**Portfolio Assignment: Trends in atomic Radii,**

**Ionization Energies and electronegativities**

**Purpose:** To identify regularities in the variation of properties of the elements when arranged in order of increasing atomic number

**Introduction:**

Atoms do not have a definite boundary, which determines their sizes, but the distance between the nuclei in a molecule such as H2 can be determined. The atomic radius can then be defined as half of this distance.

The first ionization energy is the energy required to excite one electron to such a high level that it is removed from the atom. For an atom, A, this is represented by:

A(g) + energy ® A+(g) + e-

Both atomic radius and ionization energy are related to the force attracting the electron to the nucleus. The stronger the force, the smaller the atom and the larger the energy required to ionize it.

# The table lists both the atomic radius in nanometers (1nm = 10-9m) and the ionization energy in KJ/mol of atoms for the first 36 elements.

## Table: Atomic Properties

|  |  |  |  |
| --- | --- | --- | --- |
| Atomic Number | Element | **Atomic Radius**  **(nm)** | **First Ionization Energy**  **(kJ/mol of atoms)** |
| 1  2  3  4  5  6  7  8  9  10  11  12  13  14  15  16  17  18  19  20  21  22  23  24  25  26  27  28  29  30  31  32  33  34  35  36 | H  He  Li  Be  B  C  N  O  F  Ne  Na  Mg  Al  Si  P  S  Cl  Ar  K  Ca  Sc  Ti  V  Cr  Mn  Fe  Co  Ni  Cu  Zn  Ga  Ge  As  Se  Br  Kr | 0.032  0.031  0.123  0.090  0.082  0.077  0.075  0.073  0.072  0.071  0.154  0.136  0.118  0.111  0.106  0.102  0.099  0.098  0.203  0.174  0.144  0.132  0.122  0.118  -  0.117  0.116  0.115  0.117  0.125  0.126  0.122  0.120  -  0.114  0.112 | 1312  2372  520  899  801  1086  1402  1314  1681  2081  496  738  578  786  1012  1000  1251  1521  419  590  631  658  650  653  -  759  758  737  745  906  579  762  947  -  1140  1351 |

Using this information, graph the data on the following pages. For the electronegativities, use the numbers found on the periodic table in our book