Week 3 Worksheet

Chem 11100-2: Section 33

Oct. 12, 2021

Remarks: The following information might be useful

Table 1: Electronegativity values

	F	K	Si	Br	P	H
electronegativity	4.0	0.8	1.8	2.8	2.1	2.1

1. $AlBr_3$ is aluminum bromide
2. HBr is hydrogen bromide
3. PbI_2 is lead (II) iodide
4. $Pb(NO_3)_2$ is lead (II) nitrate
5. KI is potassium iodide
6. KNO_3 is potassium nitrate

***Problem* 1:** Copper has an average atomic mass of 63.55 amu and is made of only 2 naturally occuring isotopes, Cu-63 and Cu-65. 69.1% of all Cu is Cu-63 with an exact mass of 62.93 amu.

a) Calculate the exact mass of Cu-65 atom.

b) Can we know which of the 2 isotopes is heavier? If so how?

***Problem* 2:** Aluminum metal and hydrogen bromide gas react to form hydrogen gas and solid aluminum bromide.

a) Write a balanced chemical equation for this reaction.

b) How many grams of aluminum metal would you need to fully react with 125g HBr?

c) How many grams of hydrogen gas would be formed as a result of this reaction?

d) A student ran the reaction but only got a 60.0% yield of H_2 gas. How many grams of H_2 gas did the student collect?

***Problem* 3:** Why are the ionization energies of the alkali metals in the order:

$$Li > Na > K > Rb$$

***Problem* 4:** For the following pairs, pick the element with the higher ionization energy and explain your choice.

a) Fe, Ru

b) K, Br

c) C, N

d) Cl, F

***Problem* 5:** Explain the trends in bond lengths of the following ions:

	X-O [pm]
ClO_3^-	149
BrO_3^-	165
IO_3^-	181

***Problem* 6:** Using the table of electronegativity values, determine whether each pair of atoms below would be expected to form a nonplar covalent, polar covalent, or ionic bond.

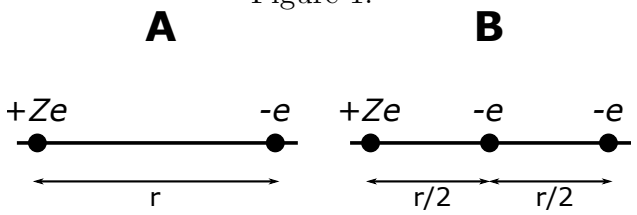
a) F and K

b) Si and Br

c) P and H

***Problem* 7:** Provide an explanation for why carbon monoxide has a greater bond-dissociation energy (1072 kJ/mol) than molecular nitrogen (945 kJ/mol).

Figure 1:



***Problem* 8** (Bonus)**:** Consider a stationary electron a distance r from the nucleus, with nuclear charge of $+Ze$ (see Figure 1A).

a) What is the potential energy for both the electron and nucleus in this configuration?

b) Place another electron exactly in the middle of the original electron and nucleus so that it sits a distance $\frac{r}{2}$ between both the electron and the nucleus (Figure 1B). Determine the potential energies for all of the particles in this arrangement.

c) Consider the case now where $Z = 2$ (that is, 2 protons are in the nucleus). What is the potential energy for the furthest electron in both scenarios? Give a brief account of why they differ.

I have plotted $U(x)$ for the outermost electron for the cases where $Z = 2, 4$ in the scenario where there is only 1 electron (A), and when there is an inner electron. This should illuminate how inner core electrons 'shield' the nucleus's attractive force on the valence/outer electrons.

Figure 2: These are the potential curves felt by the outermost electron. Solid lines indicate situation A and dashed lines indicate situation B from Figure 1