**Exam 1 Organic Chemistry 3514**

**Alfred State College 9 October 2015**

Your name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 1 pt \_\_\_\_\_\_/100 pts

* 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’)***

NO2-1 SiS2 SO3

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

a) Draw the best structure for **neutral** SOCl2  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.

Best structure for

POF3 that strictly obeys

Octet rule

1. If we relax the octet rule but insist on minimizing formal charge, what is the best structure for SOCl2?

*(Include all formal charges , lone pairs*).

1. 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 O2?

\_\_\_\_/19 includes name

* 1. **Lewis Model Bonding Part 3 ( 11 pts total)**

1. Consider the 4 compounds below:

**.. .. .. .. .. .. .. .. .. ..**

**:O=C-S=O: :O-C=S=O: H-O-C≡S-O: :O-C-S-O:**

**| | .. .. .. .. | ..**

**H H H**

**A B C D**

Which compound(s) (if any) contain S with a +2 formal charge ? \_\_\_\_\_\_\_

Which compound(s) (if any) contain an O with a +1 charge ? \_\_\_\_\_\_\_\_

Which compound(s) (if any) contain C with a +1 charge ? \_\_\_\_\_\_\_\_

Which compound(s) (if any) contain O with a -1 charge \_\_\_\_\_\_

Which compound(s) (if any) contain have C with 0 (neutral) charge ? \_\_\_\_\_\_

Which compound has an overall 0 charge (e.g. is neutral): **(circle your choice)**

**A B C D none**

1. For each pair below, circle the compound that is most stable using the rough Lewis model reactivity rules: (1 pt each/3 pts total)
2. **CH3F vs. CH4 ii) NO2 vs. NO2-1 iii) CO vs. CO2**
3. Draw both structures with the empiric formula C2H2O2 that satisfies the octet rule and results in zero formal charge on all the atoms. Show all lone pairs (2 pts)
   1. **Pauling’s Localized Hybrid Bonding Model (6 pts total/1 pt each)**
4. Identify the hybridization on the **bolded** elements in the compounds below:

**..** .. ..

:**S**=C=O: H2C=**P**=O HO-**C** ≡CH O-**N**-o

| |

H O

\_\_\_\_ \_\_\_\_ \_\_\_\_ \_\_\_

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.

\_\_\_/17 (circle your choice)

**1.5 Nomenclature of Alkanes (16 pts total)**

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









CH3C(CH3)2C(CH3)2(CH2)2CH3

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



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









\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* 1. **Functional groups (8 pts)**

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

RCOR’= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ R-COOH = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Example of an aldehyde\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ example of an ester =\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

CH3 -CH=CH2 is an example of a(n) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ example of an alcohol=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

example of an amine: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ H2N-C=O is a(n) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**|**

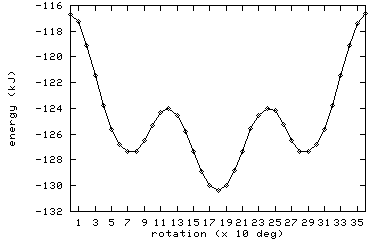
**R**

**\_\_\_/24**

* 1. **Ring and Rotational Isomer Language (13 pts total)**

**A B C D**

A

[](http://www.google.com/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0CAcQjRxqFQoTCPKvmfLmqcgCFQlYPgodzqcM8w&url=http://www.cmbi.ru.nl/mol4d/index.html/nalkanesconf/jv/exer3.html&psig=AFQjCNHHbeSoZtQ2iiSTnGUqkDY2hFOrSQ&ust=1444081876713960)

C

B

D

1. ID the position where the butane structure is gauche \_\_\_\_\_\_
2. ID the position where the butane structure is anti \_\_\_\_\_



c) Which position are the methyls on C2 and C3 of butane eclipsing each other

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 :

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 2

1

f) Sketch (eq, eq) 1,3-dichlorocyclohexane below:

Whether it is cis or trans:



**1 3**

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

**cis trans (circle your choice)**

h) What ring conformation is drawn below ? **I am a(n) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 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** *you can use plastic*

**3) cis (ax,ax) 1,2-dimethylcyclohexane yes no** *models provided*

**4) trans (eq,ax) 1,3-dichlorocyclohexane yes no**  *to help you decide*

**\_\_\_/13**

* 1. **Free Radical Chemistry of Alkanes ( 26 pts total)**

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

i) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

ii) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

iii) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

iv) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

v) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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

**(1) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**(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)

=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Potential energy

**\_\_\_\_\_ + \_\_\_\_\_\_**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**\_\_\_\_\_ + \_\_\_\_\_\_\_\_\_**

step #\_\_\_\_ step #\_\_\_

\_\_\_\_\_\_\_\_ + \_\_\_\_\_\_\_\_\_

Time or progress of reaction🡪

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* 1. **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=> X= \_\_\_\_\_\_\_\_\_\_\_**

**Transition state 1**



**Transition state 2=> X= \_\_\_\_\_\_\_\_\_\_\_**

**Transition state 2**



\_\_\_\_/2