Easily Legible Printed Name:_____

CHEM 3451, Spring 2018
Professor Walba
First Hour Exam
February 13, 2018

scores:

1)

2)

3)

4)

5)

_____

CU Honor Code Pledge: On my honor, as a University of Colorado at Boulder Student, I have neither given nor received unauthorized assistance.

Signature: _____

Recitation TA Name: _____

Recitation day and time: _____

This is a closed-book exam. The use of notes, calculators, scratch paper, or cell phones will not be allowed during the exam. You may use models brought in a clear Ziploc bag. Please put all your answers on the test in the appropriate place. Use the backs of the pages for scratch (there are two additional blank scratch sheets after the last page of the exam). DO NOT PUT ANSWERS ON THE SCRATCH SHEETS.

PLEASE read the questions very carefully!

Partial Periodic Table

1A	2A	3A	4A	5A	6A	7A	8A
1 H							2 He
3 Li	4 Be	5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
						35 Br	
						53 I	

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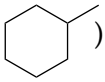
1) (20 pts) a) Draw skeletal structures (**molecular graphs – do NOT** showing hydrogens) for all possible constitutional isomers with molecular formula C_6H_{14}. Draw each isomer only once – points will be deducted for missing structures, and for drawing the same structure more than once.

b) Carefully draw the two "flip-chair" conformations for methylcyclohexane ()
in the space below and **circle the more stable conformation**.

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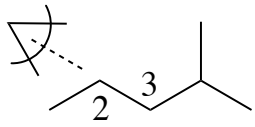
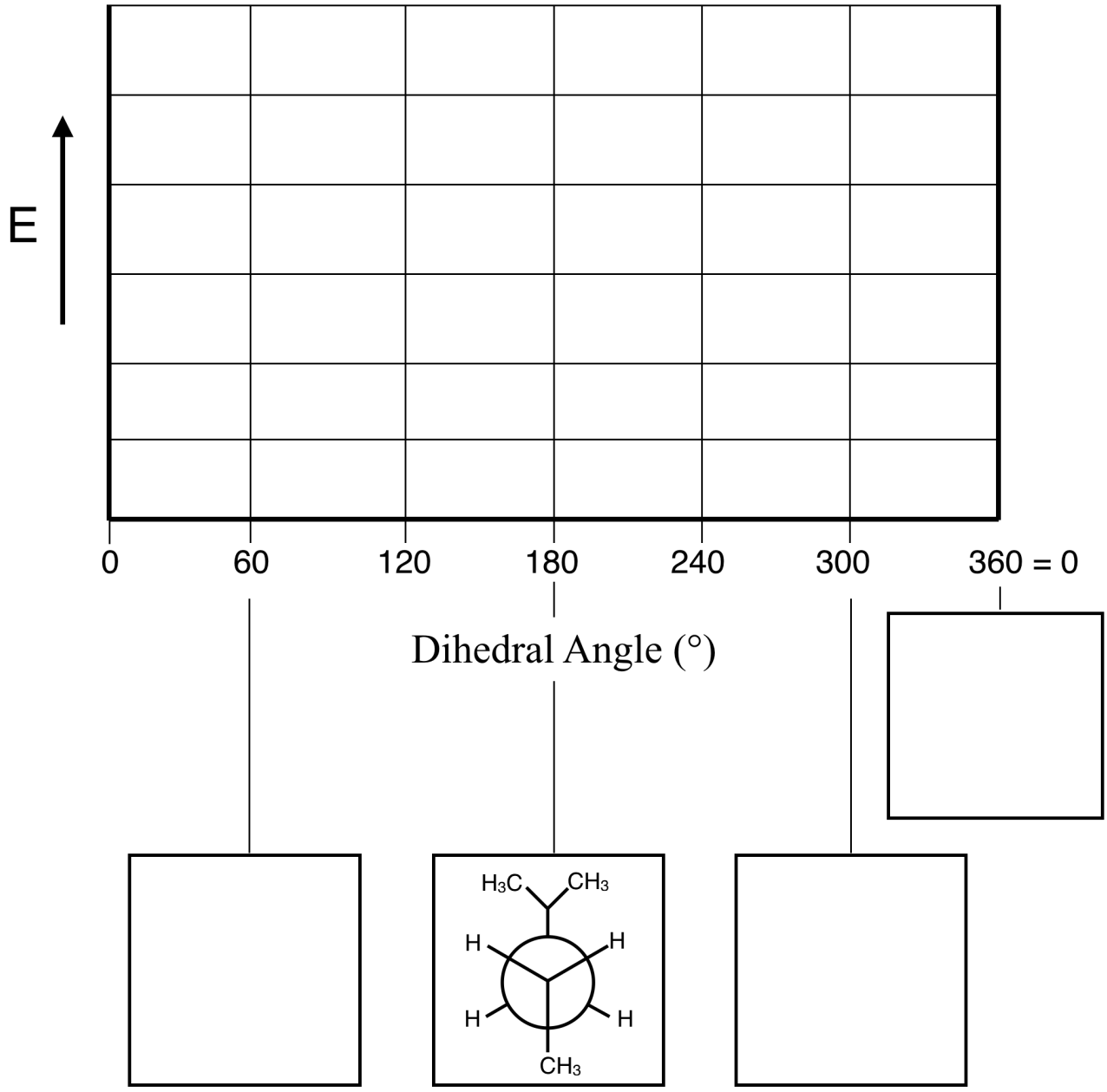
2) (20 pts) For the hexane isomer shown at right, sighting down the C2-C3 bond, define the **staggered** conformation shown in the Newman projection on the energy diagram below as having a 180° dihedral angle.



Starting with the 180° staggered conformation given, and rotating the **front** carbon **clockwise for larger dihedral angles**, draw Newman projections of the conformations with dihedrals of 300°, 360° = 0°, and 60° in their respective boxes.

Complete the energy diagram by indicating the relative energy of **all** the conformations (eclipsed, staggered, and everything in between) for rotation from 0° to 360° = 0° using a smooth curve.



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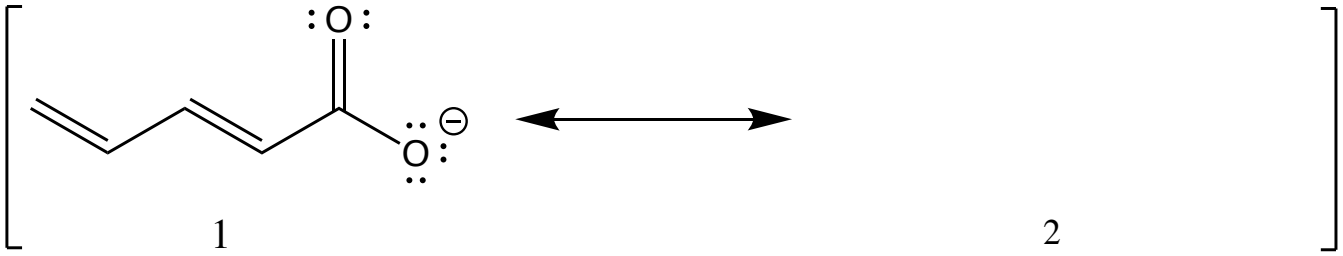
3) (20 pts) Structure **1** below has two major resonance contributors (one of them is shown). Draw the second resonance contributor (**2**) to the structure to the right of the double-headed arrow, inside the square brackets.

a)

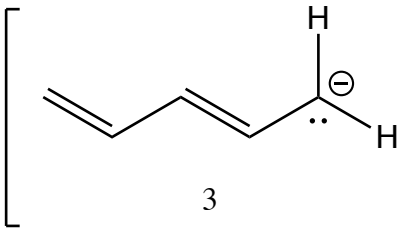


1 2

b) Using the curved arrow "arrow-pushing" formalism, indicate how the electrons "change location" in proceeding from resonance structure **1** to resonance structure **2** below.

c) How much negative charge is actually present on each oxygen in the real molecule?

d) Structure **3** below also has additional important resonance contributors. Give **all** the important resonance contributors (important contributors have only one charged atom) for this molecule, and close with a square bracket.



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4) (20 pts) a) For each of the following pairs of molecules, circle the **stronger Brønsted acid**, and give a one or two word reason for your answer in the box containing the structures

H_2S H_2O	NH_3 CH_4	NH_4^+ H_3O^+
HF HI	H_2O $H_3O^{\oplus}$	Left blank intetionally

b) For the two compounds below, circle the stronger acid.

HBr H_2O

c) Explain the reasoning behind the answer in part B. This will take more than one or two words, but please keep your answer short.

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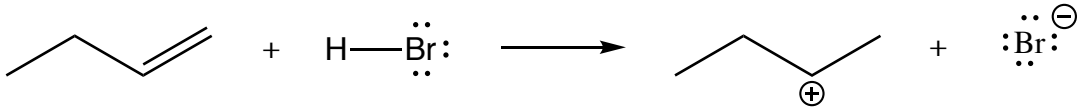
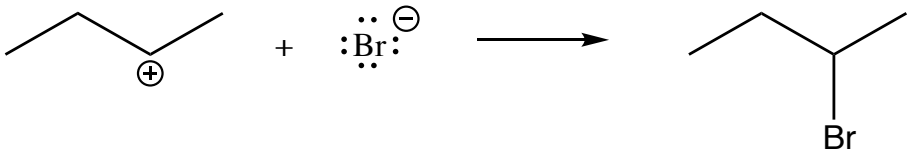
5) (20 pts) Obviously you have not learned the reactions below (these will come later in the semester). However, given valid valence bond structures for the starting material and product, showing all bonds and lone pairs, you CAN produce an arrow-pushing mechanism for "one step" reactions you haven't learned. The following reactions proceed in one mechanistic step. Propose an arrow-pushing mechanism for each of them.

a)



b)



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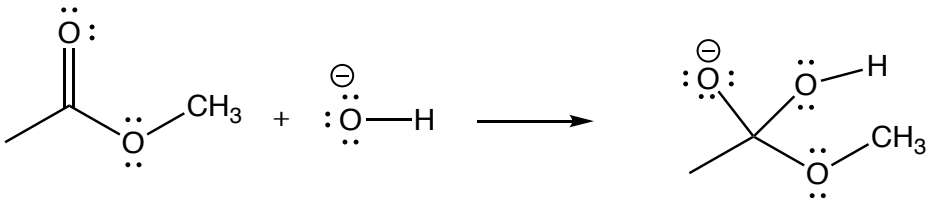
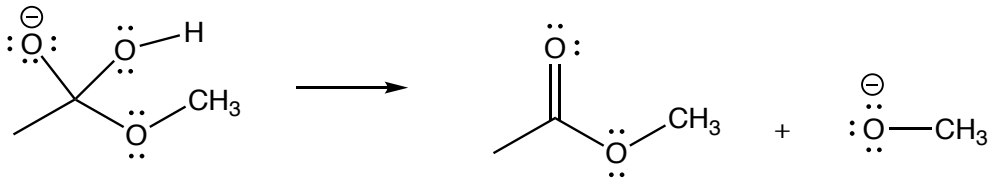
c)



d)



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