bromo-1-methylethyl)-3-(1-chloroethyl)-2,2-dimethyloctane

6.) Provide the correct IUPAC name for the structure illustrated below.



7.)

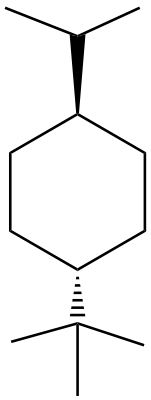
a.) Given the following free radical chlorination reaction, provide all of the unique, mono-chlorinated products formed.



b.) Draw the reaction mechanism of the above free radical chlorination, forming the thermodynamically favored product from part a.) (thermodynamically favored = most stable, remember?). **Show ONE termination step**.

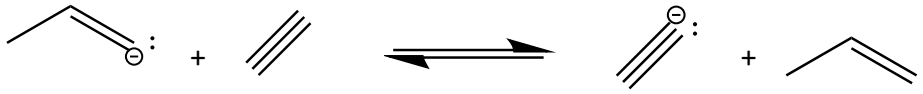
8.) With the structure of **2-bromo-3-ethyl-4-methylpentane**, draw the LEAST STABLE STAGGERED Newman Projection. Draw the projection about the C2-C3 bond axis (aka, use the 2nd and 3rd carbons as the circle and the dot carbons).

9.) Given the flat, bond-line structure of the disubstituted cyclohexane derivative below, draw the MOST stable chair conformation.



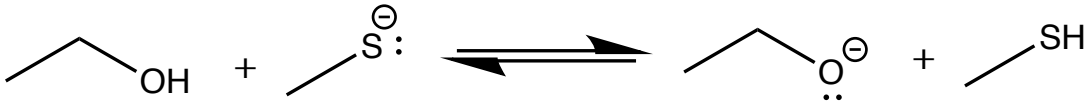
10.) Given the following acid-base equilibrium equations, predict the favored side of the reaction by **circling** the correct side, and provide "Acid-Base Property" we had discussed in class that helped you come to this conclusion.

a.)



b.) $NH_3 + :\overset{\ominus}{P}H_2 \rightleftharpoons :\overset{\ominus}{N}H_2 + PH_3$

c.)



11.) Below are 2 structures, both containing an asterisked hydrogen atom. Circle the structure that contains the **more** acidic hydrogen, and (like above), give the reason as to why the hydrogen selected is more acidic than the other.