

## 2.1 Multiple-Choice and Bimodal Questions

1) A certain mass of carbon reacts with 13.6 g of oxygen to form carbon monoxide. \_\_\_\_\_ grams of oxygen would react with that same mass of carbon to form carbon dioxide, according to the law of multiple proportions?

- A) 25.6
- B) 6.8
- C) 13.6
- D) 136
- E) 27.2

Answer: E

*Diff: 3*

*Page Ref: Sec. 2.1*

2) Methane and ethane are both made up of carbon and hydrogen. In methane, there are 12.0 g of carbon for every 4.00 g of hydrogen, a ratio of 3:1 by mass. In ethane, there are 24.0 g of carbon for every 6.00 g of hydrogen, a ratio of 4:1 by mass. This is an illustration of the law of \_\_\_\_\_.

- A) constant composition
- B) multiple proportions
- C) conservation of matter
- D) conservation of mass
- E) octaves

Answer: B

*Diff: 2*

*Page Ref: Sec. 2.1*

3) Which statement below correctly describes the responses of alpha, beta, and gamma radiation to an electric field?

- A) Both beta and gamma are deflected in the same direction, while alpha shows no response.
- B) Both alpha and gamma are deflected in the same direction, while beta shows no response.
- C) Both alpha and beta are deflected in the same direction, while gamma shows no response.
- D) Alpha and beta are deflected in opposite directions, while gamma shows no response.
- E) Only alpha is deflected, while beta and gamma show no response.

Answer: D

*Diff: 2*

*Page Ref: Sec. 2.2*

4) \_\_\_\_\_ and \_\_\_\_\_ reside in the atomic nucleus.

- A) Protons, electrons
- B) Electrons, neutrons
- C) Protons, neutrons
- D) none of the above
- E) Neutrons, only neutrons

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.2*

5) 200 pm is the same as \_\_\_\_\_ Å.

- A) 2000
- B) 20
- C) 200
- D) 2
- E)  $2 \times 10^{-12}$

Answer: D

*Diff: 1*

*Page Ref: Sec. 2.3*

6) The atomic number indicates \_\_\_\_\_.

- A) the number of neutrons in a nucleus
- B) the total number of neutrons and protons in a nucleus
- C) the number of protons or electrons in a neutral atom
- D) the number of atoms in 1 g of an element
- E) the number of different isotopes of an element

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.3*

7) Which pair of atoms constitutes a pair of isotopes of the same element?

- A)  ${}^{14}_6\text{X}$   ${}^{14}_7\text{X}$
- B)  ${}^{14}_6\text{X}$   ${}^{12}_6\text{X}$
- C)  ${}^{17}_9\text{X}$   ${}^{17}_8\text{X}$
- D)  ${}^{19}_{10}\text{X}$   ${}^{19}_9\text{X}$
- E)  ${}^{20}_{10}\text{X}$   ${}^{21}_{11}\text{X}$

Answer: B

*Diff: 1*

*Page Ref: Sec. 2.3*

8) The nucleus of an atom contains \_\_\_\_\_.

- A) electrons
- B) protons, neutrons, and electrons
- C) protons and neutrons
- D) protons and electrons
- E) protons

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.3*

9) In the periodic table, the rows are called \_\_\_\_\_ and the columns are called \_\_\_\_\_.

- A) octaves, groups
- B) staffs, families
- C) periods, groups
- D) cogeners, families
- E) rows, groups

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.5*

10) Which group in the periodic table contains only nonmetals?

- A) 1A
- B) 6A
- C) 2B
- D) 2A
- E) 8A

Answer: E

*Diff: 1*

*Page Ref: Sec. 2.5*

11) The element \_\_\_\_\_ is the most similar to strontium in chemical and physical properties.

- A) Li
- B) At
- C) Rb
- D) Ba
- E) Cs

Answer: D

*Diff: 3*

*Page Ref: Sec. 2.5*

12) Horizontal rows of the periodic table are known as \_\_\_\_\_.

- A) periods
- B) groups
- C) metalloids
- D) metals
- E) nonmetals

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.5*

13) Vertical columns of the periodic table are known as \_\_\_\_\_.

- A) metals
- B) periods
- C) nonmetals
- D) groups
- E) metalloids

Answer: D

*Diff: 1*

*Page Ref: Sec. 2.5*

14) Elements in Group 1A are known as the \_\_\_\_\_.

- A) chalcogens
- B) alkaline earth metals
- C) alkali metals
- D) halogens
- E) noble gases

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.5*

15) Elements in Group 2A are known as the \_\_\_\_\_.

- A) alkaline earth metals
- B) alkali metals
- C) chalcogens
- D) halogens
- E) noble gases

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.5*

16) Elements in Group 6A are known as the \_\_\_\_\_.

- A) alkali metals
- B) chalcogens
- C) alkaline earth metals
- D) halogens
- E) noble gases

Answer: B

*Diff: 1*

*Page Ref: Sec. 2.5*

17) Elements in Group 7A are known as the \_\_\_\_\_.

- A) chalcogens
- B) alkali metals
- C) alkaline earth metals
- D) halogens
- E) noble gases

Answer: D

*Diff: 1*

*Page Ref: Sec. 2.5*

18) Elements in Group 8A are known as the \_\_\_\_\_.

- A) halogens
- B) alkali metals
- C) alkaline earth metals
- D) chalcogens
- E) noble gases

Answer: E

*Diff: 1*

*Page Ref: Sec. 2.5*

19) Potassium is a \_\_\_\_\_ and chlorine is a \_\_\_\_\_.

- A) metal, nonmetal
- B) metal, metal
- C) metal, metalloid
- D) metalloid, nonmetal
- E) nonmetal, metal

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.5*

20) Lithium is a \_\_\_\_\_ and magnesium is a \_\_\_\_\_.

- A) nonmetal, metal
- B) nonmetal, nonmetal
- C) metal, metal
- D) metal, metalloid
- E) metalloid, metalloid

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.5*

21) Oxygen is a \_\_\_\_\_ and nitrogen is a \_\_\_\_\_.

- A) metal, metalloid
- B) nonmetal, metal
- C) metalloid, metalloid
- D) nonmetal, nonmetal
- E) nonmetal, metalloid

Answer: D

*Diff: 1*

*Page Ref: Sec. 2.5*

22) Calcium is a \_\_\_\_\_ and silver is a \_\_\_\_\_.

- A) nonmetal, metal
- B) metal, metal
- C) metalloid, metal
- D) metal, metalloid
- E) nonmetal, metalloid

Answer: B

*Diff: 1*

*Page Ref: Sec. 2.5*

23) \_\_\_\_\_ are found uncombined, as monatomic species in nature.

- A) Noble gases
- B) Chalcogens
- C) Alkali metals
- D) Alkaline earth metals
- E) Halogens

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.6*



24) When a metal and a nonmetal react, the \_\_\_\_\_ tends to lose electrons and the \_\_\_\_\_ tends to gain electrons.

- A) metal, metal
- B) nonmetal, nonmetal
- C) metal, nonmetal
- D) nonmetal, metal
- E) None of the above, these elements share electrons.

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.6*

25) The empirical formula of a compound with molecules containing 12 carbon atoms, 14 hydrogen atoms, and 6 oxygen atoms is \_\_\_\_\_.

- A)  $C_{12}H_{14}O_6$
- B) CHO
- C)  $CH_2O$
- D)  $C_6H_7O_3$
- E)  $C_2H_4O$

Answer: D

*Diff: 2*

*Page Ref: Sec. 2.6*

26) \_\_\_\_\_ typically form ions with a 2+ charge.

- A) Alkaline earth metals
- B) Halogens
- C) Chalcogens
- D) Alkali metals
- E) Transition metals

Answer: A

*Diff: 2*

*Page Ref: Sec. 2.7*

27) What is the formula of the compound formed between strontium ions and nitrogen ions?

- A) SrN
- B) Sr<sub>3</sub>N<sub>2</sub>
- C) Sr<sub>2</sub>N<sub>3</sub>
- D) SrN<sub>2</sub>
- E) SrN<sub>3</sub>

Answer: B

*Diff: 3*

*Page Ref: Sec. 2.7*

28) Magnesium reacts with a certain element to form a compound with the general formula MgX. What would the most likely formula be for the compound formed between potassium and element X?

- A) K<sub>2</sub>X
- B) KX<sub>2</sub>
- C) K<sub>2</sub>X<sub>3</sub>
- D) K<sub>2</sub>X<sub>2</sub>
- E) KX

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.7*

29) The formula of a salt is XCl<sub>2</sub>. The X-ion in this salt has 28 electrons. The metal X is \_\_\_\_\_.

- A) Ni
- B) Zn
- C) Fe
- D) V
- E) Pd

Answer: B

*Diff: 2*

*Page Ref: Sec. 2.7*

30) The charge on the manganese in the salt  $\text{MnF}_3$  is \_\_\_\_\_.

- A) 1+
- B) 1-
- C) 2+
- D) 2-
- E) 3+

Answer: E

*Diff: 1*

*Page Ref: Sec. 2.7*

31) Aluminum reacts with a certain nonmetallic element to form a compound with the general formula  $\text{AlX}$ . Element X is a diatomic gas at room temperature. Element X must be \_\_\_\_\_.

- A) oxygen
- B) fluorine
- C) chlorine
- D) nitrogen
- E) sulfur

Answer: D

*Diff: 2*

*Page Ref: Sec. 2.7*

32) Sodium forms an ion with a charge of \_\_\_\_\_.

- A) 1+
- B) 1-
- C) 2+
- D) 2-
- E) 0

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.7*

33) Potassium forms an ion with a charge of \_\_\_\_\_.

- A) 2+
- B) 1-
- C) 1+
- D) 2-
- E) 0

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.7*

34) Calcium forms an ion with a charge of \_\_\_\_\_.

- A) 1-
- B) 2-
- C) 1+
- D) 2+
- E) 0

Answer: D

*Diff: 1*

*Page Ref: Sec. 2.7*

35) Barium forms an ion with a charge of \_\_\_\_\_.

- A) 1+
- B) 2-
- C) 3+
- D) 3-
- E) 2+

Answer: E

*Diff: 1*

*Page Ref: Sec. 2.7*

36) Aluminum forms an ion with a charge of \_\_\_\_\_.

- A) 2+
- B) 3-
- C) 1+
- D) 3+
- E) 1-

Answer: D

*Diff: 1*

*Page Ref: Sec. 2.7*

37) Fluorine forms an ion with a charge of \_\_\_\_\_.

- A) 1-
- B) 1+
- C) 2+
- D) 3+
- E) 3-

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.7*

38) Iodine forms an ion with a charge of \_\_\_\_\_.

- A) 7-
- B) 1+
- C) 2-
- D) 2+
- E) 1-

Answer: E

*Diff: 1*

*Page Ref: Sec. 2.7*

39) Oxygen forms an ion with a charge of \_\_\_\_\_.

- A) 2-
- B) 2+
- C) 3-
- D) 3+
- E) 6+

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.7*

40) Sulfur forms an ion with a charge of \_\_\_\_\_.

- A) 2+
- B) 2-
- C) 3+
- D) 6-
- E) 6+

Answer: B

*Diff: 2*

*Page Ref: Sec. 2.7*

41) Predict the empirical formula of the ionic compound that forms from sodium and fluorine.

- A) NaF
- B) Na<sub>2</sub>F
- C) NaF<sub>2</sub>
- D) Na<sub>2</sub>F<sub>3</sub>
- E) Na<sub>3</sub>F<sub>2</sub>

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.7*

42) Predict the empirical formula of the ionic compound that forms from magnesium and fluorine.

- A)  $\text{Mg}_2\text{F}_3$
- B)  $\text{MgF}$
- C)  $\text{Mg}_2\text{F}$
- D)  $\text{Mg}_3\text{F}_2$
- E)  $\text{MgF}_2$

Answer: E

*Diff: 1*

*Page Ref: Sec. 2.7*

43) Predict the empirical formula of the ionic compound that forms from magnesium and oxygen.

- A)  $\text{Mg}_2\text{O}$
- B)  $\text{MgO}$
- C)  $\text{MgO}_2$
- D)  $\text{Mg}_2\text{O}_2$
- E)  $\text{Mg}_3\text{O}_2$

Answer: B

*Diff: 1*

*Page Ref: Sec. 2.7*

44) Predict the empirical formula of the ionic compound that forms from aluminum and oxygen.

- A)  $\text{AlO}$
- B)  $\text{Al}_3\text{O}_2$
- C)  $\text{Al}_2\text{O}_3$
- D)  $\text{AlO}_2$
- E)  $\text{Al}_2\text{O}$

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.7*

45) The correct name for SrO is \_\_\_\_\_.

- A) strontium oxide
- B) strontium hydroxide
- C) strontium peroxide
- D) strontium monoxide
- E) strontium dioxide

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.8*

46) The correct name for  $K_2S$  is \_\_\_\_\_.

- A) potassium sulfate
- B) potassium disulfide
- C) potassium bisulfide
- D) potassium sulfide
- E) dipotassium sulfate

Answer: D

*Diff: 1*

*Page Ref: Sec. 2.8*

47) The correct name for  $Al_2O_3$  is \_\_\_\_\_.

- A) aluminum oxide
- B) dialuminum oxide
- C) dialuminum trioxide
- D) aluminum hydroxide
- E) aluminum trioxide

Answer: A

*Diff: 2*

*Page Ref: Sec. 2.8*



48) The correct name for  $\text{CaH}_2$  is \_\_\_\_\_.

- A) hydrocalcium
- B) calcium dihydride
- C) calcium hydroxide
- D) calcium dihydroxide
- E) calcium hydride

Answer: E

*Diff: 1*

*Page Ref: Sec. 2.8*

49) The correct name for  $\text{SO}$  is \_\_\_\_\_.

- A) sulfur oxide
- B) sulfur monoxide
- C) sulfoxide
- D) sulfate
- E) sulfite

Answer: B

*Diff: 1*

*Page Ref: Sec. 2.8*

50) The correct name for  $\text{CCl}_4$  is \_\_\_\_\_.

- A) carbon chloride
- B) carbon tetrachlorate
- C) carbon perchlorate
- D) carbon tetrachloride
- E) carbon chlorate

Answer: D

*Diff: 1*

*Page Ref: Sec. 2.8*

51) The correct name for  $\text{N}_2\text{O}_5$  is \_\_\_\_\_.

- A) nitrous oxide
- B) nitrogen pentoxide
- C) dinitrogen pentoxide
- D) nitric oxide
- E) nitrogen oxide

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.8*

52) The correct name for  $\text{H}_2\text{CO}_3$  is \_\_\_\_\_.

- A) carbonous acid
- B) hydrocarbonate
- C) carbonic acid
- D) carbohydrate
- E) carbohydric acid

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.8*

53) The correct name for  $\text{H}_2\text{SO}_3$  is \_\_\_\_\_.

- A) sulfuric acid
- B) sulfurous acid
- C) hydrosulfuric acid
- D) hydrosulfic acid
- E) sulfur hydroxide

Answer: B

*Diff: 1*

*Page Ref: Sec. 2.8*

54) The correct name for  $\text{HClO}_3$  is \_\_\_\_\_.

- A) hydrochloric acid
- B) perchloric acid
- C) chloric acid
- D) chlorous acid
- E) hydrochlorous acid

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.8*

55) The correct name for  $\text{HClO}_2$  is \_\_\_\_\_.

- A) perchloric acid
- B) chloric acid
- C) hypochlorous acid
- D) hypochloric acid
- E) chlorous acid

Answer: E

*Diff: 2*

*Page Ref: Sec. 2.8*

56) The correct name of the compound  $\text{Na}_3\text{N}$  is \_\_\_\_\_.

- A) sodium nitride
- B) sodium azide
- C) sodium trinitride
- D) sodium(III) nitride
- E) trisodium nitride

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.8*

57) The formula of bromic acid is \_\_\_\_\_.

- A) HBr
- B)  $\text{HBrO}_4$
- C) HBrO
- D)  $\text{HBrO}_3$
- E)  $\text{HBrO}_2$

Answer: D

*Diff: 1*

*Page Ref: Sec. 2.8*

58) The correct formula for molybdenum(IV) hypochlorite is \_\_\_\_\_.

- A)  $\text{Mo}(\text{ClO}_3)_4$
- B)  $\text{Mo}(\text{ClO})_4$
- C)  $\text{Mo}(\text{ClO}_2)_4$
- D)  $\text{Mo}(\text{ClO}_4)_4$
- E)  $\text{MoCl}_4$

Answer: B

*Diff: 2*

*Page Ref: Sec. 2.8*

59) The name of  $\text{PCl}_3$  is \_\_\_\_\_.

- A) potassium chloride
- B) phosphorus trichloride
- C) phosphorous(III) chloride
- D) monophosphorous trichloride
- E) trichloro potassium

Answer: B

*Diff: 1*

*Page Ref: Sec. 2.8*

60) The ions  $\text{Ca}^{2+}$  and  $\text{PO}_4^{3-}$  form a salt with the formula \_\_\_\_\_.

- A)  $\text{CaPO}_4$
- B)  $\text{Ca}_2(\text{PO}_4)_3$
- C)  $\text{Ca}_2\text{PO}_4$
- D)  $\text{Ca}(\text{PO}_4)_2$
- E)  $\text{Ca}_3(\text{PO}_4)_2$

Answer: E

*Diff: 1*

*Page Ref: Sec. 2.8*

61) The correct formula of iron(III) bromide is \_\_\_\_\_.

- A)  $\text{FeBr}_2$
- B)  $\text{FeBr}_3$
- C)  $\text{FeBr}$
- D)  $\text{Fe}_3\text{Br}_3$
- E)  $\text{Fe}_3\text{Br}$

Answer: B

*Diff: 1*

*Page Ref: Sec. 2.8*

62) Element M reacts with fluorine to form an ionic compound with the formula  $\text{MF}_3$ .  
The M-ion has 18 electrons. Element M is \_\_\_\_\_.

- A) P
- B) Sc
- C) Ar
- D) Ca
- E) Cr

Answer: B

*Diff: 2*

*Page Ref: Sec. 2.8*

63) Magnesium and sulfur form an ionic compound with the formula \_\_\_\_\_.

- A) MgS
- B) Mg<sub>2</sub>S
- C) MgS<sub>2</sub>
- D) Mg<sub>2</sub>S<sub>2</sub>
- E) Mg<sub>2</sub>S<sub>3</sub>

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.8*

64) The formula of ammonium carbonate is \_\_\_\_\_.

- A) (NH<sub>4</sub>)<sub>2</sub>CO<sub>3</sub>
- B) NH<sub>4</sub>CO<sub>2</sub>
- C) (NH<sub>3</sub>)<sub>2</sub>CO<sub>4</sub>
- D) (NH<sub>3</sub>)<sub>2</sub>CO<sub>3</sub>
- E) N<sub>2</sub>(CO<sub>3</sub>)<sub>3</sub>

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.8*

65) The formula of the chromate ion is \_\_\_\_\_.

- A) CrO<sub>4</sub><sup>2-</sup>
- B) CrO<sub>2</sub><sup>3-</sup>
- C) CrO<sup>-</sup>
- D) CrO<sub>3</sub><sup>2-</sup>
- E) CrO<sup>2-</sup>

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.8*

66) The formula of the carbonate ion is \_\_\_\_\_.

- A)  $\text{CO}_2^{2-}$
- B)  $\text{CO}_3^{2-}$
- C)  $\text{CO}_3^{3-}$
- D)  $\text{CO}_2^-$
- E)  $\text{CO}^-$

Answer: B

*Diff: 1*

*Page Ref: Sec. 2.8*

67) The correct name for  $\text{Mg}(\text{ClO}_3)_2$  is \_\_\_\_\_.

- A) magnesium chlorate
- B) manganese chlorate
- C) magnesium chloroxide
- D) magnesium perchlorate
- E) manganese perchlorate

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.8*

68) What is the correct formula for ammonium sulfide?

- A)  $\text{NH}_4\text{SO}_3$
- B)  $(\text{NH}_4)_2\text{SO}_4$
- C)  $(\text{NH}_4)_2\text{S}$
- D)  $\text{NH}_3\text{S}$
- E)  $\text{N}_2\text{S}_3$

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.8*

69) When calcium reacts with sulfur the compound formed is \_\_\_\_\_.

- A)  $\text{Ca}_2\text{S}_2$
- B)  $\text{Ca}_3\text{S}_2$
- C)  $\text{CaS}$
- D)  $\text{CaS}_2$
- E)  $\text{Ca}_2\text{S}_3$

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.8*

70) Chromium and chlorine form an ionic compound whose formula is  $\text{CrCl}_3$ . The name of this compound is \_\_\_\_\_.

- A) chromium chlorine
- B) chromium(III) chloride
- C) monochromium trichloride
- D) chromium(III) trichloride
- E) chromic trichloride

Answer: B

*Diff: 1*

*Page Ref: Sec. 2.8*

71) The name of the binary compound  $\text{N}_2\text{O}_4$  is \_\_\_\_\_.

- A) nitrogen oxide
- B) nitrous oxide
- C) nitrogen(IV) oxide
- D) dinitrogen tetroxide
- E) oxygen nitride

Answer: D

*Diff: 2*

*Page Ref: Sec. 2.8*



72) The formula for zinc phosphate is  $\text{Zn}_3(\text{PO}_4)_2$ . What is the formula for cadmium arsenate?

- A)  $\text{Cd}_4(\text{AsO}_2)_3$
- B)  $\text{Cd}_3(\text{AsO}_4)_2$
- C)  $\text{Cd}_3(\text{AsO}_3)_4$
- D)  $\text{Cd}_2(\text{AsO}_4)_3$
- E)  $\text{Cd}_2(\text{AsO}_4)_4$

Answer: B

*Diff: 1*

*Page Ref: Sec. 2.8*

73) The formula for aluminum hydroxide is \_\_\_\_\_.

- A)  $\text{AlOH}$
- B)  $\text{Al}_3\text{OH}$
- C)  $\text{Al}_2(\text{OH})_3$
- D)  $\text{Al}(\text{OH})_3$
- E)  $\text{Al}_2\text{O}_3$

Answer: D

*Diff: 1*

*Page Ref: Sec. 2.8*

74) The name of the ionic compound  $\text{KBrO}_4$  is \_\_\_\_\_.

- A) potassium perbromate
- B) potassium bromate
- C) potassium hypobromate
- D) potassium perbromite
- E) potassium bromide

Answer: A

*Diff: 2*

*Page Ref: Sec. 2.8*

75) The name of the ionic compound  $V_2O_3$  is \_\_\_\_\_.

- A) vanadium(III) oxide
- B) vanadium oxide
- C) vanadium(II) oxide
- D) vanadium(III) trioxide
- E) divanadium trioxide

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.8*

76) The name of the ionic compound  $NH_4CN$  is \_\_\_\_\_.

- A) nitrogen hydrogen cyanate
- B) ammonium carbonitride
- C) ammonium cyanide
- D) ammonium hydrogen cyanate
- E) cyanonitride

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.8*

77) The name of the ionic compound  $(NH_4)_3PO_4$  is \_\_\_\_\_.

- A) ammonium phosphate
- B) nitrogen hydrogen phosphate
- C) tetrammonium phosphate
- D) ammonia phosphide
- E) triammonium phosphate

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.8*

78) What is the formula for perchloric acid?

- A) HClO
- B) HClO<sub>3</sub>
- C) HClO<sub>4</sub>
- D) HClO<sub>2</sub>
- E) HCl

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.8*

79) The correct name for HIO<sub>2</sub> is \_\_\_\_\_.

- A) hypoiodic acid
- B) hydriodic acid
- C) periodous acid
- D) iodous acid
- E) periodic acid

Answer: D

*Diff: 2*

*Page Ref: Sec. 2.8*

80) What is the molecular formula for propane?

- A) C<sub>2</sub>H<sub>8</sub>
- B) C<sub>3</sub>H<sub>6</sub>
- C) C<sub>3</sub>H<sub>8</sub>
- D) C<sub>4</sub>H<sub>8</sub>
- E) C<sub>4</sub>H<sub>10</sub>

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.9*

81) What is the molecular formula for nonane?

- A)  $C_9H_{18}$
- B)  $C_9H_{20}$
- C)  $C_{10}H_{20}$
- D)  $C_{10}H_{22}$
- E)  $C_{10}H_{24}$

Answer: B

*Diff: 2*

*Page Ref: Sec. 2.9*

82) What is the molecular formula for heptane?

- A)  $C_6H_{12}$
- B)  $C_6H_{14}$
- C)  $C_7H_{14}$
- D)  $C_7H_{16}$
- E)  $C_7H_{18}$

Answer: D

*Diff: 2*

*Page Ref: Sec. 2.9*

83) What is the molecular formula for n-hexanol?

- A)  $C_6H_{12}OH$
- B)  $C_6H_{13}OH$
- C)  $C_6H_{14}OH$
- D)  $C_7H_{13}OH$
- E)  $C_7H_{14}OH$

Answer: B

*Diff: 2*

*Page Ref: Sec. 2.9*

## 2.2 Multiple-Choice Questions

1) A molecule of water contains hydrogen and oxygen in a 1:8 ratio by mass. This is a statement of \_\_\_\_\_.

- A) the law of multiple proportions
- B) the law of constant composition
- C) the law of conservation of mass
- D) the law of conservation of energy
- E) none of the above

Answer: B

*Diff: 2*

*Page Ref: Sec. 2.1*

2) Which one of the following is not one of the postulates of Dalton's atomic theory?

- A) Atoms are composed of protons, neutrons, and electrons.
- B) All atoms of a given element are identical; the atoms of different elements are different and have different properties.
- C) Atoms of an element are not changed into different types of atoms by chemical reactions: atoms are neither created nor destroyed in chemical reactions.
- D) Compounds are formed when atoms of more than one element combine; a given compound always has the same relative number and kind of atoms.
- E) Each element is composed of extremely small particles called atoms.

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.1*

- 3) Consider the following selected postulates of Dalton's atomic theory:
- (i) Each element is composed of extremely small particles called atoms.
  - (ii) Atoms are indivisible.
  - (iii) Atoms of a given element are identical.
  - (iv) Atoms of different elements are different and have different properties.

Which of the postulates is(are) no longer considered valid?

- A) (i) and (ii)
- B) (ii) only
- C) (ii) and (iii)
- D) (iii) only
- E) (iii) and (iv)

Answer: C

*Diff: 2*

*Page Ref: Sec. 2.1*

- 4) Which pair of substances could be used to illustrate the law of multiple proportions?

- A)  $\text{SO}_2$ ,  $\text{H}_2\text{SO}_4$
- B)  $\text{CO}$ ,  $\text{CO}_2$
- C)  $\text{H}_2\text{O}$ ,  $\text{O}_2$
- D)  $\text{CH}_4$ ,  $\text{C}_6\text{H}_{12}\text{O}_6$
- E)  $\text{NaCl}$ ,  $\text{KCl}$

Answer: B

*Diff: 1*

*Page Ref: Sec. 2.1*

5) Which one of the following is not true concerning cathode rays?

- A) They originate from the negative electrode.
- B) They travel in straight lines in the absence of electric or magnetic fields.
- C) They impart a negative charge to metals exposed to them.
- D) They are made up of electrons.
- E) The characteristics of cathode rays depend on the material from which they are emitted.

Answer: E

*Diff: 2*

*Page Ref: Sec. 2.2*

6) The charge on an electron was determined in the \_\_\_\_\_.

- A) cathode ray tube, by J. J. Thompson
- B) Rutherford gold foil experiment
- C) Millikan oil drop experiment
- D) Dalton atomic theory
- E) atomic theory of matter

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.2*

7) \_\_\_\_\_-rays consist of fast-moving electrons.

- A) Alpha
- B) Beta
- C) Gamma
- D) X
- E) none of the above

Answer: B

*Diff: 1*

*Page Ref: Sec. 2.2*

8) The gold foil experiment performed in Rutherford's lab \_\_\_\_\_.

- A) confirmed the plum-pudding model of the atom
- B) led to the discovery of the atomic nucleus
- C) was the basis for Thomson's model of the atom
- D) utilized the deflection of beta particles by gold foil
- E) proved the law of multiple proportions

Answer: B

*Diff: 1*

*Page Ref: Sec. 2.2*

9) In the Rutherford nuclear-atom model, \_\_\_\_\_.

- A) the heavy subatomic particles, protons and neutrons, reside in the nucleus
- B) the three principal subatomic particles (protons, neutrons, and electrons) all have essentially the same mass
- C) the light subatomic particles, protons and neutrons, reside in the nucleus
- D) mass is spread essentially uniformly throughout the atom
- E) the three principal subatomic particles (protons, neutrons, and electrons) all have essentially the same mass and mass is spread essentially uniformly throughout the atom

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.2*

10) Cathode rays are \_\_\_\_\_.

- A) neutrons
- B) x-rays
- C) electrons
- D) protons
- E) atoms

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.2*



11) Cathode rays are deflected away from a negatively charged plate because \_\_\_\_\_.

- A) they are not particles
- B) they are positively charged particles
- C) they are neutral particles
- D) they are negatively charged particles
- E) they are emitted by all matter

Answer: D

*Diff: 1*

*Page Ref: Sec. 2.2*

12) In the absence of magnetic or electric fields, cathode rays \_\_\_\_\_.

- A) do not exist
- B) travel in straight lines
- C) cannot be detected
- D) become positively charged
- E) bend toward a light source

Answer: B

*Diff: 1*

*Page Ref: Sec. 2.2*

13) Of the three types of radioactivity characterized by Rutherford, which is/are electrically charged?

- A)  $\beta$ -rays
- B)  $\alpha$ -rays and  $\beta$ -rays
- C)  $\alpha$ -rays,  $\beta$ -rays, and  $\gamma$ -rays
- D)  $\alpha$ -rays
- E)  $\alpha$ -rays and  $\gamma$ -rays

Answer: B

*Diff: 1*

*Page Ref: Sec. 2.2*

14) Of the three types of radioactivity characterized by Rutherford, which is/are not electrically charged?

- A)  $\alpha$ -rays
- B)  $\alpha$ -rays,  $\beta$ -rays, and  $\gamma$ -rays
- C)  $\gamma$ -rays
- D)  $\alpha$ -rays and  $\beta$ -rays
- E)  $\alpha$ -rays and  $\gamma$ -rays

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.2*

15) Of the three types of radioactivity characterized by Rutherford, which are particles?

- A)  $\beta$ -rays
- B)  $\alpha$ -rays,  $\beta$ -rays, and  $\gamma$ -rays
- C)  $\gamma$ -rays
- D)  $\alpha$ -rays and  $\gamma$ -rays
- E)  $\alpha$ -rays and  $\beta$ -rays

Answer: E

*Diff: 1*

*Page Ref: Sec. 2.2*

16) Of the three types of radioactivity characterized by Rutherford, which is/are not particles?

- A)  $\beta$ -rays
- B)  $\alpha$ -rays and  $\beta$ -rays
- C)  $\alpha$ -rays
- D)  $\gamma$ -rays
- E)  $\alpha$ -rays,  $\beta$ -rays, and  $\gamma$ -rays

Answer: D

*Diff: 1*

*Page Ref: Sec. 2.2*

17) Of the following, the smallest and lightest subatomic particle is the \_\_\_\_\_.

- A) neutron
- B) proton
- C) electron
- D) nucleus
- E) alpha particle

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.3*

18) All atoms of a given element have the same \_\_\_\_\_.

- A) mass
- B) number of protons
- C) number of neutrons
- D) number of electrons and neutrons
- E) density

Answer: B

*Diff: 1*

*Page Ref: Sec. 2.3*

19) Which atom has the smallest number of neutrons?

- A) carbon-14
- B) nitrogen-14
- C) oxygen-16
- D) fluorine-19
- E) neon-20

Answer: B

*Diff: 1*

*Page Ref: Sec. 2.3*

20) Which atom has the largest number of neutrons?

- A) phosphorus-30
- B) chlorine-37
- C) potassium-39
- D) argon-40
- E) calcium-40

Answer: D

*Diff: 3*

*Page Ref: Sec. 2.3*

21) There are \_\_\_\_\_ electrons, \_\_\_\_\_ protons, and \_\_\_\_\_ neutrons in an atom of  $^{132}_{54}\text{Xe}$ .

- A) 132, 132, 54
- B) 54, 54, 132
- C) 78, 78, 54
- D) 54, 54, 78
- E) 78, 78, 132

Answer: D

*Diff: 2*

*Page Ref: Sec. 2.3*

22) An atom of the most common isotope of gold,  $^{197}\text{Au}$ , has \_\_\_\_\_ protons, \_\_\_\_\_ neutrons, and \_\_\_\_\_ electrons.

- A) 197, 79, 118
- B) 118, 79, 39
- C) 79, 197, 197
- D) 79, 118, 118
- E) 79, 118, 79

Answer: E

*Diff: 2*

*Page Ref: Sec. 2.3*

23) Which combination of protons, neutrons, and electrons is correct for the isotope of copper,  $^{63}_{29}\text{Cu}$  ?

- A) 29  $\text{p}^+$ , 34  $\text{n}^\circ$ , 29  $\text{e}^-$
- B) 29  $\text{p}^+$ , 29  $\text{n}^\circ$ , 63  $\text{e}^-$
- C) 63  $\text{p}^+$ , 29  $\text{n}^\circ$ , 63  $\text{e}^-$
- D) 34  $\text{p}^+$ , 29  $\text{n}^\circ$ , 34  $\text{e}^-$
- E) 34  $\text{p}^+$ , 34  $\text{n}^\circ$ , 29  $\text{e}^-$

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.3*

24) Which isotope has 45 neutrons?

- A)  $^{80}_{36}\text{Kr}$
- B)  $^{80}_{35}\text{Br}$
- C)  $^{78}_{34}\text{Se}$
- D)  $^{34}_{17}\text{Cl}$
- E)  $^{103}_{45}\text{Rh}$

Answer: B

*Diff: 1*

*Page Ref: Sec. 2.3*

25) Which isotope has 36 electrons in an atom?

- A)  $^{80}_{36}\text{Kr}$
- B)  $^{80}_{35}\text{Br}$
- C)  $^{78}_{34}\text{Se}$
- D)  $^{34}_{17}\text{Cl}$
- E)  $^{36}_{80}\text{Hg}$

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.3*

26) Isotopes are atoms that have the same number of \_\_\_\_\_ but differing number of \_\_\_\_\_.

- A) protons, electrons
- B) neutrons, protons
- C) protons, neutrons
- D) electrons, protons
- E) neutrons, electrons

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.3*

27) The nucleus of an atom does not contain \_\_\_\_\_.

- A) protons
- B) protons or neutrons
- C) neutrons
- D) subatomic particles
- E) electrons

Answer: E

*Diff: 1*

*Page Ref: Sec. 2.3*

28) The nucleus of an atom contains \_\_\_\_\_.

- A) electrons
- B) protons
- C) neutrons
- D) protons and neutrons
- E) protons, neutrons, and electrons

Answer: D

*Diff: 1*

*Page Ref: Sec. 2.3*

29) Different isotopes of a particular element contain the same number of \_\_\_\_\_.

- A) protons
- B) neutrons
- C) protons and neutrons
- D) protons, neutrons, and electrons
- E) subatomic particles

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.3*

30) Different isotopes of a particular element contain different numbers of \_\_\_\_\_.

- A) protons
- B) neutrons
- C) protons and neutrons
- D) protons, neutrons, and electrons
- E) None of the above is correct.

Answer: B

*Diff: 1*

*Page Ref: Sec. 2.3*

31) In the symbol shown below, x = \_\_\_\_\_.



- A) 7
- B) 13
- C) 12
- D) 6
- E) not enough information to determine

Answer: D

*Diff: 1*

*Page Ref: Sec. 2.3*

32) In the symbol below, X = \_\_\_\_\_.



- A) N
- B) C
- C) Al
- D) K
- E) not enough information to determine

Answer: B

*Diff: 1*

*Page Ref: Sec. 2.3*

33) In the symbol below, x = \_\_\_\_\_.



- A) 19
- B) 13
- C) 6
- D) 7
- E) not enough information to determine

Answer: E

*Diff: 2*

*Page Ref: Sec. 2.3*

34) In the symbol below, x is \_\_\_\_\_.



- A) the number of neutrons
- B) the atomic number
- C) the mass number
- D) the isotope number
- E) the elemental symbol

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.3*



35) Which one of the following basic forces is so small that it has no chemical significance?

- A) weak nuclear force
- B) strong nuclear force
- C) electromagnetism
- D) gravity
- E) Coulomb's law

Answer: D

*Diff: 2*

*Page Ref: Sec. 2.3*

36) Gravitational forces act between objects in proportion to their \_\_\_\_\_.

- A) volumes
- B) masses
- C) charges
- D) polarizability
- E) densities

Answer: B

*Diff: 1*

*Page Ref: Sec. 2.3*

37) Silver has two naturally occurring isotopes with the following isotopic masses:



The average atomic mass of silver is 107.8682 amu. The fractional abundance of the lighter of the two isotopes is \_\_\_\_\_.

- A) 0.24221
- B) 0.48168
- C) 0.51835
- D) 0.75783
- E) 0.90474

Answer: C

Diff: 4

Page Ref: Sec. 2.4

38) The atomic mass unit is presently based on assigning an exact integral mass (in amu) to an isotope of \_\_\_\_\_.

- A) hydrogen
- B) oxygen
- C) sodium
- D) carbon
- E) helium

Answer: D

Diff: 1

Page Ref: Sec. 2.4

39) The element X has three naturally occurring isotopes. The masses (amu) and % abundances of the isotopes are given in the table below. The average atomic mass of the element is \_\_\_\_\_ amu.

| Isotope          | Abundance | Mass  |
|------------------|-----------|-------|
| $^{221}\text{X}$ | 74.22     | 220.9 |
| $^{220}\text{X}$ | 12.78     | 220.0 |
| $^{218}\text{X}$ | 13.00     | 218.1 |

- A) 219.7
- B) 220.4
- C) 220.42
- D) 218.5
- E) 221.0

Answer: B

*Diff: 1*

*Page Ref: Sec. 2.4*

40) Element X has three naturally occurring isotopes. The masses (amu) and % abundances of the isotopes are given in the table below. The average atomic mass of the element is \_\_\_\_\_ amu.

| Isotope         | Abundance | Mass   |
|-----------------|-----------|--------|
| $^{38}\text{X}$ | 5.07      | 37.919 |
| $^{39}\text{X}$ | 15.35     | 39.017 |
| $^{42}\text{X}$ | 79.85     | 42.111 |

- A) 41.54
- B) 39.68
- C) 39.07
- D) 38.64
- E) 33.33

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.4*

41) The element X has three naturally occurring isotopes. The isotopic masses (amu) and % abundances of the isotopes are given in the table below. The average atomic mass of the element is \_\_\_\_\_ amu.

| Isotope          | Abundance | Mass   |
|------------------|-----------|--------|
| $^{159}\text{X}$ | 30.60     | 159.37 |
| $^{163}\text{X}$ | 15.79     | 162.79 |
| $^{164}\text{X}$ | 53.61     | 163.92 |

- A) 161.75
- B) 162.03
- C) 162.35
- D) 163.15
- E) 33.33

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.4*

42) The element X has three naturally occurring isotopes. The isotopic masses (amu) and % abundances of the isotopes are given in the table below. The average atomic mass of the element is \_\_\_\_\_ amu.

| Isotope         | Abundance | Mass  |
|-----------------|-----------|-------|
| $^{53}\text{X}$ | 19.61     | 52.62 |
| $^{56}\text{X}$ | 53.91     | 56.29 |
| $^{58}\text{X}$ | 26.48     | 58.31 |

- A) 33.33
- B) 55.74
- C) 56.11
- D) 57.23
- E) 56.29

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.4*

43) The element X has two naturally occurring isotopes. The masses (amu) and % abundances of the isotopes are given in the table below. The average atomic mass of the element is \_\_\_\_\_ amu.

| Isotope         | Abundance (%) | Mass (amu) |
|-----------------|---------------|------------|
| $^{31}\text{X}$ | 35.16         | 31.16      |
| $^{34}\text{X}$ | 64.84         | 34.30      |

- A) 30.20
- B) 33.20
- C) 34.02
- D) 35.22
- E) 32.73

Answer: B

*Diff: 1*

*Page Ref: Sec. 2.4*

44) The average atomic weight of copper, which has two naturally occurring isotopes, is 63.5. One of the isotopes has an atomic weight of 62.9 amu and constitutes 69.1% of the copper isotopes. The other isotope has an abundance of 30.9%. The atomic weight (amu) of the second isotope is \_\_\_\_\_ amu.

- A) 63.2
- B) 63.8
- C) 64.1
- D) 64.8
- E) 28.1

Answer: D

*Diff: 4*

*Page Ref: Sec. 2.4*

45) The element X has three naturally occurring isotopes. The masses (amu) and % abundances of the isotopes are given in the table below. The average atomic mass of the element is \_\_\_\_\_ amu.

| Isotope         | Abundance (%) | Mass (amu) |
|-----------------|---------------|------------|
| $^{15}\text{X}$ | 28.60         | 15.33      |
| $^{17}\text{X}$ | 13.30         | 17.26      |
| $^{16}\text{X}$ | 58.10         | 18.11      |

- A) 17.20
- B) 16.90
- C) 17.65
- D) 17.11
- E) 16.90

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.4*

46) Vanadium has two naturally occurring isotopes,  $^{50}\text{V}$  with an atomic mass of 49.9472 amu and  $^{51}\text{V}$  with an atomic mass of 50.9440. The atomic weight of vanadium is 50.9415. The percent abundances of the vanadium isotopes are \_\_\_\_\_%  $^{50}\text{V}$  and \_\_\_\_\_%  $^{51}\text{V}$ .

- A) 0.25, 99.75
- B) 99.75, 0.25
- C) 49, 51
- D) 1.0, 99
- E) 99, 1.0

Answer: A

*Diff: 4*

*Page Ref: Sec. 2.4*

47) An unknown element is found to have three naturally occurring isotopes with atomic masses of 35.9675 (0.337%), 37.9627 (0.063%), and 39.9624 (99.600%). Which of the following is the unknown element?

- A) Ar
- B) K
- C) Cl
- D) Ca
- E) None of the above could be the unknown element.

Answer: A

*Diff: 2*

*Page Ref: Sec. 2.4*

48) In the periodic table, the elements are arranged in \_\_\_\_\_.

- A) alphabetical order
- B) order of increasing atomic number
- C) order of increasing metallic properties
- D) order of increasing neutron content
- E) reverse alphabetical order

Answer: B

*Diff: 1*

*Page Ref: Sec. 2.5*

49) Elements \_\_\_\_\_ exhibit similar physical and chemical properties.

- A) with similar chemical symbols
- B) with similar atomic masses
- C) in the same period of the periodic table
- D) on opposite sides of the periodic table
- E) in the same group of the periodic table

Answer: E

*Diff: 1*

*Page Ref: Sec. 2.5*

50) Which pair of elements would you expect to exhibit the greatest similarity in their physical and chemical properties?

- A) H, Li
- B) Cs, Ba
- C) Ca, Sr
- D) Ga, Ge
- E) C, O

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.5*

51) Which pair of elements would you expect to exhibit the greatest similarity in their physical and chemical properties?

- A) O, S
- B) C, N
- C) K, Ca
- D) H, He
- E) Si, P

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.5*

52) Which one of the following is a nonmetal?

- A) W
- B) Sr
- C) Os
- D) Ir
- E) Br

Answer: E

*Diff: 1*

*Page Ref: Sec. 2.5*



53) Of the following, only \_\_\_\_\_ is not a metalloid.

- A) B
- B) Al
- C) Si
- D) Ge
- E) As

Answer: B

*Diff: 1*

*Page Ref: Sec. 2.5*

54) Which of the following elements is a metalloid?

- A) B
- B) C
- C) Ga
- D) Se
- E) In

Answer: A

*Diff: 3*

*Page Ref: Sec. 2.5*

55) The elements in groups 1A, 6A, and 7A are called, \_\_\_\_\_, respectively.

- A) alkaline earth metals, halogens, and chalcogens
- B) alkali metals, chalcogens, and halogens
- C) alkali metals, halogens, and noble gases
- D) alkaline earth metals, transition metals, and halogens
- E) halogens, transition metals, and alkali metals

Answer: B

*Diff: 2*

*Page Ref: Sec. 2.5*

56) Which pair of elements below should be the most similar in chemical properties?

- A) C and O
- B) B and As
- C) I and Br
- D) K and Kr
- E) Cs and He

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.5*

57) An element in the upper right corner of the periodic table \_\_\_\_\_.

- A) is either a metal or metalloid
- B) is definitely a metal
- C) is either a metalloid or a non-metal
- D) is definitely a non-metal
- E) is definitely a metalloid

Answer: D

*Diff: 1*

*Page Ref: Sec. 2.5*

58) An element that appears in the lower left corner of the periodic table is \_\_\_\_\_.

- A) either a metal or metalloid
- B) definitely a metal
- C) either a metalloid or a non-metal
- D) definitely a non-metal
- E) definitely a metalloid

Answer: B

*Diff: 1*

*Page Ref: Sec. 2.5*

59) Elements in the same group of the periodic table typically have \_\_\_\_\_.

- A) similar mass numbers
- B) similar physical properties only
- C) similar chemical properties only
- D) similar atomic masses
- E) similar physical and chemical properties

Answer: E

*Diff: 1*

*Page Ref: Sec. 2.5*

60) Which one of the following does not occur as diatomic molecules in elemental form?

- A) oxygen
- B) nitrogen
- C) sulfur
- D) hydrogen
- E) bromine

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.6*

61) Which one of the following molecular formulas is also an empirical formula?

- A)  $C_6H_6O_2$
- B)  $C_2H_6SO$
- C)  $H_2O_2$
- D)  $H_2P_4O_6$
- E)  $C_6H_6$

Answer: B

*Diff: 2*

*Page Ref: Sec. 2.6*

62) Which compounds do not have the same empirical formula?

- A)  $C_2H_2$ ,  $C_6H_6$
- B)  $CO$ ,  $CO_2$
- C)  $C_2H_4$ ,  $C_3H_6$
- D)  $C_2H_4O_2$ ,  $C_6H_{12}O_6$
- E)  $C_2H_5COOCH_3$ ,  $CH_3CHO$

Answer: B

*Diff: 2*

*Page Ref: Sec. 2.6*

63) Of the choices below, which one is not an ionic compound?

- A)  $PCl_5$
- B)  $MoCl_6$
- C)  $RbCl$
- D)  $PbCl_2$
- E)  $NaCl$

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.6*

64) Which type of formula provides the most information about a compound?

- A) empirical
- B) molecular
- C) simplest
- D) structural
- E) chemical

Answer: D

*Diff: 1*

*Page Ref: Sec. 2.6*

65) A molecular formula always indicates \_\_\_\_\_.

- A) how many of each atom are in a molecule
- B) the simplest whole-number ratio of different atoms in a compound
- C) which atoms are attached to which in a molecule
- D) the isotope of each element in a compound
- E) the geometry of a molecule

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.6*

66) An empirical formula always indicates \_\_\_\_\_.

- A) which atoms are attached to which in a molecule
- B) how many of each atom are in a molecule
- C) the simplest whole-number ratio of different atoms in a compound
- D) the isotope of each element in a compound
- E) the geometry of a molecule

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.6*

67) The molecular formula of a compound is always \_\_\_\_\_ the empirical formula.

- A) more complex than
- B) different from
- C) an integral multiple of
- D) the same as
- E) simpler than

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.6*

68) Formulas that show how atoms are attached in a molecule are called \_\_\_\_\_.

- A) molecular formulas
- B) ionic formulas
- C) empirical formulas
- D) diatomic formulas
- E) structural formulas

Answer: E

*Diff: 1*

*Page Ref: Sec. 2.6*

69) Of the following, \_\_\_\_\_ contains the greatest number of electrons.

- A)  $P^{3+}$
- B) P
- C)  $P^{2-}$
- D)  $P^{3-}$
- E)  $P^{2+}$

Answer: D

*Diff: 1*

*Page Ref: Sec. 2.7*

70) Which one of the following is most likely to lose electrons when forming an ion?

- A) F
- B) P
- C) Rh
- D) S
- E) N

Answer: C

*Diff: 2*

*Page Ref: Sec. 2.7*

71) Which species has 54 electrons?

- A)  $^{132}_{54}\text{Xe}^+$
- B)  $^{128}_{52}\text{Te}^{2-}$
- C)  $^{118}_{50}\text{Sn}^{2+}$
- D)  $^{112}_{48}\text{Cd}$
- E)  $^{132}_{54}\text{Xe}^{2+}$

Answer: B

*Diff: 1*

*Page Ref: Sec. 2.7*

72) Which species has 16 protons?

- A)  $^{31}\text{P}$
- B)  $^{34}\text{S}^{2-}$
- C)  $^{36}\text{Cl}$
- D)  $^{80}\text{Br}^-$
- E)  $^{16}\text{O}$

Answer: B

*Diff: 1*

*Page Ref: Sec. 2.7*

73) Which species has 18 electrons?

- A)  $^{39}\text{K}$
- B)  $^{32}\text{S}^{-2}$
- C)  $^{35}\text{Cl}$
- D)  $^{27}\text{Al}^{+3}$
- E)  $^{64}\text{Cu}^{+2}$

Answer: B

*Diff: 2*

*Page Ref: Sec 2.7*

74) The species \_\_\_\_\_ contains 16 neutrons.

- A)  $^{31}\text{P}$
- B)  $^{34}\text{S}^{2-}$
- C)  $^{36}\text{Cl}$
- D)  $^{80}\text{Br}^-$
- E)  $^{16}\text{O}$

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.7*

75) Which species is an isotope of  $^{39}\text{Cl}$ ?

- A)  $^{40}\text{Ar}^+$
- B)  $^{34}\text{S}^{2-}$
- C)  $^{36}\text{Cl}^-$
- D)  $^{80}\text{Br}$
- E)  $^{39}\text{Ar}$

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.7*

76) Which one of the following species has as many electrons as it has neutrons?

- A)  $^1\text{H}$
- B)  $^{40}\text{Ca}^{2+}$
- C)  $^{14}\text{C}$
- D)  $^{19}\text{F}^-$
- E)  $^{14}\text{C}^{2+}$

Answer: D

*Diff: 2*

*Page Ref: Sec. 2.7*



77) There are \_\_\_\_\_ protons, \_\_\_\_\_ neutrons, and \_\_\_\_\_ electrons in  $^{131}\text{I}^-$ .

- A) 131, 53, and 54
- B) 131, 53, and 52
- C) 53, 78, and 54
- D) 53, 131, and 52
- E) 78, 53, and 72

Answer: C

*Diff: 2*

*Page Ref: Sec. 2.7*

78) Which species has 48 electrons?

- A)  $^{118}_{50}\text{Sn}^{+2}$
- B)  $^{116}_{50}\text{Sn}^{+4}$
- C)  $^{112}_{48}\text{Cd}^{+2}$
- D)  $^{68}_{31}\text{Ga}$
- E)  $^{48}_{22}\text{Ti}$

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.7*

79) Which of the following compounds would you expect to be ionic?

- A)  $\text{SF}_6$
- B)  $\text{H}_2\text{O}$
- C)  $\text{H}_2\text{O}_2$
- D)  $\text{NH}_3$
- E)  $\text{CaO}$

Answer: E

*Diff: 1*

*Page Ref: Sec. 2.7*

80) Which of the following compounds would you expect to be ionic?

- A) H<sub>2</sub>O
- B) CO<sub>2</sub>
- C) SrCl<sub>2</sub>
- D) SO<sub>2</sub>
- E) H<sub>2</sub>S

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.7*

81) Which pair of elements is most apt to form an ionic compound with each other?

- A) barium, bromine
- B) calcium, sodium
- C) oxygen, fluorine
- D) sulfur, fluorine
- E) nitrogen, hydrogen

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.7*

82) Which pair of elements is most apt to form a molecular compound with each other?

- A) aluminum, oxygen
- B) magnesium, iodine
- C) sulfur, fluorine
- D) potassium, lithium
- E) barium, bromine

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.7*

83) Which species below is the nitride ion?

- A)  $\text{Na}^+$
- B)  $\text{NO}_3^-$
- C)  $\text{NO}_2^-$
- D)  $\text{NH}_4^+$
- E)  $\text{N}^{3-}$

Answer: E

*Diff: 1*

*Page Ref: Sec. 2.7*

84) Which species below is the sulfite ion?

- A)  $\text{SO}_2^{-2}$
- B)  $\text{SO}_3^{-2}$
- C)  $\text{S}^{2-}$
- D)  $\text{SO}_4^{-2}$
- E)  $\text{HS}^-$

Answer: B

*Diff: 1*

*Page Ref: Sec. 2.7*

85) Which species below is the nitrate ion?

- A)  $\text{NO}_2^-$
- B)  $\text{NH}_4^+$
- C)  $\text{NO}_3^-$
- D)  $\text{N}_3^-$
- E)  $\text{N}^{3-}$

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.7*

86) Barium reacts with a polyatomic ion to form a compound with the general formula  $Ba_3(X)_2$ . What would be the most likely formula for the compound formed between sodium and the polyatomic ion X?

- A) NaX
- B)  $Na_2X$
- C)  $Na_2X_2$
- D)  $Na_3X$
- E)  $Na_3X_2$

Answer: D

*Diff: 2*

*Page Ref: Sec. 2.8*

87) Aluminum reacts with a certain nonmetallic element to form a compound with the general formula  $Al_2X_3$ . Element X must be from Group \_\_\_\_\_ of the Periodic Table of Elements.

- A) 3A
- B) 4A
- C) 5A
- D) 6A
- E) 7A

Answer: D

*Diff: 2*

*Page Ref: Sec. 2.8*

88) The formula for a salt is XBr. The X-ion in this salt has 46 electrons. The metal X is \_\_\_\_\_.

- A) Ag
- B) Pd
- C) Cd
- D) Cu
- E) Cs

Answer: A

*Diff: 2*

*Page Ref: Sec. 2.8*

89) The charge on the iron ion in the salt  $\text{Fe}_2\text{O}_3$  is \_\_\_\_\_.

- A) +1
- B) +2
- C) +3
- D) -5
- E) -6

Answer: C

*Diff: 2*

*Page Ref: Sec. 2.8*

90) Which formula/name pair is incorrect?

- A)  $\text{Mn}(\text{NO}_2)_2$  manganese(II) nitrite
- B)  $\text{Mg}(\text{NO}_3)_2$  magnesium nitrate
- C)  $\text{Mn}(\text{NO}_3)_2$  manganese(II) nitrate
- D)  $\text{Mg}_3\text{N}_2$  magnesium nitrite
- E)  $\text{Mg}(\text{MnO}_4)_2$  magnesium permanganate

Answer: D

*Diff: 2*

*Page Ref: Sec. 2.8*

91) Which formula/name pair is incorrect?

- A)  $\text{FeSO}_4$  iron(II) sulfate
- B)  $\text{Fe}_2(\text{SO}_3)_3$  iron(III) sulfite
- C)  $\text{FeS}$  iron(II) sulfide
- D)  $\text{FeSO}_3$  iron(II) sulfite
- E)  $\text{Fe}_2(\text{SO}_4)_3$  iron(III) sulfide

Answer: E

*Diff: 1*

*Page Ref: Sec. 2.8*

92) Which one of the following is the formula of hydrochloric acid?

- A)  $\text{HClO}_3$
- B)  $\text{HClO}_4$
- C)  $\text{HClO}$
- D)  $\text{HCl}$
- E)  $\text{HClO}_2$

Answer: D

*Diff: 1*

*Page Ref: Sec. 2.8*

93) The suffix -ide is used primarily \_\_\_\_\_.

- A) for monatomic anion names
- B) for polyatomic cation names
- C) for the name of the first element in a molecular compound
- D) to indicate binary acids
- E) for monoatomic cations

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.8*

94) Which one of the following compounds is chromium(III) oxide?

- A)  $\text{Cr}_2\text{O}_3$
- B)  $\text{CrO}_3$
- C)  $\text{Cr}_3\text{O}_2$
- D)  $\text{Cr}_3\text{O}$
- E)  $\text{Cr}_2\text{O}_4$

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.8*

95) Which one of the following compounds is copper(I) chloride?

- A) CuCl
- B) CuCl<sub>2</sub>
- C) Cu<sub>2</sub>Cl
- D) Cu<sub>2</sub>Cl<sub>3</sub>
- E) Cu<sub>3</sub>Cl<sub>2</sub>

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.8*

96) The correct name for MgF<sub>2</sub> is \_\_\_\_\_.

- A) monomagnesium difluoride
- B) magnesium difluoride
- C) manganese difluoride
- D) manganese bifluoride
- E) magnesium fluoride

Answer: E

*Diff: 2*

*Page Ref: Sec. 2.8*

97) A correct name for Fe(NO<sub>3</sub>)<sub>2</sub> is \_\_\_\_\_.

- A) iron nitrite
- B) ferrous nitrite
- C) ferrous nitrate
- D) ferric nitrite
- E) ferric nitrate

Answer: C

*Diff: 3*

*Page Ref: Sec. 2.8*

98) The correct name for  $\text{HNO}_2$  is \_\_\_\_\_.

- A) nitrous acid
- B) nitric acid
- C) hydrogen nitrate
- D) hyponitrous acid
- E) pernitric acid

Answer: A

*Diff: 3*

*Page Ref: Sec. 2.8*

99) The proper formula for the hydronium ion is \_\_\_\_\_.

- A)  $\text{H}^-$
- B)  $\text{OH}^-$
- C)  $\text{N}^{-3}$
- D)  $\text{H}_3\text{O}^+$
- E)  $\text{NH}_4^+$

Answer: D

*Diff: 2*

*Page Ref: Sec. 2.8*

100) The charge on the \_\_\_\_\_ ion is -3.

- A) sulfate
- B) acetate
- C) permanganate
- D) oxide
- E) nitride

Answer: E

*Diff: 2*

*Page Ref: Sec. 2.8*



101) Which one of the following polyatomic ions has the same charge as the hydroxide ion?

- A) ammonium
- B) carbonate
- C) nitrate
- D) sulfate
- E) phosphate

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.8*

102) Which element forms an ion with the same charge as the ammonium ion?

- A) potassium
- B) chlorine
- C) calcium
- D) oxygen
- E) nitrogen

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.8*

103) Which element forms an ion with the same charge as the sulfate ion?

- A) magnesium
- B) copper
- C) iron
- D) phosphorus
- E) oxygen

Answer: E

*Diff: 2*

*Page Ref: Sec. 2.8*

104) When a fluorine atom forms the fluoride ion, it has the same charge as the \_\_\_\_\_ ion.

- A) sulfide
- B) ammonium
- C) nitrate
- D) phosphate
- E) sulfite

Answer: C

*Diff: 1*

*Page Ref: Sec. 2.8*

105) The formula for the compound formed between aluminum ions and phosphate ions is \_\_\_\_\_.

- A)  $\text{Al}_3(\text{PO}_4)_3$
- B)  $\text{AlPO}_4$
- C)  $\text{Al}(\text{PO}_4)_3$
- D)  $\text{Al}_2(\text{PO}_4)_3$
- E)  $\text{AlP}$

Answer: B

*Diff: 1*

*Page Ref: Sec. 2.8*

106) Which metal does not form cations of differing charges?

- A) Na
- B) Cu
- C) Co
- D) Fe
- E) Sn

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.8*

107) Which metal forms cations of differing charges?

- A) K
- B) Cs
- C) Ba
- D) Al
- E) Sn

Answer: E

*Diff: 1*

*Page Ref: Sec. 2.8*

108) The correct name for  $\text{Ni}(\text{CN})_2$  is \_\_\_\_\_.

- A) nickel (I) cyanide
- B) nickel cyanate
- C) nickel carbonate
- D) nickel (II) cyanide
- E) nickel (I) nitride

Answer: D

*Diff: 1*

*Page Ref: Sec. 2.8*

109) The correct name for  $\text{Na}_2\text{O}_2$  is \_\_\_\_\_.

- A) sodium oxide
- B) sodium dioxide
- C) disodium oxide
- D) sodium peroxide
- E) disodium dioxide

Answer: D

*Diff: 2*

*Page Ref: Sec. 2.8*

110) Which metal is not required to have its charge specified in the names of ionic compounds it forms?

- A) Mn
- B) Fe
- C) Cu
- D) Ca
- E) Pb

Answer: D

*Diff: 1*

*Page Ref: Sec. 2.8*

111) What is the molecular formula for n-propanol?

- A) CH<sub>3</sub>OH
- B) C<sub>2</sub>H<sub>5</sub>OH
- C) C<sub>3</sub>H<sub>7</sub>OH
- D) C<sub>4</sub>H<sub>9</sub>OH
- E) C<sub>5</sub>H<sub>11</sub>OH

Answer: C

*Diff: 3*

*Page Ref: Sec. 2.9*

### 2.3 Short Answer Questions

1) What group in the periodic table would the fictitious element  $\ddot{X}$  be found?

Answer: VIIA

*Diff: 2*

*Page Ref: Sec. 2.5*

2) Carbon can exist in different forms called \_\_\_\_\_.

Answer: allotropes

*Diff: 3*

*Page Ref: Sec. 2.5*

3) Which element in Group IA is the most electropositive?

Answer: francium

*Diff: 2*

*Page Ref: Sec. 2.5*

4) Which element in the halogen family is the most electronegative?

Answer: fluorine

*Diff: 1*

*Page Ref: Sec. 2.5*

5) The formula for potassium sulfide is \_\_\_\_\_.

Answer:  $K_2S$

*Diff: 1*

*Page Ref: Sec. 2.8*

6) What is the name of an alcohol derived from hexane \_\_\_\_\_?

Answer: hexanol

*Diff: 2*

*Page Ref: Sec. 2.9*

## 2.4 True/False Questions

1) The least electronegative halogen is astatine.

Answer: True

*Diff: 3*

*Page Ref: Sec. 2.5*

2) The possible oxidation numbers for iron are +1 and +2.

Answer: False

*Diff: 1*

*Page Ref: Sec. 2.7*

3) The formula for chromium (II) iodide is  $\text{CrI}_2$ .

Answer: True

*Diff: 1*

*Page Ref: Sec. 2.8*

4)  $\text{H}_2\text{SeO}_4$  is called selenic acid.

Answer: True

*Diff: 2*

*Page Ref: Sec. 2.8*

5) The correct name for  $\text{Na}_3\text{N}$  is sodium azide.

Answer: False

*Diff: 2*

*Page Ref: Sec. 2.8*

## 2.5 Algorithmic Questions

1) An atom of  $^{17}\text{O}$  contains \_\_\_\_\_ protons.

- A) 8
- B) 25
- C) 9
- D) 11
- E) 17

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.3*

2) An atom of  $^{15}\text{N}$  contains \_\_\_\_\_ neutrons.

- A) 7
- B) 22
- C) 8
- D) 10
- E) 15

Answer: C

*Diff: 2*

*Page Ref: Sec. 2.3*

3) An atom of  $^{131}\text{I}$  contains \_\_\_\_\_ electrons.

- A) 131
- B) 184
- C) 78
- D) 124
- E) 53

Answer: E

*Diff: 1*

*Page Ref: Sec. 2.3*

4) 420 pm is the same as \_\_\_\_\_ Angstroms.

- A) 4200
- B) 42
- C) 420
- D) 4.2
- E) 0.42

Answer: D

*Diff: 2*

*Page Ref: Sec. 2.3*

5) The mass number of an atom of  $^{118}\text{Xe}$  is \_\_\_\_\_.

- A) 54
- B) 172
- C) 64
- D) 118
- E) 110

Answer: D

*Diff: 2*

*Page Ref: Sec. 2.5*

6) The atomic number of an atom of  $^{80}\text{Br}$  is \_\_\_\_\_.

- A) 115
- B) 35
- C) 45
- D) 73
- E) 80

Answer: B

*Diff: 1*

*Page Ref: Sec. 2.5*



7) An ion has 8 protons, 9 neutrons, and 10 electrons. The symbol for the ion is \_\_\_\_\_.

- A)  $17\text{O}^{2-}$
- B)  $17\text{O}^{2+}$
- C)  $19\text{F}^+$
- D)  $19\text{F}^-$
- E)  $17\text{Ne}^{2+}$

Answer: A

*Diff: 1*

*Page Ref: Sec. 2.5*

8) How many electrons does the  $\text{Al}^{3+}$  ion possess?

- A) 16
- B) 10
- C) 6
- D) 0
- E) 13

Answer: B

*Diff: 1*

*Page Ref: Sec. 2.7*

9) How many protons does the  $\text{Br}^-$  ion possess?

- A) 34
- B) 36
- C) 6
- D) 8
- E) 35

Answer: E

*Diff: 1*

*Page Ref: Sec. 2.7*

10) Predict the charge of the most stable ion of bromine.

- A) 2+
- B) 1+
- C) 3+
- D) 1-
- E) 2-

Answer: D

*Diff: 1*

*Page Ref: Sec. 2.7*

11) Predict the charge of the most stable ion of potassium.

- A) 3+
- B) 1-
- C) 2+
- D) 2-
- E) 1+

Answer: E

*Diff: 1*

*Page Ref: Sec. 2.7*