Name: _____

CHEMISTRY 3311, Fall 1991
Professor Walba
First Hour Exam
10/3/91

scores:

1)

2)

3)

4)

5)

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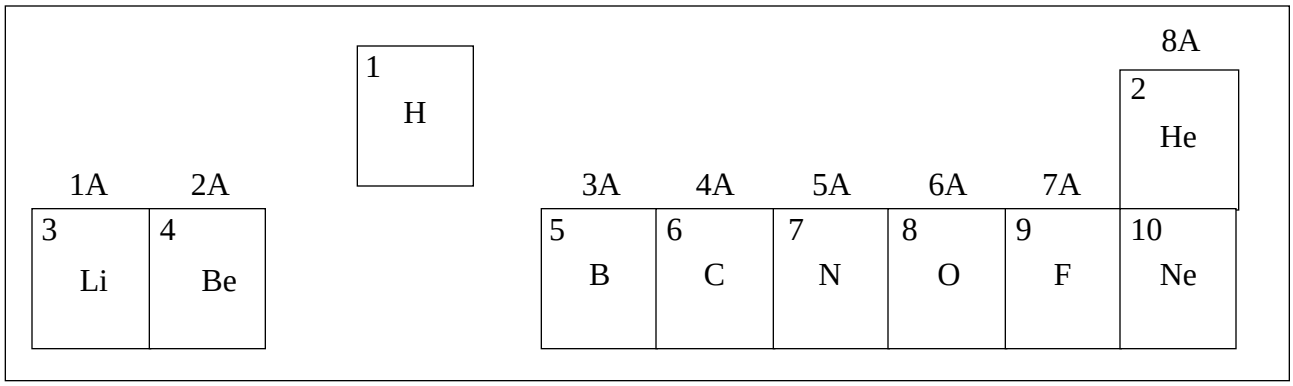
This is a closed-book "open model" exam. You may use models, but no notes or books. Please put all your answers on the test. Use the backs of the pages for scratch.

Partial Periodic Ta



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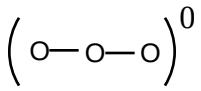
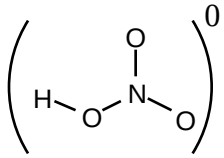
1) (15 pts) The famous compound ozone, which is a major component of Denver air pollution, destroys your tires, but also protects you from harmful ultraviolet radiation from the sun, has the molecular formula O_3, with the three oxygen atoms connected linearly as indicated below (the total charge of ozone is zero).



(a) Draw the structure of ozone using the "valence bond with resonance" model. Be sure to show all lone pairs and formal charges. If you think resonance is important, be sure to show all of the necessary resonance contributors to the structure. As always for resonance, use a double-headed arrow between the resonance structures, like this [A ⟷ B].

(b) Predict the bond angle for ozone.

The atoms of nitric acid (HNO_3) are connected as indicated below. The total charge is zero.



(c) Give the structure of nitric acid using the valence bond with resonance model.

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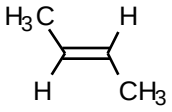
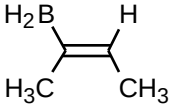
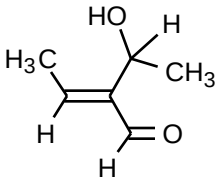
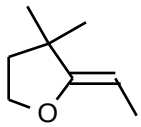
2) (15 pts) Draw valence bond structures (i.e. Lewis structures) for all of the possible constitutional isomers with molecular formula C_3H_4. You must show all of the H atoms in your structures, but don't need to show Euclidean geometry.

3) (16 pts) Indicate the stereochemistry of each of the following alkenes using the E/Z system. That is, label each structure as E or Z.

a) 

b) 

c) 

d) 

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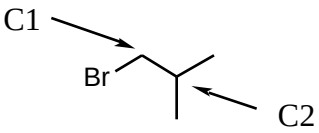
4) (24 pts) It is well-known that the bromine atom in an alkyl bromide is almost the same size



1-bromo-2-methylpropane

as a methyl group. That is, with respect the steric strain, bromine and methyl are about the same.

(a) In the boxes below, draw a wedges and dashes structure and a Newman projection sighting down the C1-C2 bond (i.e. C1 in front) for the staggered conformations of 1-bromo-2-methylpropane generated by rotating about the C1-C2 bond. For this problem, abbreviate the methyl groups as CH_3.

(b) Circle a structure that you think would be lowest in energy (i.e. most stable), and label the other structures as either the same energy or higher energy.

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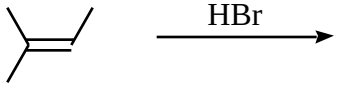
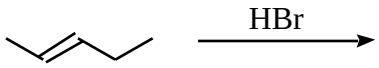
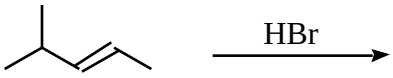
5) (30 pts) Predict the products of the following reactions. If you think only one product would be obtained, show that product. If you think more than one product would be produced, show all of them, even if some are formed in smaller amounts than others. For this problem, you don't have to show all the hydrogen atoms in the structures.

a) 

b) 

c) 

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