Chang Self-Test C-7

TRUE-FALSE QUESTIONS

Correct all false answers

1. There was no periodic table before electron configurations of the elements were known.

(2.) Mendeleev had no explanation for the gaps in his periodic table.

3. The chemical and physical properties of elements vary in a periodic manner when the elements are arranged according to increasing atomic mass.

(4.) The representative elements include all the metals and nonmetals.

5. The electron configuration of the outermost electrons of the noble gas elements is ns^2np^6.

(6.) Carbon is a representative element.

7. Gallium is a nonmetal.

(8.) Electron affinity is the energy change when an element such as $Br_2(l)$ acquires one electron to become an ion:

$$\tfrac{1}{2}Br_2(l) + e^- \longrightarrow Br^-(l)$$

9. As a rule, the metallic elements have higher ionization energies than the nonmetallic elements.

(10.) Electrons in the outermost shell of a many-electron atom do not feel the full attraction of the positively charged nucleus.

11. The atomic radius increases with increasing atomic mass within a group, but the ionization energy decreases.

12. The effective nuclear charge increases in a group as atomic mass increases.

13. The atomic radii of representative elements vary more than those of transition elements in a period of the periodic table.

SELF-TEST A

1. The element francium is extremely rare, and very little is known about its chemical and physical properties. Use the following data to estimate its density and ionization energy:

	K	Rb	Cs
Density (g/cm^3)	0.86	1.53	1.87
Ionization energy (kJ/mol)	419	403	375

2. The element technetium ($Z = 43$) does not occur on earth. The densities of Mo and Ru are 10.2 and 12.4 g/cm^3, respectively. Estimate the density of Tc.

3. The periodic table has been extended to include the transuranium elements ($Z > 92$). What elements would element number 104 be similar to in chemical properties?

4. Which is the general electron configuration for the outermost electrons of elements in Group 4A?
a. ns^1 b. ns^2 c. ns^2np^4 d. ns^2np^2 e. $ns^2np^6nd^7$

5. In what group of the periodic table is each of the following elements found?
a. $1s^22s^22p^6$ c. $[Xe]6s^24f^{14}5d^5$
b. $[Ar]4s^1$ d. $[Ne]3s^23p^5$

6. Use the periodic table to write the electron configurations of Cr, Sb, and Pb.

7. How many valence electrons does an arsenic atom have?

8. Successive ionization energies—first, second, third, etc.—always show an increasing trend: $I_1 < I_2 < I_3 < I_n$. For aluminum atoms, which ionization energy value will show an exceptionally large increase over the preceding ionization energy value?
a. second b. third c. fourth d. fifth e. sixth

9. Write the electron configurations for the following ions:
a. Ca^{2+} b. Se^{2-} c. Cl^- d. Mn^{2+} e. Co^{3+} f. Sc^{3+}

10. An Ar atom is isoelectronic with which one of the following?
a. Ne b. K c. Sc^{3+} d. Cl^{2-} e. Na^+

11. Which atom should have the largest radius? (explain)
a. Br b. Cl c. Se d. Ge e. C

12. Which is the larger ion or atom in each pair? (explain)
a. I^- or Cs^+ b. Ne or K^+ c. Mg or Mg^{2+}

13. Which atom should have the greatest ionization energy? (explain)
a. Se b. Te c. Na d. Si e. S

14. Why does atomic radius decrease in going from left to right across a row in the periodic table?

15. Which two from the following would be most likely to have similar ionization energies? B, C, Si, Al, Ar.

SELF-TEST B1

1. Without referring to the periodic table, write the electron configuration of the element with atomic number 21.
2. How many valence electrons does an atom of phosphorus have?
3. Write the outer electron configuration for the halogen elements.
4. Based on periodic trends, which one of the following elements has the greatest ionization energy? Cl, K, S, Se, Br.
5. Which of the following has the largest radius? Na^+, Mg^{2+}, Al^{3+}, S^{2-}, Ar.
6. Identify an isoelectronic pair among the following: Na^+, Ar, K^+, Ne, Se^{2-}.
7. Which of the following atoms has both a large ionization energy and a large negative electron affinity? K, Ne, Br, Fe, N.
8. Of the following, which is the most metallic element? V, Ge, Se, As, Zn.

SELF-TEST B2

1. Write the electron configuration of Sc by first finding its position in the periodic table.
2. Write the symbol of an element with five valence electrons.
3. What group of elements has the outer electron configuration ns^2np^5?
4. Based on periodic trends, which one of the following elements has the smallest ionization energy? Cl, K, S, Se, Br.
5. Which of the following has the largest radius? S^{2-}, Ar, Se^{2-}, O^{2-}, Al^{3+}.
6. How many electrons does each of the following species have? Na^+, Ar, K^+, Ne, Se^{2-}.
7. Which one of the following elements has both a low ionization energy and a small negative electron affinity? K, Ne, Br, Fe, N.
8. Which of the following is the least metallic element? V, Ge, Al, As, Ca.