Recitation Activity: Periodic Trends

1. Here are the atomic radii (in pm) for the third row of the periodic table:

Na	Mg	Al	Si	P	S	Cl	Ar
186	160	143	118	110	103	100	98

a. Make a plot of the atomic radius (y axis) vs atomic number (element, on the x axis)

b. What factors affect the size of an atom?

c. Explain why the atomic radius decreases across the row in the periodic table. What causes a heavier atom (with more subatomic particles) to be smaller in size than a lighter atom?

2. Another property of atoms is called the ionization energy. It is the energy required to remove an electron from an atom in the gas phase.
   For example: $Na(g) \rightarrow Na^+(g) + e^-$

   a. Why is energy required to remove an electron from an atom? Explain your answer in terms of the forces and interactions involved in this process.

   b. What do you think happens to the atomic radius when an electron is removed from a neutral atom (for example when Na forms Na^+)? Explain your answer in terms of the forces and interactions that govern the size of the atom.

   c. What do you think happens to the atomic radius when an electron is added to a neutral atom (for example if Cl added an electron to form Cl^-)? Explain your answer in terms of the forces and interactions that govern the size of the atom.

3. Here is a table of the first ionization energies (energy required to remove the outermost electron) for the third row of the periodic table: (in kJ/mol)

Na	Mg	Al	Si	P	S	Cl	Ar
496	738	577	788	1060	1000	1258	1520

a. Make a plot of the first ionization energy (y axis) vs atomic number (element, on the x axis)

b. Compare your graph from Q3 to that in Q1. Are the trends you see in each graph related? How so?

c. Explain why (in general) the first ionization energy **increases** across the period. (Don't worry about the dips at Al and S).