

Exam #2 Chem151
(35 points)

03 Nov 2015

Name:

Question 1 (6 points)

(a) The most common form of lithium oxide is Li_2O . Why is LiO rarely observed?

(b) Why is Li_2O a solid at room temperature?

(c) H is in the same column as Li, but H_2O is a liquid at room temperature. Why?

(d) Li_2O unlike many other ionic solids, hardly dissolves in water. Would you expect Li_2O to conduct electricity? Explain.

(e) On the other hand solid elemental Li conducts electricity. Explain.

Question 2 (6 points)

(a) Order Kr, Rb, Rb^{+1} cation, Br^{-1} anion according to size and explain your choice.

(b) The first ionization energies of Li, Be, B and C are 520, 900, 801 and 1086 kJ/mol respectively. Explain.

Question 3 (10 points)

(a) For each of the following molecules or molecular ions:

(i) Draw the Lewis structure (including any resonance structures where applicable)

(ii) Predict the molecular shape and appropriate bond angles

(iii) Predict the direction of the net dipole (or write “no net dipole”)

IF_3 (iodine trifluoride)

SF_2 (sulfur difluoride)

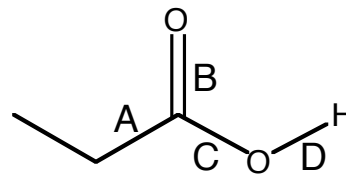
$[\text{NO}_3]^-$ (nitrate anion)

(b) Which bond do you expect to be more polar: I–F or S–F? Explain.

(c) Which has the higher boiling point: IF_3 or SF_2 ? Explain

Question 4 (9 points)

(a) Write the chemical formula of propionic acid shown on the right.



(b) Indicate the hybridization of all carbon atoms in the molecule.

(c) Order the indicated bonds (A, B, C, D) according to *length* and briefly explain your choice.

(d) Which bond is the *strongest*?

(e) What are differences between the sigma and pi-bonds in the bond labeled B?

(f) What intermolecular forces present in propionic acid?

Question 5 (4 points)

The energy change to form aluminum fluoride from its elements (metallic aluminum and fluorine gas diatomic molecules) can be calculated using numbers that can be obtained from tables (such as those at the end of your text book). List the energies you would need, and whether you expect those numbers to be positive or negative, and how you would set up the calculation.

Extra Credit (2 points – all or nothing)

H₂S, H₂Se and H₂Te all have bond angles of ~90° while the water bond angle is 104.5°. Explain.