– KEY –

7 Forming and Naming Ions

SECTION 7.1 IONS (pages 194-199)

This section explains how to use the periodic table to infer the number of valence electrons in an atom and draw its electron dot structure. It also describes the formation of cations from metals and anions from nonmetals.

▶ Valence Electrons (pages 194-195)

1. What are valence electrons? e⁻ in the highest occupied energy level
2. The valence electrons largely determine the chemical properties of an element and are usually the only electrons used in bonding.
3. Is the following sentence true or false? The group number of an element in the periodic table is related to the number of valence electrons it has. True

▶ The Octet Rule (page 195)

6. What is the octet rule? When forming compounds, atoms tend to fill their s- and p-sublevels to have 8 valence e⁻ and achieve the e⁻ config. of a noble gas
7. Metallic atoms tend to lose their valence electrons to produce a(n) cation, or a positively charged ion. Most nonmetallic atoms achieve a complete octet by gaining or sharing electrons.

▶ Formation of Cations (pages 195-197)

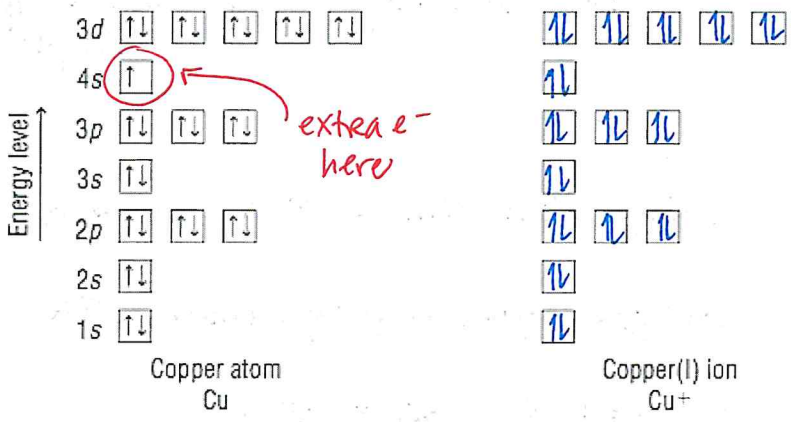
8. Write the electron configurations for these metals and circle the electrons lost when each metal forms a cation.
   a. Mg $1s^2 2s^2 2p^6 (3s^2)$
   b. Al $1s^2 2s^2 2p^6 (3s^2 3p^1)$
   c. K $1s^2 2s^2 2p^6 3s^2 3p^6 (4s^1)$

Match the noble gas with its electron configuration.

C	9. argon	a. $1s^2$
A	10. helium	b. $1s^2 2s^2 2p^6$
B	11. neon	c. $1s^2 2s^2 2p^6 3s^2 3p^6$
D	12. krypton	d. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6$

13. What is the electron configuration called that has 18 electrons in the outer energy level and all of the orbitals filled?
    Noble gas configuration
14. Write the electron configuration for zinc.
    $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6$

15. Fill in the electron configuration diagram for the copper(I) ion.



▶ Formation of Anions (pages 198)

16. Atoms of most nonmetallic elements achieve noble-gas electron configurations by gaining electrons to become anions, or negatively charged ions.
17. What property of nonmetallic elements makes them more likely to gain electrons than lose electrons?
    Their valence shells are already relatively full.

18. Is the following sentence true or false? Elements of the halogen family ~~lose one~~ gain one electron to become halide ions. False

19. How many electrons will each element gain in forming an ion?

a. nitrogen 3

b. oxygen 2

c. sulfur 2

d. bromine 1

20. Write the symbol and electron configuration for each ion from Question 19, and name the noble gas with the same configuration.

a. nitride N^{3-} $1s^2 2s^2 2p^6$ (Neon)

b. oxide O^{2-} $1s^2 2s^2 2p^6$ (Neon)

c. sulfide S^{2-} $1s^2 2s^2 2p^6 3s^2 3p^6$ (Argon)

d. bromide Br^{1-} $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6$ (Krypton)

▶ Monatomic Ions (pages 264-267)

1. What are monatomic ions?

a single atom with a (+) or (−) charge

2. How is the ionic charge of a Group 1A, 2A, or 3A ion determined?

charges equal to group number (1A = 1+)

3. How is the ionic charge of a Group 5A, 6A, or 7A ion determined?

substract 8 (5A = −3)

4. Circle the letter of the type of element that often has more than one common ionic charge.

a. alkali metal

b. alkaline earth metal

(c.) transition metal

d. nonmetal

8. Use the periodic table to write the name and formula (including charge) for each ion in the table below.

Element	Name	Formula
Fluorine	fluoride	F^{1-}
Calcium	calcium ion	Ca^{2+}
Oxygen	oxide	O^{2-}
Lead 2+ charge	~~Pb(II)~~ lead (II) ion	Pb^{2+}
Lead 4+ charge	~~Pb(IV)~~ lead (IV) ion	Pb^{4+}
Phosphorus	phosphide	P^{3-}
Strontium	strontium ion	Sr^{2+}