

I)

The Periodic Table

1. Which has a larger radius, Na⁺ or Ne?
2. Identify the three elements using the information listed below:
Element X:
 has a relatively high ionization energy
 generally forms a 2- ion
 has an outermost electron configuration of $3s^2 3p^4$
Element Y:
 reacts with oxygen to form Y₂O
 has a very low ionization energy
 is in the fourth period of the periodic table
Element Z:
 is a transition metal
 is used in coinage
 has eight electrons in the third orbital system
3. Briefly explain why Ba has a lower first ionization energy than Ca.
4. Which of the following elements would have the largest third ionization energy: K, Ca, or Ga?
5. The first four ionization energies in kJ/mol for the element Al are as follows:
 $IE_1 = 577 \text{ kJ/mol}$ $IE_3 = 2745 \text{ kJ/mol}$
 $IE_2 = 1817 \text{ kJ/mol}$ $IE_4 = 11580 \text{ kJ/mol}$
 What is the charge for the most common ion of aluminum? How many outermost electrons does aluminum have?
6. Which of the following electron configurations would you expect to have the lowest second ionization energy? Give reasons for your choice.
 a. $1s^2 2s^2 2p^6$
 b. $1s^2 2s^2 2p^6 3s^1$
 c. $1s^2 2s^2 2p^6 3s^2$
7. Which of these elements—Na, Si, Cl, or Cs—has:
 a. the highest first ionization energy?
 b. the smallest radius?
 c. the most metallic character?
8. Use the periodic table to predict which substance in each of these pairs has the smaller radius:
 a. K, Br c. K⁺, Ga³⁺
 b. Ne, F⁻ d. S, Se

9. The electron configuration for the following neutral atoms are given for use in answering questions a to e:
 A $1s^2 2s^2 2p^6 3s^2$
 B $1s^2 2s^2 2p^6 3s^1$
 C $1s^2 2s^2 2p^6$
 D $1s^2 2s^2 2p^5$
 E $1s^2 2s^2 2p^3$
- a. Which of the electron configurations given above would you expect to have the lowest ionization energy?
- b. Which of the electron configurations given above would you expect for a noble gas?
- c. List the five configurations in predicted order of increasing ionization energy (lowest to highest).
- d. Predict the configuration that should have the highest second ionization energy (IE_2).
- e. Predict the configuration that should have the lowest second ionization energy (IE_2).

10. What does isoelectronic mean?

11. What is the electron configuration for the oxide ion?

With which noble gas is this ion isoelectronic?

12. Predict the charge on the most common ion for each of the following elements. Then predict which ions would be smaller than their neutral atoms and which would be larger.
 Mg Cl Al S Cs I O

The Periodic Table

II)

- 1) Elements A, B, C, and D have electronic structures as shown:
A $1s^2 2s^2 2p^2$, B $1s^2 2s^2 2p^6 3s^1$, C $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^5$,
D $1s^2 2s^2 2p^6 3s^2 3p^5$
Answer the following questions:
(a) Which of the elements, if any, are metals?
(b) Which of the elements, if any, is (or are) transition metal(s)?
- 2) Which one of the following atoms would have the *largest* first ionization energy: (a) Na (b) Rb (c) Ca (d) C (e) Ne (f) Ba?
- 3) Which of the following ionization energy values would be the largest?
(a) The first ionization energy for Na; the first ionization energy for Mg; the first ionization energy for Si. Explain your answer.
(b) The second ionization energy for Na; the second ionization energy for Mg; the second ionization energy for Si. Explain your answer.
(c) The first ionization energy for Mg; the first ionization energy for C; the third ionization energy for Be.
- 4) More and more energy is required to remove successive electrons from an atom. How many electrons would be relatively easy to remove from a (a) lithium atom, (b) potassium atom, (c) calcium atom, and (d) barium atom? Explain your answers.
- 5) Given the successive ionization energies for the elements listed below, determine the number of valence electrons for each.
Element A 259.5 562.3 1,104 1,487 9,042 11,298
Element B 100.1 733.8 1,061 1,405 1,905 2,300
Element C 150.8 295.2 571 1,704 2,122 2,560
- 6) The ionization energies for a given element, M, are listed as: 590 kJ , 1145 kJ , and 4936 kJ . Given this information, write the formulas of an oxide, a phosphide, a sulfide, a fluoride, and a nitride of M.