Periodic Trends Questions

Part 1: Atomic Radius and 1st Ionization Energy

1. Explain the observed trend in atomic radii for the following sets of elements.
   a. Li > B > F
   b. K > Li > Na
   c. I > Br > Cl
2. Explain the relationship between the number of protons in the nucleus and atomic size.

3. Core charge = (protons #) - (inner electron #) and indicates nuclear force of attraction. Why are the inner shells of electrons taken into consideration for this calculation?

4. Explain why moving down one period has a larger impact on change in atomic size than moving across one family.

5. Why does Rb have a lower first ionization energy than Na?

6. What factors affect the magnitude of the ionization energy?

7. Identify the element with the highest ionization energy and offer an explanation for each.
   a. B, Li, or F
   b. K, Li, or Na
   c. Cl, Br, or I

Part 2: Ionic Radius and Multiple Ionization Energies

8. Complete the following table indicating which element of the pair has the higher value for each property.

	Atomic Properties			Atomic Properties	
	Atomic Radius	**Ionization Energy**		**Atomic Radius**	**Ionization Energy**
K or Ca			S or Se		
Li or N			Na or Cl		
F or Cs			Na^+ or Na		
Cl or I			Na^+ or Cl^-		

9. Which of the following elements naturally forms an ion that is larger than its neutral atom? Explain. Na, Ne, Ba, Br
10. Which element, Al, B, Cl, or Ca forms a 2+ ion that is decreased in size the most compared to its neutral atom? Explain.
11. Which of the following elements is predicted to have the largest ionic radius? Explain. Na, F, K, Cl
12. Which ion would have the smallest radius? Explain. Ca^{1+} K^{1+} Cl^{2-} Sr^{2+}
13. Which group would you expect to have a low first and second ionization energy but a high third ionization energy?
14. Use the following data to explain why Be has the higher 1st stage ionization energy but a lower 2nd stage ionization energy than Li.

Element	**1st Ionization Energy (eV)**	**2nd Ionization Energy (eV)**
Li	5.4	75.8
Be	9.3	18.2

15. Given the successive ionization energies for the following atoms, determine the number of outer electrons in each case.

IE (MJ/mol)	Atom 1	Atom 2	Atom 3	Atom 4
IE_1	0.5	0.58	1.01	0.55
IE_2	4.6	1.82	1.9	1.06
IE_3	6.9	2.74	2.91	4.21
IE_4	9.5	11.58	4.96	5.5
IE_5	13.4	14.83	6.27	6.91
IE_6	Not Available	18.38	21.17	8.76
IE_7	Not Available	Not Available	25.4	Not Available
IE_8	Not Available	Not Available	29.85	Not Available
IE_9	Not Available	Not Available	35.97	Not Available

Part 3: Electron Affinity

16. If an element has a high ionization energy would it most likely have a high or low electron affinity? Explain.
17. Which element would your predict to have the highest E.A.?
    a. Br, Kr, Se
    b. S, Se, Te
    c. Al, C
18. Can noble gases have ionization energies?
19. What would a negative electron affinity indicate?
20. How many electrons would the following elements tend to gain or lose: Mg, Cl, N, Al, S, Ar. Write the symbol of the ion formed.