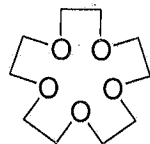
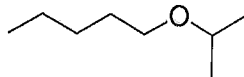


I. Nomenclature:

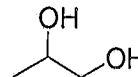
1. Provide the common name for each of the following structures. (9 points)



15-crown-5

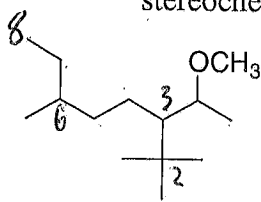


isopropylpentyl ether

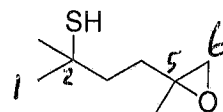


propylene glycol

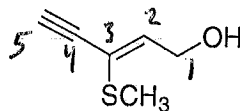
2. Using IUPAC rules, correctly name each structure below. Indicate correct stereochemistry where needed. (15-points)



3-(1-methoxyethyl)-2,2,6-trimethyloctane

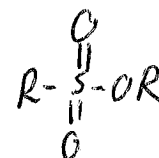
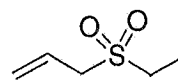
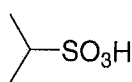
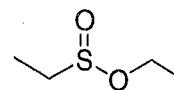
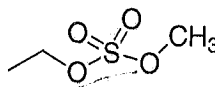
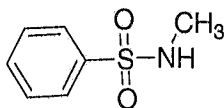
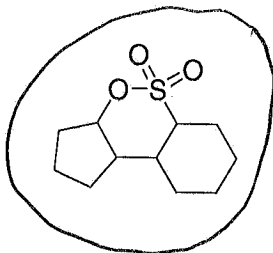


2,5-dimethyl-5,6-epoxyhexane-2-thiol



(Z) 3-methylthiopent-2-en-4-yn-1-ol

3. Circle all structures below that contain a sulfonate ester. (4 points)



II. Theory:

1. Circle all of the following values that has an impact on the thermodynamics of a reaction. (6 points)

(a)  $\Delta H$

(b)  $K_{eq}$

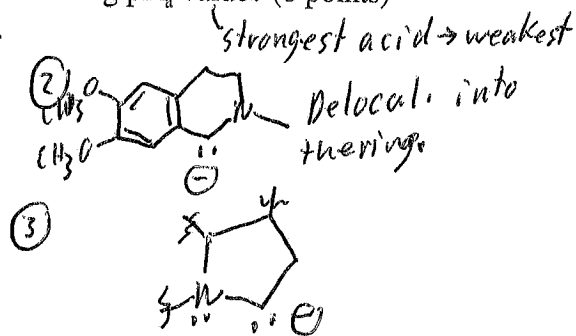
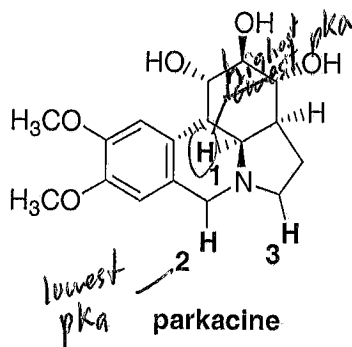
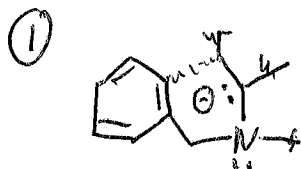
c)  $k$

(d)  $\Delta S$

e)  $E_a$

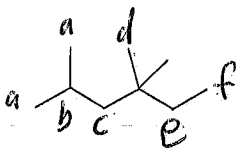
$$\Delta G = \Delta H - T\Delta S$$

2. The following structure was reported in *Tetrahedron Letters*, 2012, 123. Which sequence ranks the following protons in order of increasing pK<sub>a</sub> value? (6 points)



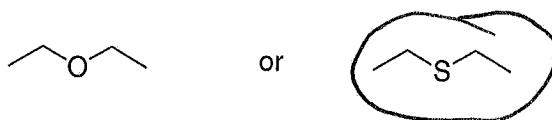
- a) 1<2<3    **b) 2<3<1**    c) 3<1<2    d) 3<2<1    e) 2<1<3    f) 1<3<2

3. How many monochlorination products would result from the chlorination of the following hydrocarbon? (4 points)

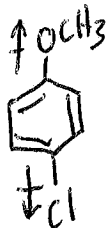
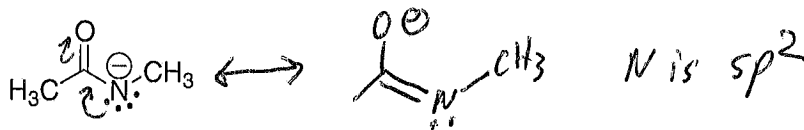


- a) 4    b) 5    **c) 6**    d) 7    e) 9

4. Circle the strongest nucleophile in the pair below. (4 points)



5. State the hybridization of nitrogen in the structure below. (4 points)



6. Which isomer of chloroanisole has the smallest molecular dipole moment? (3 points)

- a) cis    **b) para**    c) meta    d) vicinal    e) ortho

7. If a compound has a molecular formula of C<sub>11</sub>H<sub>21</sub>N<sub>2</sub>OCl, how many degrees of unsaturation does it have? (3 points)

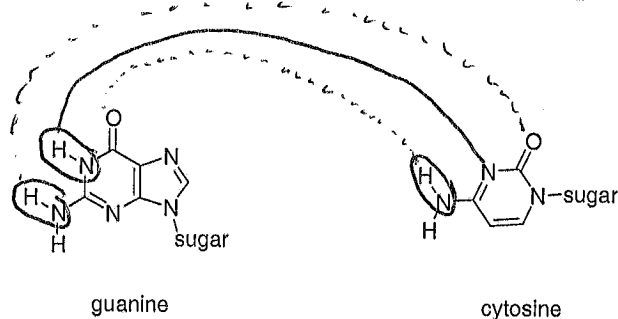
$$2(11) + 2 + \frac{N}{2} - \frac{Cl}{1}$$

$$22 + 3 = 25 \text{ H's}$$

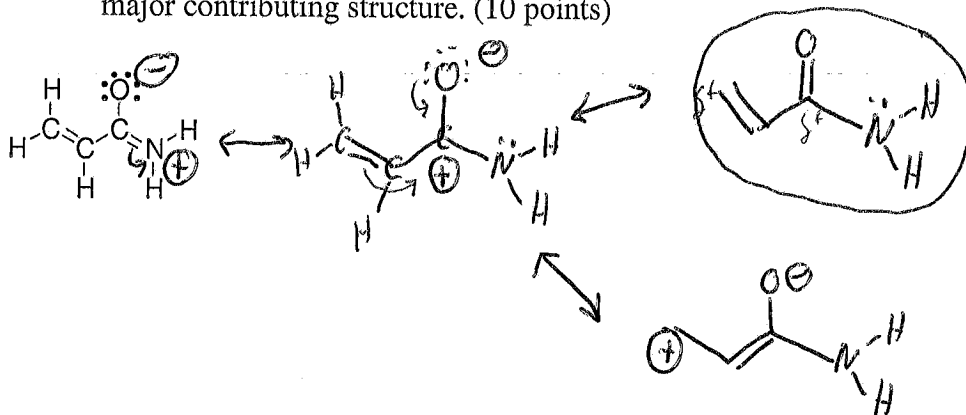
$$\begin{array}{r} 25 \\ - 21 \\ \hline 4 \text{ H's short} \end{array}$$

$$\frac{4}{2} = 2^\circ \text{ unsat.}$$

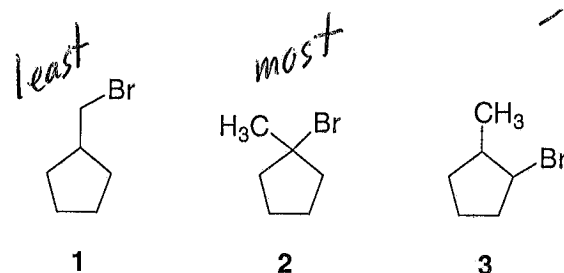
8. Shown below are two matching DNA base pairs guanine, a purine, and cytosine, a pyrimidine. The two structures are tightly held together through three hydrogen bonding interactions. Draw a line connecting each donor to each acceptor for each hydrogen bond and then circle the donor in each pair. (6 points)



9. Fill in any missing formal charges in the structure below. Then provide 3 additional structures which contribute to the overall resonance hybrid. Circle the major contributing structure. (10 points)



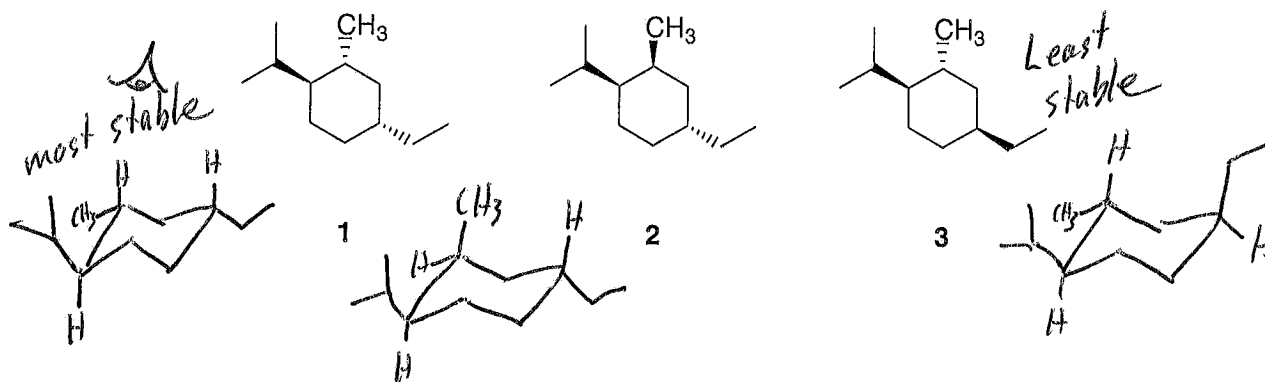
10. Which sequence ranks the following alkyl bromide structures in order of increasing reactivity in an  $S_N1$  reaction? (4 points)



- a) 1<2<3    b) 2<3<1    c) 3<1<2    d) 3<2<1    e) 2<1<3    **f) 1<3<2**

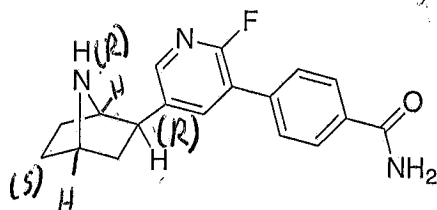
### III. Conformations and Stereochemistry

1. Drawn in their most stable chair conformation, which sequences ranks the following structures in order of increasing stability. (6 points)



- a) 1<2<3    b) 2<3<1    c) 3<1<2    **(d) 3<2<1**    e) 2<1<3    f) 1<3<2

2. The following structure is an acetyl choline antagonist proposed to help break nicotine addiction (*J. Med. Chem.* **2012**, 6512). Label each chiral center as *R* or *S* configuration. (9 points)



3. What is the stereochemical relationship between the two structures below. (4 points)

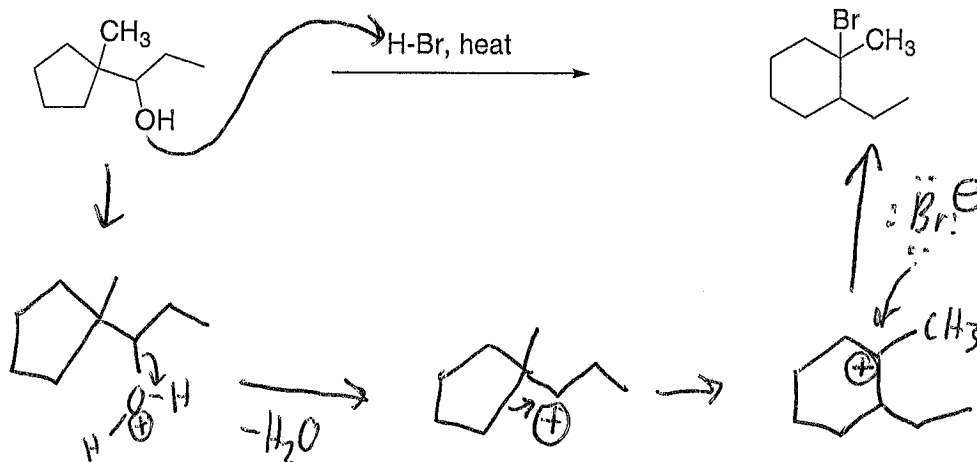
(2*R*, 4*R*) pentan-2,4-diol

(2*R*, 4*S*) pentan-2,4-diol

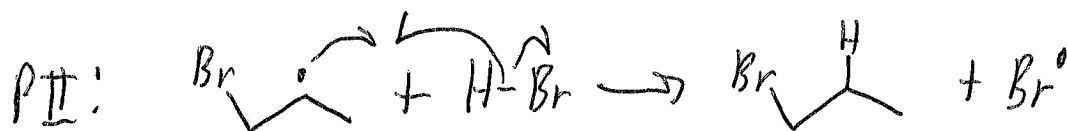
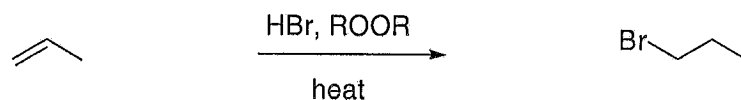
Diastereomer

## IV. Mechanism:

1. Provide a mechanism for the following reaction. Include all intermediates, formal charges and correct pushing of electrons. (15 points)

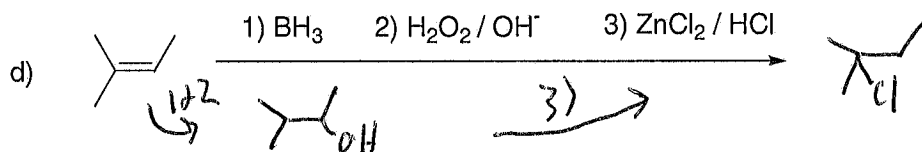
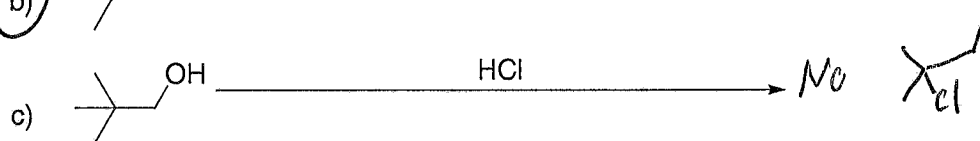
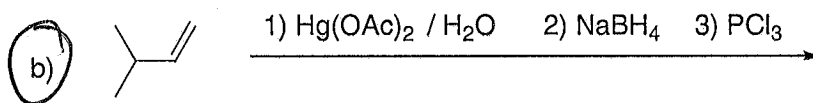
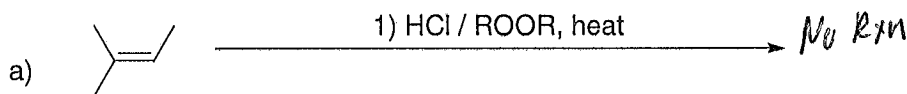


2. Provide an arrow-pushing mechanism for the propagation steps of the following reaction. (12 points)

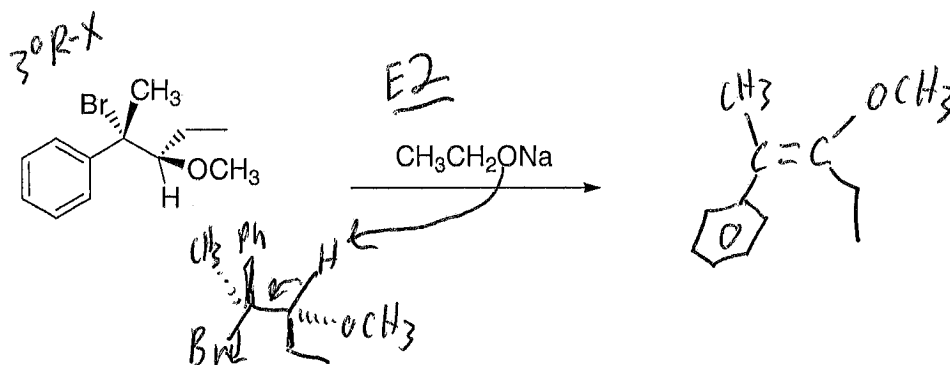
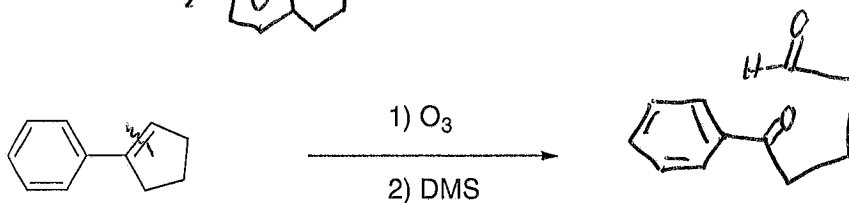
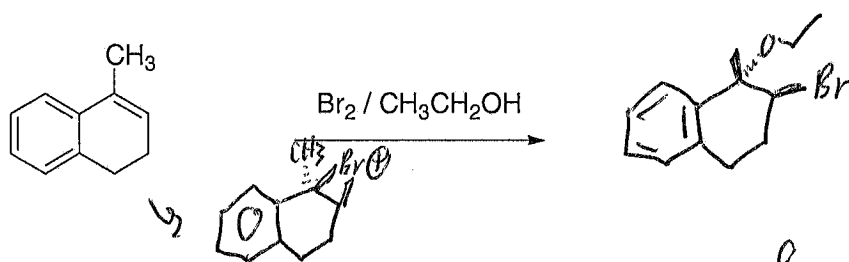
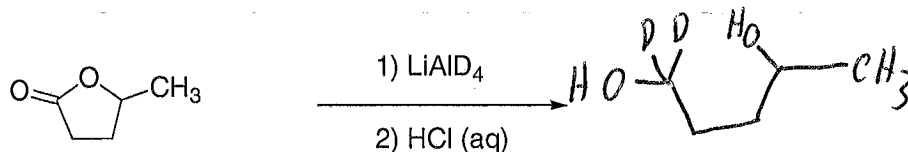


V. Reactions:

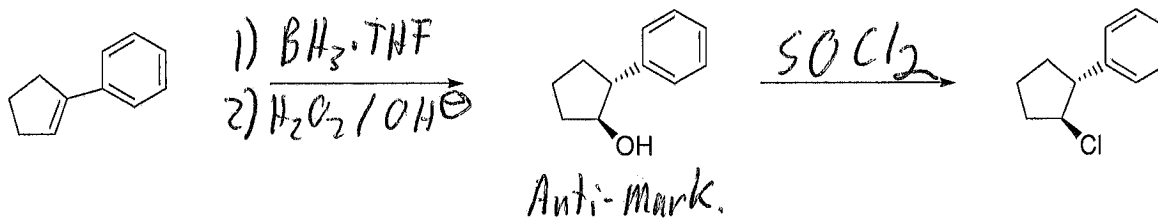
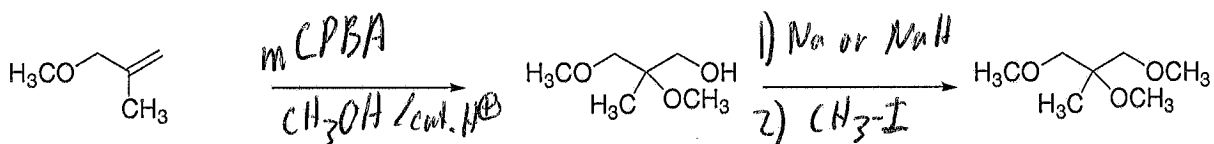
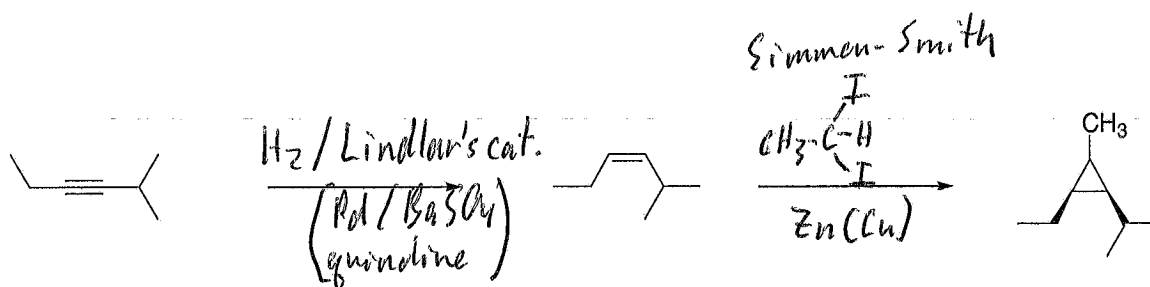
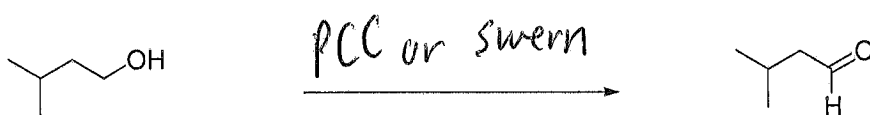
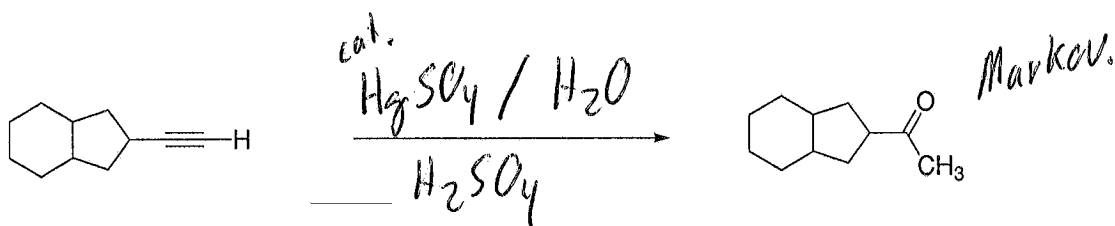
1. Circle all methods that would successfully produce 2-chloro-3-methylbutane (6 points)



2. Complete each of the following reactions by providing a correct structure of each expected product. Include correct stereochemistry where applicable. (24 points)

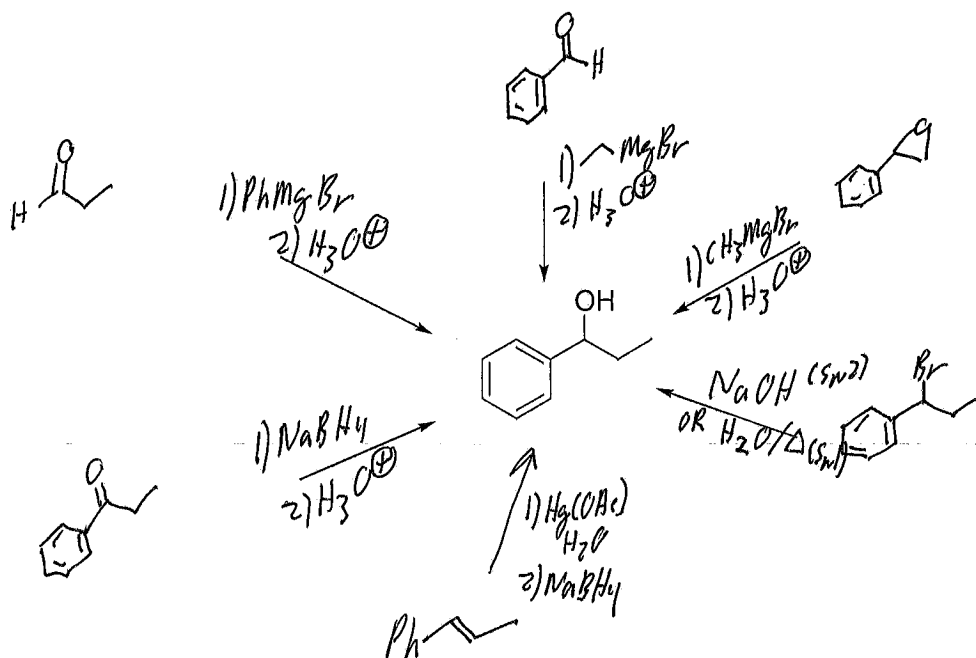


3. Fill in the missing reagents for each of the following reaction. (46 points)



## VI. Extra Credit:

1. Beginning with 5 different starting materials, provide 5 methods of synthesis for the following alcohol. (10 points)



You received \_\_\_\_\_ points out of 200 points possible. To check your overall performance in lecture see <http://canvas.weber.edu>.

A study is being conducted to determine what factors strongly effect academic performance in either a positive or negative manner. The intent of the collected data is to assist me in better advising students on how to be successful in Organic Chemistry. It is anticipated that the results of this survey will be published in a pedagogical journal, such as The Journal of Chemical Education. Be assured your responses to this survey will be held completely anonymous since the survey will be separated from your exam before processing data. Your choice to participate in this survey will neither effect your grade positively or negatively, and you are free to terminate your participation at any time. If you have any questions, please contact me, Dr. Don Davies, at 801-626-6224 or [ddavies1@weber.edu](mailto:ddavies1@weber.edu).