Name: _____

CHEMISTRY 3311, Fall 1992
Professor Walba
First Hour Exam
October 1, 1992

scores:

1)

2)

3)

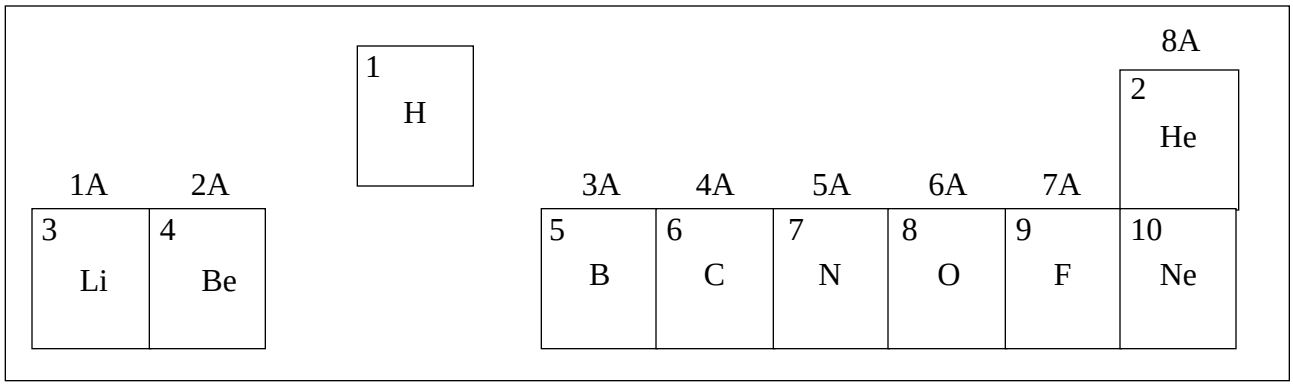
4)

5)

_____

This is a closed-book "open model" exam. You may use models, but no notes or books. Please put all your answers on the test. Use the backs of the pages for scratch.

Partial Periodic Ta



Name: _____

1) (21 pts) (a) Draw a valid valence bond structure for each of the following molecules (the connectivity of these molecules should be obvious from the molecular formula). Be sure to show all lone pairs and formal charges. You don't need to show geometry.

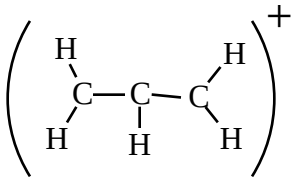
Nitrogen = N_2

Carbon monoxide = CO

Borohydride ion = $(BH_4)^-$

Ammonium ion = $(NH_4)^+$

(b) Using the "valence bond with resonance" model draw the structure of allyl cation $(C_3H_5)^+$. The connectivity of the atoms of this cation is indicated below.



Name: _____

1) -continued-

(c) Predict the C-C-C bond angle for allyl cation and give the hybridization of the central carbon atom.

(d) Are the two carbon-carbon bonds the same length or different lengths?

2) (14 pts) Circle the most stable isomer for each of the following pairs.

a) 

b) 

c) 

2) -continued-

d) Briefly suggest a way to measure the relative stabilities of these isomers experimentally.

3) (15 pts) Give the structure of each of the following compounds.

a) Isobutycyclopropane

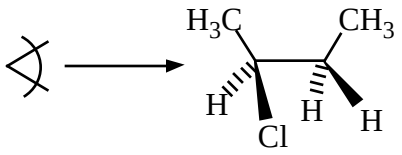
b) 5-ethyl-5-(1,2-dimethylpropyl)decane

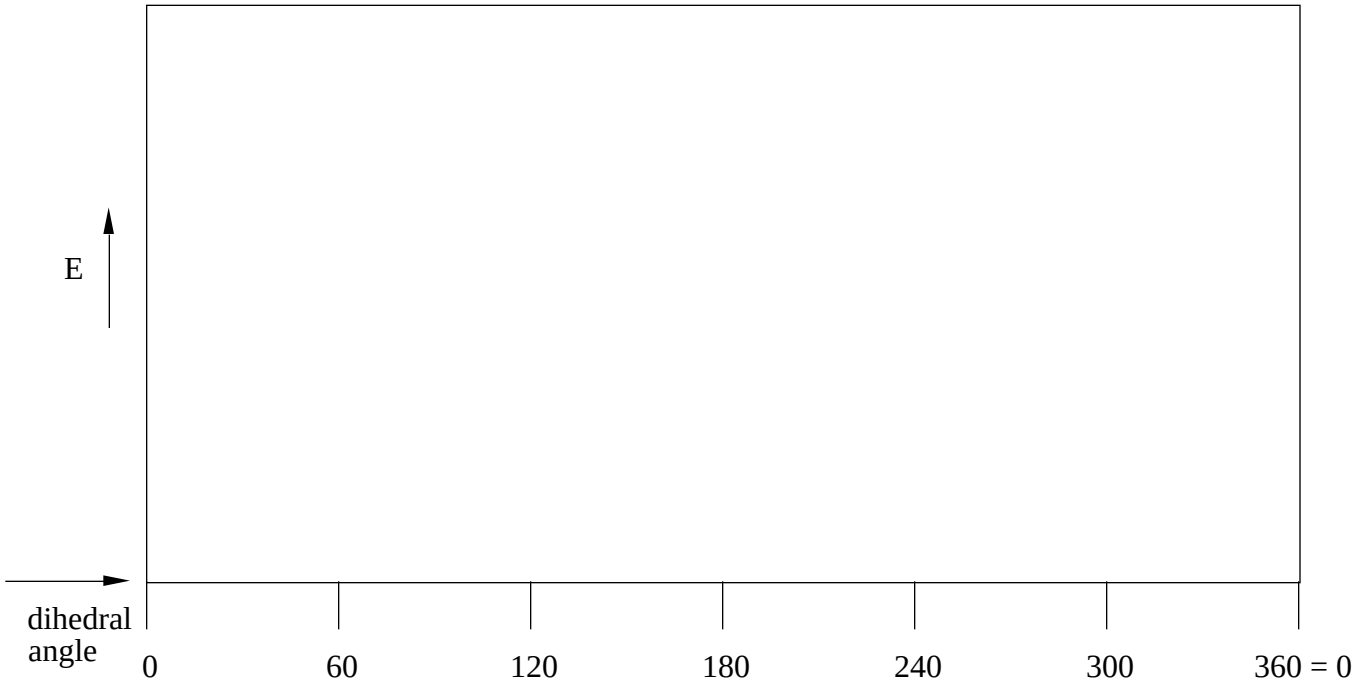
c) Sec-butylcyclooctane

Name: _____

4) (25 pts) A wedges and dashes picture of an eclipsed rotamer of 2-chlorobutane is given below. The C-C-C-C dihedral angle for this rotamer is 0° = 360°. Draw Newman projections for each of the rotamers indicated on the energy diagram under its C-C-C-C dihedral angle, sighting down the C2-C3 bond.

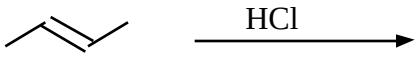
Propose an energy diagram showing qualitatively (i.e. with no numbers) the relative energies of all the rotamers given that: 1) A chlorine group is smaller than a methyl group, but much larger than an H; 2) Anti 1-chloropropane is more stable than gauche 1-chloropropane; and 3) The difference in stability between anti and gauche 1-chloropropane is not as great as the difference in stability between anti and gauche n-butane.

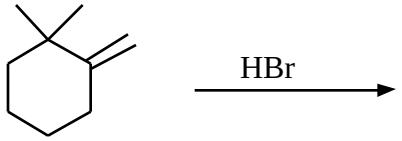


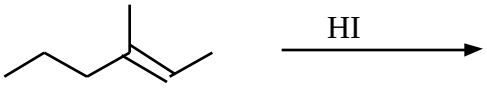


Name: _____

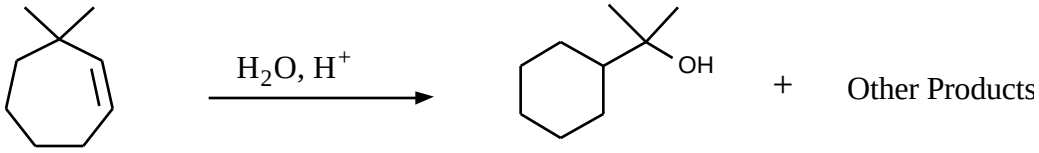
5) (25 pts) Predict the single major product of each of the following reactions.

a) 

b) 

c) 

d) When treated with a catalytic amount of H_2SO_4 in H_2O, 3,3-dimethylcycloheptene (1) gives many products in significant amount, including the rather surprising cyclohexane derivative 2. Propose structures for all of the other products, and propose an arrow-pushing mechanism for the formation of compound 2. In your mechanism be sure to show <u>all</u> intermediates, with lone pairs and formal charges.



1 **2**