***Chemistry***

**6: Electronic Structure and Periodic Properties of Elements**

**6.4: Electronic Structure of Atoms (Electron Configurations)**

47. Read the labels of several commercial products and identify monatomic ions of at least six main group elements contained in the products. Write the complete electron configurations of these cations and anions.

Solution

For example, Na+: 1*s*22*s*22*p*6; Ca2+: 1*s*22*s*22*p*6; Sn2+: 1*s*22*s*22*p*63*s*23*p*63*d*104*s*24*p*64*d*105*s*2; F–: 1*s*22*s*22*p*6; O2–: 1*s*22*s*22*p*6; Cl–: 1*s*22*s*22*p*63*s*23*p*6.

49. Using complete subshell notation (1*s*22*s*22*p*6, and so forth), predict the electron configuration of each of the following atoms:

(a) N

(b) Si

(c) Fe

(d) Te

(e) Tb

Solution

(a) 1*s*22 *s*22*p*3; (b) 1*s*22 *s*22*p*63*s*23*p*2; (c) 1*s*22 *s*22*p*63*s*23*p*64*s*23*d*6; (d) 1*s*22 *s*22*p*63*s*23*p*64*s*23*d*104*p*65*s*24*d*105*p*4; (e) 1*s*22 *s*22*p*63*s*23*p*64*s*23*d*104*p*65*s*24*d*105*p*66*s*24*f*9

51. What additional information do we need to answer the question “Which ion has the electron configuration 1*s*22*s*22*p*63*s*23*p*6”?

Solution

The charge on the ion.

53. Use an orbital diagram to describe the electron configuration of the valence shell of each of the following atoms:

(a) N

(b) Si

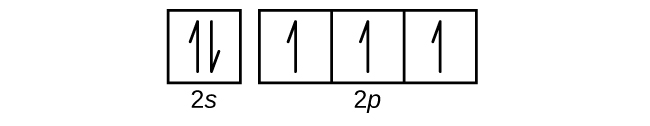
(c) Fe

(d) Te

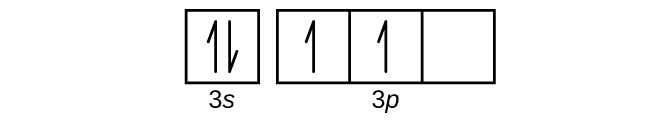
(e) Mo

Solution

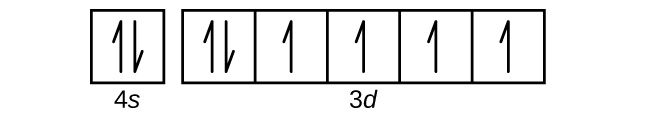
(a)



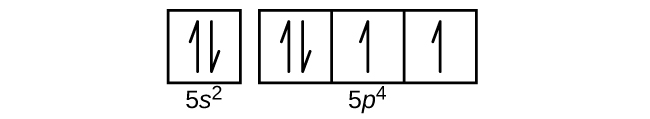
(b)



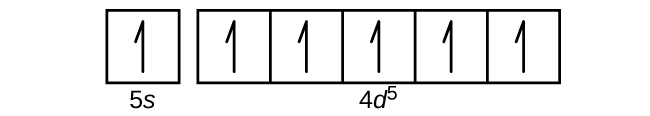
(c)



(d)



(e)



55. Which atom has the electron configuration 1*s*22*s*22*p*63*s*23*p*64*s*23*d*104*p*65*s*24*d*2?

Solution

Zr

57. Which ion with a +1 charge has the electron configuration 1*s*22*s*22*p*63*s*23*p*63*d*104*s*24*p*6? Which ion with a –2 charge has this configuration?

Solution

Rb+, Se2−

59. Which of the following has two unpaired electrons?

(a) Mg

(b) Si

(c) S

(d) Both Mg and S

(e) Both Si and S.

Solution

Although both (b) and (c) are correct, (e) encompasses both and is the best answer.

61. Which atom would be expected to have a half-filled 4*s* subshell?

Solution

K

63. Thallium was used as a poison in the Agatha Christie mystery story “The Pale Horse.” Thallium has two possible cationic forms, +1 and +3. The +1 compounds are the more stable. Write the electron structure of the +1 cation of thallium.

Solution

1*s*22*s*22*p*63*s*23*p*63*d*104*s*24*p*64*d*105*s*25*p*66*s*24*f*145*d*10

65. Cobalt–60 and iodine–131 are radioactive isotopes commonly used in nuclear medicine. How many protons, neutrons, and electrons are in atoms of these isotopes? Write the complete electron configuration for each isotope.

Solution

Co has 27 protons, 27 electrons, and 33 neutrons: 1*s*22*s*22*p*63*s*23*p*64*s*23*d*7.

I has 53 protons, 53 electrons, and 78 neutrons: 1*s*22*s*22*p*63*s*23*p*63*d*104*s*24*p*64*d*105*s*25*p*5.

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