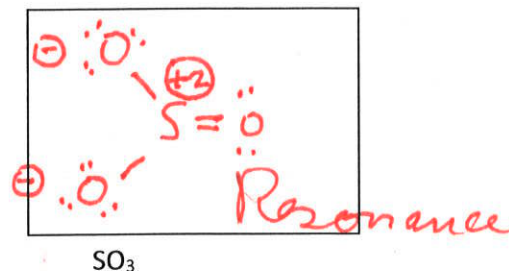
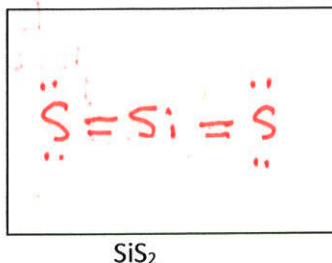
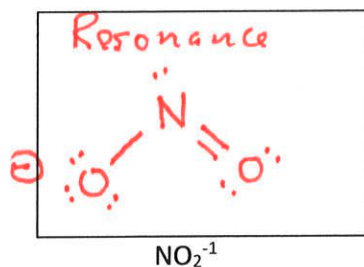


Exam 1 Organic Chemistry 3514
Alfred State College 9 October 2015

Your name: Answers 1 pt _____/100 pts

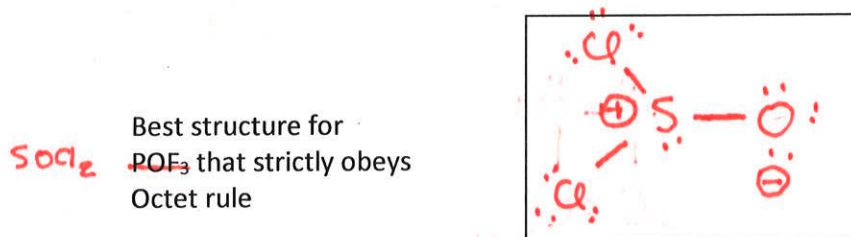
1.1. Lewis Model Bonding Part 1 (9 pts total/3 pts each)

Sketch the most stable Lewis structures that strictly obey the octet rule for the compounds below:
(include formal charges, lone pairs & indicate if symmetric resonances are present when necessary by writing 'RES')

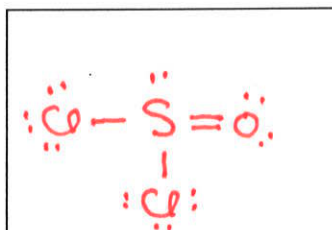


1.2. Lewis Model Bonding Part 2 (9 pts total/ 3 pts each)

- a) Draw the best structure for neutral SOCl_2 that strictly obeys the octet rule and indicate where the formal charges are likely to be. Assume O and the two Cl are bonded to a central S.



- a) If we relax the octet rule but insist on minimizing formal charge, what is the best structure for SOCl_2 ?
(Include all formal charges, lone pairs).



- b) With the help of appropriate Lewis models, explain why CO is over 200 times more likely to react with the iron in your blood than O_2 ?

Formal charge on C in CO electrostatically binds strongly to Fe^{3+} in hemoglobin. O_2 has no such charge - no formal charge

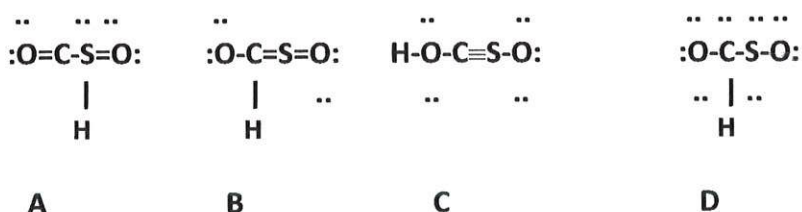
$\ominus : \text{C} \equiv \text{O} : \oplus$

$\ddot{\text{O}} = \ddot{\text{O}} \leftarrow$

_____/19 includes name

1.3. Lewis Model Bonding Part 3 (11 pts total)

a) Consider the 4 compounds below:



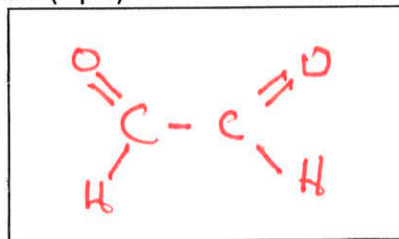
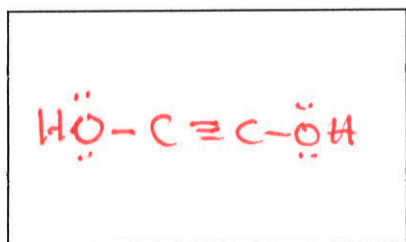
Which compound(s) (if any) contain S with a +2 formal charge ? B, C
 Which compound(s) (if any) contain an O with a +1 charge ? B, D
 Which compound(s) (if any) contain C with a +1 charge ? A
 Which compound(s) (if any) contain O with a -1 charge ? C, D
 Which compound(s) (if any) contain have C with 0 (neutral) charge ? B, C
 Which compound has an overall 0 charge (e.g. is neutral): (circle your choice)

A **B** **C** **D** none

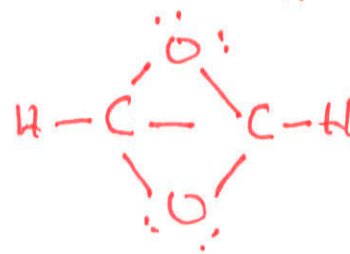
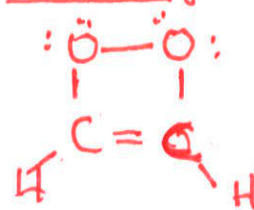
b) For each pair below, circle the compound that is most stable using the rough Lewis model reactivity rules: (1 pt each/3 pts total)

i) CH_3F vs. CH_4 ii) NO_2 vs. NO_2^{-1} iii) CO vs. CO_2 c) Draw both structures with the empiric formula $\text{C}_2\text{H}_2\text{O}_2$ that satisfies the octet rule and results in zero formal charge on all the atoms. Show all lone pairs (2 pts)

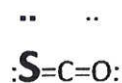
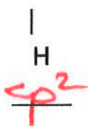
Several
possibilities
(4)



Also rings:



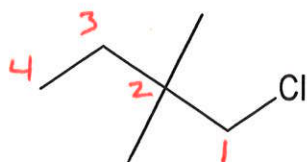
1.4. Pauling's Localized Hybrid Bonding Model (6 pts total/1 pt each)

a) Identify the hybridization on the **bolded** elements in the compounds below: sp^2  sp^2  sp  sp^3 b) In the Pauling Valence bond model the number of atomic orbitals must = the number molecular orbitals.c) The pi bond lies above/below on the same axis as the line connecting the participating atoms.
(circle your choice)

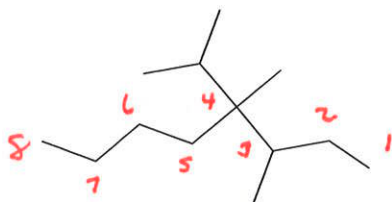
___/17

1.5 Nomenclature of Alkanes (16 pts total)

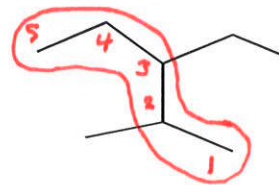
a) Using just IUPAC rules, name the compounds below: (2 pts each)



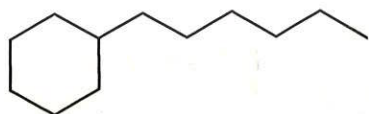
1-chloro-2,2-dimethylbutane



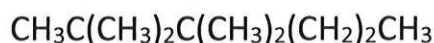
4-(1-methylethyl)-3,4-dimethyloctane



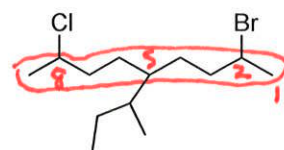
3-ethyl-2-methylpentane



hexylcyclohexane

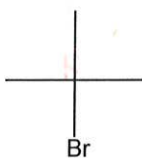


2,2,3,3-tetramethylhexane

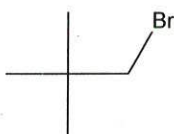


2-bromo-8-chloro-5-(1-methylpropyl)nonane

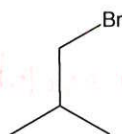
b) Provide common names for the compounds below: (4 pts total/1 pt each)



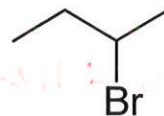
tert-butyl bromide
(tert-butyl bromide)



neopentyl bromide



isobutyl bromide



sec-butyl bromide

1.6. Functional groups (8 pts)

Supply the name or chemical equivalent for the functional group designations below:

$\text{RCOR}' =$ ketone

$\text{R-COOH} =$ Carboxylic acid

Example of an aldehyde CH_3CHO (RCHO)

example of an ester = $\text{CH}_3\text{-O-C(=O)CH}_3$ (RCOOR')

$\text{CH}_3\text{-CH=CH}_2$ is an example of a(n) alkene

example of an alcohol = CH_3OH (ROH)

example of an amine: $\text{CH}_3\text{-NH}_2$

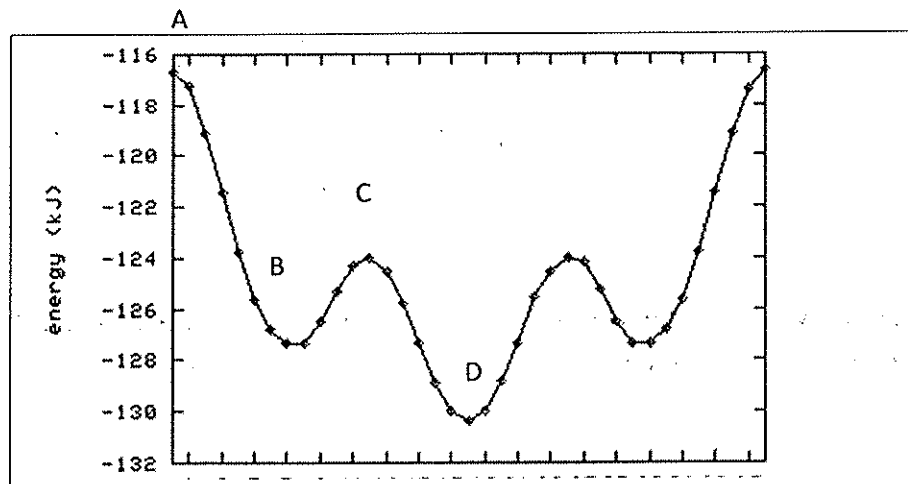
$\text{H}_2\text{N-C(=O)-R}$ is a(n) amide

($\text{NRR}'\text{R}''$)

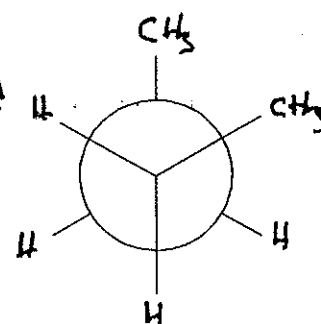
"R" = alkyl or H...

but must have at least one alkyl)

1.7 Ring and Rotational Isomer Language (13 pts total)



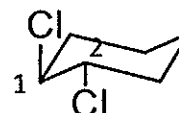
- a) ID the position where the butane structure is gauche B
 b) ID the position where the butane structure is anti D
 c) Which position are the methyls on C2 and C3 of butane eclipsing each other A
 d) Using the Neuman projection template to the right, draw the structure associated with a gauche butane configuration.



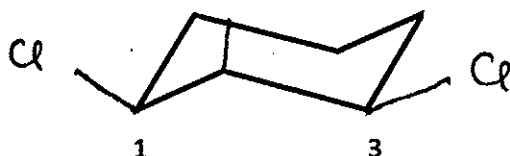
- e) Consider the dichloro ring compound shown on the right:

Provide the most complete name for it:

trans (ax, ax) 1,2-dichlorocyclohexane



- f) Sketch (eq, eq) 1,3-dichlorocyclohexane below:
 Whether it is cis or trans:



- g) (eq, eq) 1,3-dichlorocyclohexane is:

cis

trans (circle your choice)

- h) What ring conformation is drawn below? I am a(n) Boat ring conformer



- i) Decide whether the proposed structures can exist (assuming chair form): Circle your choice

1) trans (eq, ax) 1,2-dimethylcyclohexane

yes

no

2) cis (eq, eq) 1,4-dimethylcyclohexane

yes

no

3) cis (ax, ax) 1,2-dimethylcyclohexane

yes

no

4) trans (eq, ax) 1,3-dichlorocyclohexane

yes

no

you can use plastic models provided to help you decide

1.8 Free Radical Chemistry of Alkanes (26 pts total)

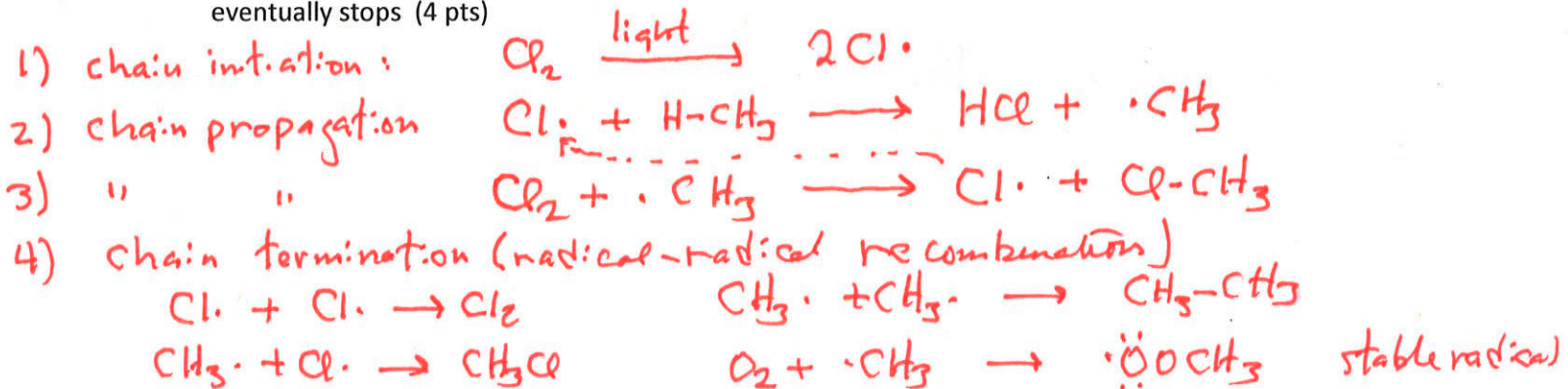
a) Write down 5 facts that characterize the reaction behavior of methane under free radical halogenations.

- Must use heat ($T > 250^\circ\text{C}$) or light to initiate reaction
- Wavelength of light must $\sim$ dissociation energy of halogen
- 1 photon causes many reactions (high photo yield)
- O_2 quenches reaction
- Rate of reaction varies as $\text{F}_2 > \text{Cl}_2 > \text{Br}_2 > \text{I}_2$

b) What are the two new key facts connected to free radical halogenation of higher alkanes? (2 pts)

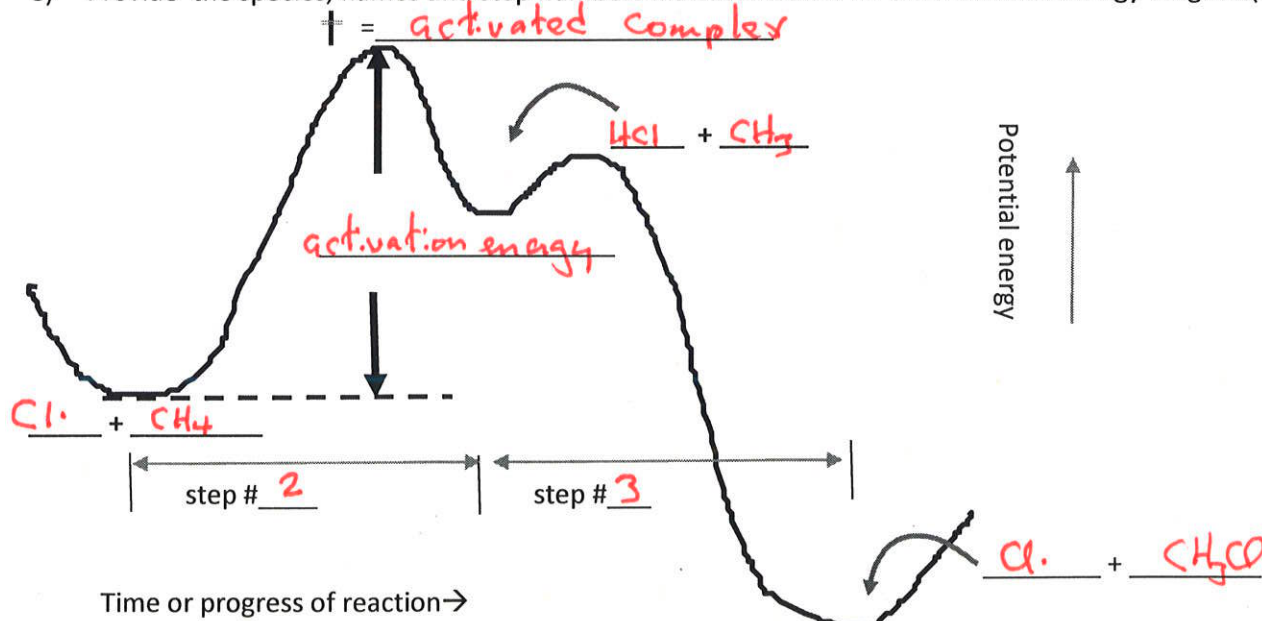
- $3^\circ > 2^\circ > 1^\circ > 0^\circ$ in reactivity
- Br_2 more selective than Cl_2

c) Write down the mechanism forwarded to explain the overall reaction including how the reaction eventually stops (4 pts)



d) Label the various steps with their assigned names next to the steps above (3 pts)

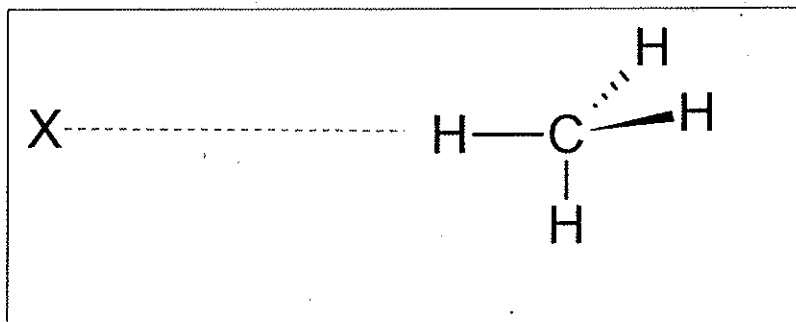
e) Provide the species, names and step numbers indicated below for the Activated Energy Diagram (10 pts)



1.8 Free Radical Chemistry of Alkanes (continued)

f) Assign the correct halogen ($X=F$ or $X=Br$) to the transition states 1 and 2 below: (2 pts)

Reaction A:

Transition state 1 $\Rightarrow X = \underline{F}$ Transition state 1Transition state 2 $\Rightarrow X = \underline{Br}$ Transition state 2