

Chapter 3 Molecules, Compounds, and Nomenclature

Multiple Choice Questions

1) An ionic bond is best described as

- A) the sharing of electrons.
- B) the transfer of electrons from one atom to another.
- C) the attraction that holds the atoms together in a polyatomic ion.
- D) the attraction between two nonmetal atoms.
- E) the attraction between two metal atoms.

Answer: B

Diff: 1 Type: MC Var: 1 Page Ref: 3.2

2) When forming ionic compounds, cations and anions form three-dimensional networks known as

- A) a molecular compound.
- B) a space-filling compound.
- C) a lattice.
- D) an empirical formula.

Answer: C

Diff: 1 Type: MC Var: 1 Page Ref: 3.2

3) A covalent bond is best described as

- A) the sharing of electrons between atoms.
- B) the transfer of electrons.
- C) a bond between a metal and a nonmetal.
- D) a bond between a metal and a polyatomic ion.
- E) a bond between two polyatomic ions.

Answer: A

Diff: 1 Type: MC Var: 1 Page Ref: 3.2

4) Identify the compound with (an) ionic bond(s).

- A) Ne
- B) CO
- C) O₂
- D) H₂O
- E) KBr

Answer: E

Diff: 1 Type: MC Var: 1 Page Ref: 3.2

5) Identify the compound with (an) ionic bond(s).

A) CO_2

B) H_2O

C) CH_4

D) LiBr

E) H_2

Answer: D

Diff: 1 Type: MC Var: 1 Page Ref: 3.2

6) Identify the compound with (a) covalent bond(s).

A) CH_4

B) Ne

C) KBr

D) Mg

E) NaCl

Answer: A

Diff: 1 Type: MC Var: 1 Page Ref: 3.2

7) Which of the following contains BOTH ionic and covalent bonds?

A) CaI_2

B) COS

C) CaSO_4

D) SF_6

E) C_2H_4

Answer: C

Diff: 2 Type: MC Var: 1 Page Ref: 3.2

8) Which of the following contains BOTH ionic and covalent bonds?

A) KI

B) NH_4Cl

C) CaS

D) H_2S

E) SiF_4

Answer: B

Diff: 2 Type: MC Var: 1 Page Ref: 3.2

9) Which of the following is a possible molecular formula for $\text{C}_4\text{H}_4\text{O}$?

A) $\text{C}_8\text{H}_8\text{O}_2$

B) $\text{C}_{12}\text{H}_{12}\text{O}_2$

C) $\text{C}_2\text{H}_2\text{O}$

D) $\text{C}_8\text{H}_8\text{O}$

Answer: A

Diff: 1 Type: MC Var: 1 Page Ref: 3.3

10) Identify a possible molecular formula for C_3H_5ClO .

- A) $C_6H_{10}ClO_2$
- B) $C_5H_{10}Cl_2O_2$
- C) $C_6H_{10}Cl_2O_2$
- D) $C_6H_{10}O_2$
- E) $C_6H_{12}Cl_2O_2$

Answer: C

Diff: 1 Type: MC Var: 1 Page Ref: 3.3

11) What is the empirical formula for $Hg_2(NO_3)_2$?

- A) $Hg_2(NO_3)_2$
- B) $HgNO_3$
- C) $Hg(NO_3)_2$
- D) Hg_2NO_3
- E) $Hg_4(NO_3)_4$

Answer: B

Diff: 2 Type: MC Var: 1 Page Ref: 3.3

12) Which of the following is an atomic element?

- A) Br
- B) H
- C) N
- D) O
- E) Mg

Answer: E

Diff: 1 Type: MC Var: 1 Page Ref: 3.3

13) Which of the following is a molecular element?

- A) Kr
- B) Ag
- C) S
- D) Mg
- E) Ti

Answer: C

Diff: 1 Type: MC Var: 1 Page Ref: 3.3

14) Which of the following is a molecular element?

- A) Mg
- B) Ar
- C) Xe
- D) I
- E) Li

Answer: D

Diff: 1 Type: MC Var: 1 Page Ref: 3.3

15) Which of the following is a molecular compound?

- A) CuCl_2
- B) KCl
- C) NaNO_3
- D) CH_3Cl
- E) RbBr

Answer: D

Diff: 1 Type: MC Var: 1 Page Ref: 3.3

16) Which of the following is a molecular compound?

- A) NaCN
- B) LiOH
- C) SrI_2
- D) ZnS
- E) P_4O_{10}

Answer: E

Diff: 1 Type: MC Var: 1 Page Ref: 3.3

17) Which of the following exists as a diatomic molecule?

- A) N
- B) C
- C) P
- D) Na
- E) Ne

Answer: A

Diff: 1 Type: MC Var: 1 Page Ref: 3.3

18) Which of the following exists as a polyatomic molecule?

- A) N
- B) C
- C) P
- D) Na
- E) Ne

Answer: C

Diff: 1 Type: MC Var: 1 Page Ref: 3.3

19) Which of the following is an ionic compound?

- A) LiCl
- B) NO_2
- C) PCl_3
- D) CF_4
- E) SeBr_2

Answer: A

Diff: 1 Type: MC Var: 1 Page Ref: 3.3

20) Which of the following is an ionic compound?

- A) SCl_2
- B) $\text{Mg}_3(\text{PO}_4)_2$
- C) Cl_2O
- D) CH_2O
- E) PF_5

Answer: B

Diff: 1 Type: MC Var: 1 Page Ref: 3.3

21) Which of the following is a molecular compound?

- A) CuCl_2
- B) N_2O_4
- C) NaNO_3
- D) SrSO_3
- E) RbBr

Answer: B

Diff: 1 Type: MC Var: 1 Page Ref: 3.3

22) Which of the following is an acid in aqueous solution?

- A) CaCO_3
- B) HClO_2
- C) CH_3OCH_3
- D) NaCl
- E) KNO_3

Answer: B

Diff: 1 Type: MC Var: 1 Page Ref: 3.4

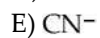
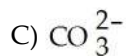
23) Which of the following is an acid in aqueous solution?

- A) NH_3
- B) NaF
- C) $\text{Ca}(\text{C}_2\text{H}_3\text{O}_2)_2$
- D) HI
- E) KCl

Answer: D

Diff: 1 Type: MC Var: 1 Page Ref: 3.4

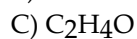
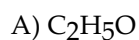
24) Identify the cyanide ion.



Answer: E

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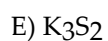
25) What is the empirical formula for $\text{C}_4\text{H}_{10}\text{O}_2$?



Answer: A

Diff: 1 Type: MC Var: 1 Page Ref: 3.4

26) Identify the formula for the compound formed between potassium and sulfur.



Answer: C

Diff: 2 Type: MC Var: 1 Page Ref: 3.4

27) Identify the charge, X, on the acetate ion $\text{C}_2\text{H}_3\text{O}_2^X$



Answer: E

Diff: 1 Type: MC Var: 1 Page Ref: 3.4

28) Identify the charge, X, on the phosphide ion P^X

- A) -4
- B) -3
- C) -2
- D) -1
- E) +1

Answer: B

Diff: 1 Type: MC Var: 1 Page Ref: 3.4

29) Identify the charge, X, on the barium ion Ba^X

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

Answer: B

Diff: 1 Type: MC Var: 1 Page Ref: 3.4

30) Identify the sulfite ion.



Answer: A

Diff: 1 Type: MC Var: 1 Page Ref: 3.4

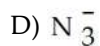
31) Identify the perchlorate ion.



Answer: C

Diff: 1 Type: MC Var: 1 Page Ref: 3.4

32) Identify the nitrite ion.



Answer: B

Diff: 1 Type: MC Var: 1 Page Ref: 3.4

33) Identify the name for SnO .

A) tin(I) oxide

B) tin(II) oxide

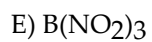
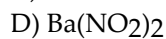
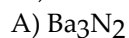
C) tin(III) oxide

D) tin(IV) oxide

Answer: B

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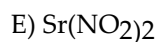
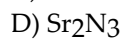
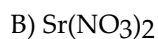
34) Identify the formula for barium nitrite.



Answer: D

Diff: 2 Type: MC Var: 1 Page Ref: 3.4

35) Identify the formula for strontium nitride.



Answer: A

Diff: 2 Type: MC Var: 1 Page Ref: 3.4

36) Determine the name for TiCO_3 . Remember that titanium forms several ions.

- A) titanium(II) carbonate
- B) titanium carbide
- C) titanium carbonite
- D) titanium(II) carbonite
- E) titanium(I) carbonate

Answer: A

Diff: 2 Type: MC Var: 1 Page Ref: 3.4

37) Identify the formula for sodium chlorate.

- A) NaClO
- B) NaClO_2
- C) NaClO_3
- D) NaClO_4

Answer: C

Diff: 2 Type: MC Var: 1 Page Ref: 3.4

38) Identify the formula for magnesium nitrate hexahydrate.

- A) $\text{Mg}(\text{NO}_3)_2 \cdot 5\text{H}_2\text{O}$
- B) $\text{Mg}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$
- C) $\text{Mg}(\text{NO}_3)_2 \cdot 7\text{H}_2\text{O}$
- D) $\text{MgNO}_3 \cdot 5\text{H}_2\text{O}$
- E) $\text{MgNO}_3 \cdot 6\text{H}_2\text{O}$

Answer: B

Diff: 1 Type: MC Var: 1 Page Ref: 3.4

39) Identify the formula for barium hydroxide octahydrate.

- A) $\text{Ba}(\text{OH})_2 \cdot 8\text{H}_2\text{O}$
- B) $\text{BaOH} \cdot 8\text{H}_2\text{O}$
- C) $\text{B}(\text{OH})_3 \cdot 8\text{H}_2\text{O}$
- D) $8\text{Ba}(\text{OH})_2 \cdot \text{H}_2\text{O}$
- E) $8\text{BaOH} \cdot \text{H}_2\text{O}$

Answer: A

Diff: 1 Type: MC Var: 1 Page Ref: 3.4

40) Identify the name for $\text{LiNO}_3 \cdot 3\text{H}_2\text{O}$.

- A) lithium nitrate
- B) lithium nitrate hemihydrate
- C) lithium nitrate monohydrate
- D) lithium nitrate dihydrate
- E) lithium nitrate trihydrate

Answer: E

Diff: 1 Type: MC Var: 1 Page Ref: 3.4

41) Identify the name for $\text{Sr}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$.

- A) tin(II) nitrate tetrahydrate
- B) strontium nitrate tetrahydrate
- C) scandium nitrate tetrahydrate
- D) tin(III) nitrate tetrahydrate
- E) tin(II) nitrate quadhydrate

Answer: B

Diff: 1 Type: MC Var: 1 Page Ref: 3.4

42) Identify the name for $\text{Sn}(\text{SO}_4)_2$. Remember that Sn forms several ions.

- A) tin(I) sulfite
- B) tin(IV) sulfate
- C) tin sulfide
- D) tin(II) sulfite
- E) tin(I) sulfate

Answer: B

Diff: 2 Type: MC Var: 1 Page Ref: 3.4

43) Determine the name for $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$. Remember that Co forms several ions.

- A) cobalt chloride hydrate
- B) cobalt(I) chloride heptahydrate
- C) cobalt(II) chloride heptahydrate
- D) cobalt(II) chloride hexahydrate
- E) cobalt(I) chloride

Answer: D

Diff: 2 Type: MC Var: 1 Page Ref: 3.4

44) Identify the name for $\text{Ca}_3(\text{PO}_4)_2$.

- A) calcium(III) phosphite
- B) calcium(II) phosphite
- C) calcium phosphate
- D) tricalcium phosphorustetraoxide
- E) calcium phosphite

Answer: C

Diff: 3 Type: MC Var: 1 Page Ref: 3.4

45) Identify the name for FeS.

- A) iron(I) sulfate
- B) iron(I) sulfide
- C) iron(II) sulfide
- D) iron(II) sulfate
- E) iron sulfide

Answer: C

Diff: 3 Type: MC Var: 1 Page Ref: 3.4

46) Identify the formula for chromium(II) nitrate.

- A) $\text{Cr}(\text{NO}_2)_3$
- B) $\text{Cr}(\text{NO}_3)_3$
- C) $\text{Cr}(\text{NO}_3)_2$
- D) $\text{Cr}(\text{NO}_2)_2$
- E) $\text{Cr}_2(\text{NO}_2)$

Answer: C

Diff: 3 Type: MC Var: 1 Page Ref: 3.4

47) What is the correct formula for lead (II) chloride?

- A) LdCl_4
- B) SbCl_4
- C) PbCl_2
- D) PbCl_4
- E) LaCl_3

Answer: C

Diff: 1 Type: MC Var: 1 Page Ref: 3.4

48) Identify the correct formula for aluminum sulfate.

- A) Al_2SO_4
- B) $\text{Al}(\text{SO}_4)_3$
- C) $\text{Al}_3(\text{SO}_4)_2$
- D) $\text{Al}_2(\text{SO}_4)_3$

Answer: D

Diff: 3 Type: MC Var: 1 Page Ref: 3.4

49) What is the charge on an aluminum ion?

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

Answer: A

Diff: 1 Type: MC Var: 1 Page Ref: 3.4

50) Identify the correct formula for sodium chlorate.

- A) NaClO
- B) NaClO_2
- C) NaClO_3
- D) NaClO_4

Answer: C

Diff: 3 Type: MC Var: 1 Page Ref: 3.4

51) Identify the formula for copper (II) sulfate pentahydrate.

- A) $\text{Cu}_2\text{SO}_3 \cdot \text{H}_5$
- B) $\text{Cu}_2\text{S} \cdot \text{H}_2\text{O}$
- C) $\text{CuS} \cdot 5\text{H}_2\text{O}$
- D) $(\text{CuSO}_4)_5$
- E) $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$

Answer: E

Diff: 3 Type: MC Var: 1 Page Ref: 3.4

52) Determine the name for H_2CO_3 .

- A) carbonous acid
- B) dihydrogen carbonate
- C) carbonic acid
- D) hydrocarbonic acid
- E) hydrocarbide acid

Answer: C

Diff: 2 Type: MC Var: 1 Page Ref: 3.4

53) Determine the name for aqueous HBr.

- A) bromic acid
- B) bromous acid
- C) hydrobromous acid
- D) hydrogen bromate
- E) hydrobromic acid

Answer: E

Diff: 2 Type: MC Var: 1 Page Ref: 3.4

54) Identify the formula for sulfurous acid.

- A) H_2SO_3
- B) HSO_3
- C) H_2SO_4
- D) HSO_4

Answer: A

Diff: 2 Type: MC Var: 1 Page Ref: 3.4

55) Identify the name for H_2SO_4 .

- A) sulfuric acid
- B) persulfurous acid
- C) sulfurous acid
- D) hyposulfurous acid
- E) persulfuric acid

Answer: A

Diff: 2 Type: MC Var: 1 Page Ref: 3.4

56) Determine the name for P_4O_{10} .

- A) phosphorus(IV) oxide
- B) diphosphorus pentoxide
- C) phosphorus oxide
- D) phosphorus(II) oxide
- E) tetraphosphorus decoxide

Answer: E

Diff: 3 Type: MC Var: 1 Page Ref: 3.4

57) Determine the name for N_2O_5 .

- A) dinitrogen pentoxide
- B) nitrogen oxide
- C) nitrogen(IV) oxide
- D) nitrogen(II) oxide
- E) nitrogen tetroxide

Answer: A

Diff: 3 Type: MC Var: 1 Page Ref: 3.4

58) Determine the name for Cl_2O .

- A) chlorine oxide
- B) dichlorine monoxide
- C) chlorine(I) oxide
- D) chlorine(II) oxide
- E) chlorate

Answer: B

Diff: 3 Type: MC Var: 1 Page Ref: 3.4

59) Identify the name for PBr_3 .

- A) phosphorus tribromide
- B) potassium tribromide
- C) phosphorus(III) bromide
- D) phosphorus(II) bromide
- E) phosphorus bromide

Answer: A

Diff: 3 Type: MC Var: 1 Page Ref: 3.4

60) Determine the name for aqueous $HClO_3$.

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

Answer: D

Diff: 3 Type: MC Var: 1 Page Ref: 3.4

61) Identify the name for the compound $\text{Fe}(\text{C}_2\text{H}_3\text{O}_2)_2$.

- A) iron(II) hydrogen carbonate
- B) iron(III) carbonate
- C) iron acetate
- D) iron(II) acetate
- E) iron(II) dihydrogen phosphate

Answer: D

Diff: 2 Type: MC Var: 1 Page Ref: 3.4

62) Which of the following is a formula for the compound disulfur tetrafluoride?

- A) SF_4
- B) 2SF_4
- C) S_2F_4
- D) SF_6
- E) S_2F_2

Answer: C

Diff: 2 Type: MC Var: 1 Page Ref: 3.4

63) Which of the following is a formula for the compound iridium(III) bromide tetrahydrate?

- A) $\text{IrBr} \cdot \frac{1}{2}\text{H}_2\text{O}$
- B) $\text{IrBr} \cdot 4\text{H}_2\text{O}$
- C) $\text{IrBr}_3 \cdot 4\text{H}_2\text{O}$
- D) $\text{IBr}_3 \cdot 4\text{H}_2\text{O}$
- E) $\text{IBr}_3 \cdot 2\text{H}_2\text{O}$

Answer: C

Diff: 2 Type: MC Var: 1 Page Ref: 3.4

64) Which of the following is one possible form of pentane?

- A) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$
- B) $\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_3$
- C) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$
- D) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$
- E) $\text{CH}_3\text{CH}_2\text{-O-CH}_2\text{CH}_2\text{CH}_3$

Answer: A

Diff: 2 Type: MC Var: 1 Page Ref: 3.5

65) Which of the following compounds is ethanol?

- A) C_2H_6
- B) $\text{C}_2\text{H}_5\text{OH}$
- C) $\text{CH}_3\text{CO}_2\text{H}$
- D) $\text{CH}_3\text{CO}_2\text{CH}_3$
- E) $\text{CH}_3\text{-O-CH}_3$

Answer: B

Diff: 2 Type: MC Var: 1 Page Ref: 3.5

66) Identify an amine.

- A) $\text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_3$
- B) $\text{CH}_3\text{CH}_2\text{OH}$
- C) $\text{CH}_3\text{CH}_2\text{NH}_2$
- D) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$
- E) CH_3COOH

Answer: C

Diff: 2 Type: MC Var: 1 Page Ref: 3.5

67) Identify an ether.

- A) $\text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_3$
- B) $\text{CH}_3\text{CH}_2\text{OH}$
- C) $\text{CH}_3\text{CH}_2\text{NH}_2$
- D) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$
- E) CH_3COOH

Answer: A

Diff: 2 Type: MC Var: 1 Page Ref: 3.5

68) Identify a carboxylic acid.

- A) $\text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_3$
- B) $\text{CH}_3\text{CH}_2\text{OH}$
- C) $\text{CH}_3\text{CH}_2\text{NH}_2$
- D) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$
- E) CH_3COOH

Answer: E

Diff: 2 Type: MC Var: 1 Page Ref: 3.5

69) Identify a hydrocarbon.

- A) $\text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_3$
- B) $\text{CH}_3\text{CH}_2\text{OH}$
- C) $\text{CH}_3\text{CH}_2\text{NH}_2$
- D) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$
- E) CH_3COOH

Answer: D

Diff: 2 Type: MC Var: 1 Page Ref: 3.5

70) Calculate the molar mass for $\text{Mg}(\text{ClO}_4)_2$.

- A) $223.21 \text{ g mol}^{-1}$
- B) $123.76 \text{ g mol}^{-1}$
- C) $119.52 \text{ g mol}^{-1}$
- D) $247.52 \text{ g mol}^{-1}$
- E) 75.76 g mol^{-1}

Answer: A

Diff: 2 Type: MC Var: 1 Page Ref: 3.6

71) Calculate the molar mass of $\text{Al}(\text{C}_2\text{H}_3\text{O}_2)_3$.

- A) 86.03 g mol^{-1}

- B) 204.13 g mol⁻¹
- C) 56.00 g mol⁻¹
- D) 258.09 g mol⁻¹
- E) 139.99 g mol⁻¹

Answer: B

Diff: 2 Type: MC Var: 1 Page Ref: 3.6

72) Calculate the molar mass of Ca₃(PO₄)₂.

- A) 87.05 g mol⁻¹
- B) 215.21 g mol⁻¹
- C) 310.18 g mol⁻¹
- D) 279.21 g mol⁻¹
- E) 246.18 g mol⁻¹

Answer: C

Diff: 2 Type: MC Var: 1 Page Ref: 3.6

73) Calculate the molar mass of H₂CO₃.

- A) 62.03 g mol⁻¹
- B) 29.02 g mol⁻¹
- C) 61.02 g mol⁻¹
- D) 60.01 g mol⁻¹
- E) 74.04 g mol⁻¹

Answer: A

Diff: 2 Type: MC Var: 1 Page Ref: 3.6

74) How many millimoles of Ca(NO₃)₂ contain 4.78×10^{22} formula units of Ca(NO₃)₂? The molar mass of Ca(NO₃)₂ is 164.10 g mol⁻¹.

- A) 12.6 mmol Ca(NO₃)₂
- B) 13.0 mmol Ca(NO₃)₂
- C) 20.7 mmol Ca(NO₃)₂
- D) 79.4 mmol Ca(NO₃)₂
- E) 57.0 mmol Ca(NO₃)₂

Answer: D

Diff: 2 Type: MC Var: 1 Page Ref: 3.6

75) How many moles of C_3H_8 contain 9.25×10^{24} molecules of C_3H_8 ?

- A) 65.1 moles C_3H_8
- B) 28.6 moles C_3H_8
- C) 34.9 moles C_3H_8
- D) 46.2 moles C_3H_8
- E) 15.4 moles C_3H_8

Answer: E

Diff: 2 Type: MC Var: 1 Page Ref: 3.6

76) How many molecules of N_2O_4 are in 76.3 g N_2O_4 ? The molar mass of N_2O_4 is 92.02 g mol^{-1} .

- A) 5.54×10^{25} N_2O_4 molecules
- B) 7.26×10^{23} N_2O_4 molecules
- C) 1.38×10^{24} N_2O_4 molecules
- D) 4.59×10^{25} N_2O_4 molecules
- E) 4.99×10^{23} N_2O_4 molecules

Answer: E

Diff: 3 Type: MC Var: 1 Page Ref: 3.6

77) How many moles of N_2O_4 are in 76.3 g N_2O_4 ? The molar mass of N_2O_4 is 92.02 g mol^{-1} .

- A) 7.02×10^3 moles N_2O_4
- B) 1.42×10^{-4} moles N_2O_4
- C) 1.00 mole N_2O_4
- D) 1.21 moles N_2O_4
- E) 0.829 moles N_2O_4

Answer: E

Diff: 3 Type: MC Var: 1 Page Ref: 3.6

78) How many C_2H_4 molecules are contained in 45.8 mg of C_2H_4 ? The molar mass of C_2H_4 is 28.05 g mol^{-1} .

- A) 9.83×10^{20} C_2H_4 molecules
- B) 7.74×10^{26} C_2H_4 molecules
- C) 2.71×10^{20} C_2H_4 molecules
- D) 3.69×10^{23} C_2H_4 molecules
- E) 4.69×10^{23} C_2H_4 molecules

Answer: A

Diff: 3 Type: MC Var: 1 Page Ref: 3.6

79) What is the mass (in kg) of 6.89×10^{25} molecules of CO_2 ? The molar mass of CO_2 is 44.01 g mol^{-1} .

- A) 3.85 kg
- B) 5.04 kg
- C) 2.60 kg
- D) 3.03 kg
- E) 6.39 kg

Answer: B

Diff: 3 Type: MC Var: 1 Page Ref: 3.6

80) What is the mass of 9.44×10^{24} molecules of NO_2 ? The molar mass of NO_2 is 46.01 g mol^{-1} .

- A) 205 g
- B) 294 g
- C) 721 g
- D) 341 g
- E) 685 g

Answer: C

Diff: 3 Type: MC Var: 1 Page Ref: 3.6

81) How many molecules are in 114.86 g of vitamin C, $\text{C}_6\text{H}_8\text{O}_6$?

- A) 1.218×10^{28}
- B) 3.927×10^{23}
- C) 2.546×10^{-24}
- D) 2.977×10^{19}
- E) 2.977×10^{22}

Answer: B

Diff: 3 Type: MC Var: 1 Page Ref: 3.6

82) How many molecules are in 1.500 g of riboflavin, $\text{C}_{17}\text{H}_{20}\text{N}_4\text{O}_6$?

- A) 1.066×10^{21}
- B) 4.167×10^{-22}
- C) 3.400×10^{26}
- D) 1.067×10^{24}
- E) 2.400×10^{21}

Answer: E

Diff: 3 Type: MC Var: 1 Page Ref: 3.6

83) How many molecules are in 0.1339 kg of ethanol, $\text{C}_2\text{H}_6\text{O}$?

- A) 1.750×10^{24}
- B) 3.715×10^{27}
- C) 5.712×10^{-25}
- D) 9.763×10^{19}
- E) 9.763×10^{22}

Answer: A

Diff: 3 Type: MC Var: 1 Page Ref: 3.6

84) How many molecules are in 16.61 g of acetic acid, $C_2H_4O_2$?

- A) 6.007×10^{26}
- B) 6.0375×10^{23}
- C) 1.666×10^{23}
- D) 6.0375×10^{20}
- E) 6.004×10^{-24}

Answer: C

Diff: 3 Type: MC Var: 1 Page Ref: 3.6

85) A typical cup of coffee has about 100 mg of caffeine. Calculate the number of caffeine molecules in 100. mg $C_8H_{10}N_4O_2$.

- A) 3.22×10^{-21}
- B) 3.10×10^{20}
- C) 1.17×10^{25}
- D) 3.10×10^{22}
- E) 3.10×10^{25}

Answer: B

Diff: 3 Type: MC Var: 1 Page Ref: 3.6

86) Calculate the mass percent composition of sulfur in $Al_2(SO_4)_3$.

- A) 28.12%
- B) 9.372%
- C) 42.73%
- D) 21.38%
- E) 35.97%

Answer: A

Diff: 2 Type: MC Var: 1 Page Ref: 3.7

87) Calculate the mass percent composition of lithium in Li_3PO_4 .

- A) 26.75%
- B) 17.98%
- C) 30.72%
- D) 55.27%
- E) 20.82%

Answer: B

Diff: 2 Type: MC Var: 1 Page Ref: 3.7

88) How many moles of N_2O_3 contain 2.55×10^{24} oxygen atoms?

- A) 1.41 moles N_2O_3
- B) 4.23 moles N_2O_3
- C) 12.7 moles N_2O_3
- D) 7.87 moles N_2O_3
- E) 2.82 moles N_2O_3

Answer: A

Diff: 2 Type: MC Var: 1 Page Ref: 3.7

89) Give the mass percent of carbon in $C_{14}H_{19}NO_2$.

- A) 38.89%
- B) 72.07%
- C) 5.17%
- D) 2.78%

Answer: B

Diff: 3 Type: MC Var: 1 Page Ref: 3.7

90) How many moles of PCl_3 contain 3.68×10^{25} chlorine atoms?

- A) 61.1 moles PCl_3
- B) 20.4 moles PCl_3
- C) 16.4 moles PCl_3
- D) 54.5 moles PCl_3
- E) 49.1 moles PCl_3

Answer: B

Diff: 3 Type: MC Var: 1 Page Ref: 3.7

91) How many moles of C_3H_8 contain 4.95×10^{24} hydrogen atoms?

- A) 8.22 moles C_3H_8
- B) 6.58 moles C_3H_8
- C) 1.03 moles C_3H_8
- D) 9.73 moles C_3H_8
- E) 3.09 moles C_3H_8

Answer: C

Diff: 3 Type: MC Var: 1 Page Ref: 3.7

92) How many atoms of oxygen are contained in 47.6 g of $\text{Al}_2(\text{CO}_3)_3$? The molar mass of $\text{Al}_2(\text{CO}_3)_3$ is $233.99 \text{ g mol}^{-1}$.

- A) 1.23×10^{23} O atoms
- B) 2.96×10^{24} O atoms
- C) 2.87×10^{25} O atoms
- D) 1.10×10^{24} O atoms
- E) 3.68×10^{23} O atoms

Answer: D

Diff: 3 Type: MC Var: 1 Page Ref: 3.7

93) How many atoms of carbon are contained in 47.6 g of $\text{Al}_2(\text{CO}_3)_3$? The molar mass of $\text{Al}_2(\text{CO}_3)_3$ is $233.99 \text{ g mol}^{-1}$.

- A) 1.23×10^{23} C atoms
- B) 2.96×10^{24} C atoms
- C) 2.87×10^{25} C atoms
- D) 1.10×10^{24} C atoms
- E) 3.68×10^{23} C atoms

Answer: E

Diff: 3 Type: MC Var: 1 Page Ref: 3.7

94) Hematite is the mineral form of iron(III) oxide. Calculate the number of iron ions in 20.0 kg of pure

hematite.

- A) 1.51×10^{26}
- B) 7.54×10^{25}
- C) 3.77×10^{17}
- D) 6.63×10^{-27}
- E) 9.62×10^{21}

Answer: B

Diff: 3 Type: MC Var: 1 Page Ref: 3.7

95) Calculate the number of oxygen atoms in 1.187 g of nickel(II) carbonate.

- A) 1.807×10^{26}
- B) 5.535×10^{23}
- C) 6.022×10^{21}
- D) 1.282×10^{22}
- E) 1.807×10^{22}

Answer: E

Diff: 3 Type: MC Var: 1 Page Ref: 3.7

96) Calculate the number of carbon atoms in 76.91 g of benzoic acid, C_6H_5COOH .

- A) 6.693×10^{24}
- B) 3.793×10^{23}
- C) 2.655×10^{24}
- D) 3.767×10^{25}
- E) 4.488×10^{20}

Answer: C

Diff: 3 Type: MC Var: 1 Page Ref: 3.7

97) Formic acid, $HCOOH$, is a major component in ant bites. Calculate the mass, in grams, of 3.14×10^{23} molecules of formic acid.

- A) 0.0113 g
- B) 0.0417 g
- C) 24.0 g
- D) 11.3 g
- E) 0.0799 g

Answer: C

Diff: 3 Type: MC Var: 1 Page Ref: 3.7

98) Formaldehyde, CH_2O , is the simplest aldehyde and is commonly used as an embalming fluid.

Calculate the mass of 8.16×10^{24} molecules of formaldehyde.

- A) 451 g
- B) 407 g
- C) 0.451 g
- D) 246 g
- E) 24.6 g

Answer: B

Diff: 3 Type: MC Var: 1 Page Ref: 3.7

99) How many sodium ions are contained in 99.6 mg of Na_2SO_3 ? The molar mass of Na_2SO_3 is 126.05 g mol^{-1} .

- A) 1.52×10^{27} sodium ions
- B) 4.76×10^{20} sodium ions
- C) 2.10×10^{21} sodium ions
- D) 1.05×10^{21} sodium ions
- E) 9.52×10^{20} sodium ions

Answer: E

Diff: 3 Type: MC Var: 1 Page Ref: 3.7

100) How many SO_3^{2-} ions are contained in 99.6 mg of Na_2SO_3 ? The molar mass of Na_2SO_3 is 126.05 g mol^{-1} .

- A) 1.52×10^{27} SO_3^{2-} ions
- B) 4.76×10^{20} SO_3^{2-} ions
- C) 2.10×10^{21} SO_3^{2-} ions
- D) 1.05×10^{21} SO_3^{2-} ions
- E) 9.52×10^{20} SO_3^{2-} ions

Answer: B

Diff: 3 Type: MC Var: 1 Page Ref: 3.7

101) Determine the volume of hexane that contains 5.33×10^{22} molecules of hexane. The density of hexane is 0.6548 g mL^{-1} and its molar mass is 86.17 g mol^{-1} .

- A) 8.59 mL
- B) 13.5 mL
- C) 7.40 mL
- D) 12.4 mL
- E) 11.6 mL

Answer: E

Diff: 3 Type: MC Var: 1 Page Ref: 3.7

102) How many molecules of butane are contained in 25.0 mL of butane? The density of butane is 0.6011 g mL⁻¹ and the molar mass is 58.12 g mol⁻¹.

- A) 2.59×10^{23} molecules butane
- B) 1.46×10^{27} molecules butane
- C) 6.87×10^{23} molecules butane
- D) 1.56×10^{23} molecules butane
- E) 7.14×10^{25} molecules butane

Answer: D

Diff: 3 Type: MC Var: 1 Page Ref: 3.7

103) Determine the molecular formula of a compound that has a molar mass of 183.2 g mol⁻¹ and an empirical formula of C₂H₅O₂.

- A) C₂H₅O₂
- B) C₆H₁₅O₆
- C) C₃H₇O₃
- D) C₄H₁₀O₄
- E) C₈H₂₀O₈

Answer: B

Diff: 2 Type: MC Var: 1 Page Ref: 3.8

104) Determine the molecular formula of a compound that has a molar mass of 92.0 g mol⁻¹ and an empirical formula of NO₂.

- A) N₂O₃
- B) N₃O₆
- C) N₂O₄
- D) NO₂
- E) N₂O₅

Answer: C

Diff: 2 Type: MC Var: 1 Page Ref: 3.8

105) Determine the empirical formula for a compound that is 36.86% N and 63.14% O by mass.

- A) NO
- B) N₂O
- C) NO₂
- D) N₂O₃
- E) NO₃

Answer: D

Diff: 3 Type: MC Var: 1 Page Ref: 3.8

106) Determine the empirical formula for a compound that is found to contain 10.15 mg P and 34.85 mg Cl.

- A) P_3Cl
- B) PCl
- C) PCl_2
- D) P_2Cl_3
- E) PCl_3

Answer: E

Diff: 3 Type: MC Var: 1 Page Ref: 3.8

107) Determine the empirical formula for a compound that contains C, H, and O. It contains 52.14% C and 34.73% O by mass.

- A) C_2H_6O
- B) CHO
- C) $C_4H_{13}O_2$
- D) CH_4O_3
- E) CH_3O

Answer: A

Diff: 3 Type: MC Var: 1 Page Ref: 3.8

108) Determine the molecular formula for a compound that is 70.79% carbon, 8.91% hydrogen, 4.59% nitrogen, and 15.72% oxygen.

- A) $C_{18}H_{27}NO_3$
- B) $C_{18}H_{27}NO_2$
- C) $C_{17}H_{27}NO_3$
- D) $C_{17}H_{26}NO_3$

Answer: A

Diff: 3 Type: MC Var: 1 Page Ref: 3.8

109) Combustion analysis of an unknown hydrocarbon produced the following results: C 60.00%, H 4.48%, O 35.52%. Determine the empirical formula.

- A) $C_9H_9O_5$
- B) $C_9H_8O_3$
- C) $C_8H_9O_4$
- D) $C_9H_8O_4$
- E) $C_8H_8O_4$

Answer: D

Diff: 3 Type: MC Var: 1 Page Ref: 3.8

110) Combustion analysis of an unknown hydrocarbon produced the following results: C 52.14%, H 13.13%, O 34.73%. Determine the empirical formula.

- A) $C_4H_8O_2$
- B) $C_4H_{12}O_2$
- C) C_2H_6O
- D) $C_4H_6O_2$
- E) $C_6H_8O_4$

Answer: C

Diff: 3 Type: MC Var: 1 Page Ref: 3.8

111) Combustion analysis of an unknown hydrocarbon produced the following results: C 59.96%, H 13.42%, and O 26.62%. Determine the empirical formula.

- A) C_3H_8O
- B) $C_8H_8O_2$
- C) $C_5H_8O_4$
- D) $C_6H_{16}O_4$
- E) $C_9H_{16}O_2$

Answer: A

Diff: 3 Type: MC Var: 1 Page Ref: 3.8

112) Determine the molecular formula of a compound that is 49.48% carbon, 5.19% hydrogen, 28.85% nitrogen, and 16.48% oxygen. The molecular weight is $194.19 \text{ g mol}^{-1}$.

- A) $C_8H_{12}N_4O_2$
- B) $C_4H_5N_2O$
- C) $C_8H_{10}N_4O_2$
- D) $C_8H_{10}N_2O$

Answer: C

Diff: 3 Type: MC Var: 1 Page Ref: 3.8

113) Combustion analysis of 63.8 mg of a C, H, and O-containing compound produced 145.0 mg of CO_2 and 59.38 mg of H_2O . What is the empirical formula for the compound?

- A) C_5H_2O
- B) CHO
- C) C_3H_6O
- D) C_3H_7O
- E) C_6HO_3

Answer: C

Diff: 3 Type: MC Var: 1 Page Ref: 3.8

Algorithmic Questions

1) In which set do all elements tend to form anions in binary ionic compounds?

- A) C, S, Pb
- B) K, Fe, Br
- C) Li, Na, K
- D) N, O, I

Answer: D

Diff: 1 Type: MC Var: 5 Page Ref: 3.3

2) What type of bonding is found in the compound OF_2 ?

- A) covalent bonding
- B) hydrogen bonding
- C) ionic bonding
- D) metallic bonding

Answer: A

Diff: 1 Type: MC Var: 5 Page Ref: 3.3

3) Which one of the following compounds contains ionic bonds?

- A) SrO
- B) HBr
- C) PBr_3
- D) SiO_2

Answer: A

Diff: 1 Type: MC Var: 5 Page Ref: 3.3

4) Which of the following is the correct chemical formula for a molecule of astatine?

- A) At
- B) At^-
- C) At^+
- D) At_2

Answer: D

Diff: 1 Type: MC Var: 5 Page Ref: 3.3

5) Which of the compounds, NaH, HS, C_4H_{10} , BrF_3 , are ionic compounds?

- A) only C_4H_{10}
- B) only NaH
- C) NaH and HS
- D) HS, C_4H_{10} , and BrF_3

Answer: B

Diff: 1 Type: MC Var: 5 Page Ref: 3.3

6) Which of the compounds, C_4H_{10} , $BaCl_2$, $Ni(NO_3)_2$, SF_6 , are expected to exist as molecules?

- A) only C_4H_{10}
- B) C_4H_{10} and SF_6
- C) C_4H_{10} , $Ni(NO_3)_2$, and SF_6
- D) $BaCl_2$ and $Ni(NO_3)_2$

Answer: B

Diff: 1 Type: MC Var: 5 Page Ref: 3.3

7) Which of the following elements has the LEAST tendency to form an ion?

- A) Ca
- B) K
- C) Kr
- D) Se

Answer: C

Diff: 1 Type: MC Var: 5 Page Ref: 3.3

8) In which set do all elements tend to form cations in binary ionic compounds?

- A) K, Ga, O
- B) Sr, Ni, Hg
- C) N, P, Bi
- D) O, Br, I

Answer: B

Diff: 3 Type: MC Var: 5 Page Ref: 3.4

9) The solid compound Na_2CO_3 contains

- A) Na^+ , C^{4+} , and O^{2-} ions.
- B) Na^+ and CO_3^{-2} ions.
- C) Na_2^+ and CO_3^{-2} ions.
- D) Na_2CO_3 molecules.

Answer: B

Diff: 3 Type: MC Var: 4 Page Ref: 3.4

10) What is the chemical formula for iron(III) sulfate?

- A) Fe_3S
- B) Fe_3SO_4
- C) Fe_2S_3
- D) $Fe_2(SO_4)_3$

Answer: D

Diff: 3 Type: MC Var: 5 Page Ref: 3.4

11) Rb_2S is named

- A) rubidium disulfide.
- B) rubidium sulfide.
- C) rubidium(II) sulfide.
- D) rubidium sulfur.

Answer: B

Diff: 3 Type: MC Var: 5 Page Ref: 3.4

12) What is the chemical formula for calcium hydroxide?

- A) CaH_2
- B) CaOH
- C) CaOH_2
- D) Ca(OH)_2

Answer: D

Diff: 3 Type: MC Var: 5 Page Ref: 3.4

13) What is the chemical formula for magnesium hydride?

- A) MgH_2
- B) MgOH
- C) MgOH_2
- D) Mg(OH)_2

Answer: A

Diff: 3 Type: MC Var: 5 Page Ref: 3.4

14) The chemical formula for lithium peroxide is

- A) LiOH .
- B) LiO_2 .
- C) Li_2O .
- D) Li_2O_2 .

Answer: D

Diff: 3 Type: MC Var: 5 Page Ref: 3.4

15) The compound $\text{Cu(I O}_3)_2$ is named

- A) copper iodate(II).
- B) copper(I) iodate.
- C) copper(I) iodate(II).
- D) copper(II) iodate.

Answer: D

Diff: 3 Type: MC Var: 5 Page Ref: 3.4

16) The compound CO is named

- A) carbonate.
- B) carbonite.
- C) carbon dioxide.
- D) carbon(IV) oxide.

Answer: C

Diff: 3 Type: MC Var: 5 Page Ref: 3.4

17) The chemical formula for calcium nitride is

- A) $\text{Ca}(\text{NO}_3)_2$.
- B) $\text{Ca}(\text{NO}_2)_2$.
- C) Ca_3N_2 .
- D) CaN_2 .

Answer: C

Diff: 3 Type: MC Var: 5 Page Ref: 3.4

18) An aqueous solution of H_2S is named

- A) hydrosulfuric acid.
- B) hydrosulfurous acid.
- C) sulfuric acid.
- D) sulfurous acid.

Answer: A

Diff: 3 Type: MC Var: 5 Page Ref: 3.4

19) The chemical formula for the selenite ion is

- A) Se^- .
- B) Se^{2-} .
- C) SeO_3^{2-} .
- D) SeO_4^{2-} .

Answer: C

Diff: 3 Type: MC Var: 5 Page Ref: 3.4

20) The ion IO_2^- is named

- A) iodate ion.
- B) iodite ion.
- C) iodine dioxide ion.
- D) iodine(II) oxide ion.

Answer: B

Diff: 3 Type: MC Var: 5 Page Ref: 3.4

21) The chemical formula for selenous acid is

- A) $\text{H}_2\text{Se}(aq)$.
- B) $\text{HSeO}_3(aq)$.
- C) $\text{HSeO}_4(aq)$.
- D) $\text{H}_2\text{Se}_2\text{O}_7(aq)$.

Answer: B

Diff: 3 Type: MC Var: 5 Page Ref: 3.4

22) What is the charge on the Cr ions in Cr_2O_3 ?

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

Answer: D

Diff: 2 Type: MC Var: 5 Page Ref: 3.4

23) What is the molar mass of nitrogen gas?

- A) 14.0 g mol⁻¹
- B) 28.0 g mol⁻¹
- C) 6.02×10^{23} g mol⁻¹
- D) 1.20×10^{23} g mol⁻¹

Answer: B

Diff: 3 Type: MC Var: 5 Page Ref: 3.6

24) What is the mass of a single fluorine molecule, F₂?

- A) 3.155×10^{-23} g
- B) 6.310×10^{-23} g
- C) 19.00 g
- D) 38.00 g

Answer: B

Diff: 3 Type: MC Var: 5 Page Ref: 3.6

25) What is the mass of 0.500 mol of dichlorodifluoromethane, CCl₂F₂?

- A) 4.14×10^{-3} g
- B) 60.5 g
- C) 121 g
- D) 242 g

Answer: B

Diff: 3 Type: MC Var: 5 Page Ref: 3.6

26) How many moles are there in 3.00 g of ethanol, CH₃CH₂OH?

- A) 0.00725 mol
- B) 0.0652 mol
- C) 15.3 mol
- D) 138 mol

Answer: B

Diff: 3 Type: MC Var: 5 Page Ref: 3.6

27) What is the mass of 8.50×10^{22} molecules of NH₃?

- A) 0.00829 g
- B) 0.417 g
- C) 2.40 g
- D) 121 g

Answer: C

Diff: 3 Type: MC Var: 5 Page Ref: 3.6

28) What is the molar mass of 1-butene if 5.38×10^{16} molecules of 1-butene weigh $5.00 \mu\text{g}$?

- A) 56.0 g mol^{-1}
- B) 178 g mol^{-1}
- C) 224 g mol^{-1}
- D) 447 g mol^{-1}

Answer: A

Diff: 3 Type: MC Var: 5 Page Ref: 3.6

29) What mass of ethane, CH_6 , contains the same number of molecules as 3.00 g of trichlorofluoromethane, CCl_3F ?

- A) 0.0727 g
- B) 0.655 g
- C) 1.52 g
- D) 13.7 g

Answer: B

Diff: 3 Type: MC Var: 5 Page Ref: 3.6

30) What mass of phosphorus pentafluoride, PF_5 , has the same number of fluorine atoms as 25.0 g of oxygen difluoride, OF_2 ?

- A) 0.933 g
- B) 10.0 g
- C) 23.3 g
- D) 146 g

Answer: C

Diff: 3 Type: MC Var: 5 Page Ref: 3.6

31) How many anions are there in 2.50 g of MgBr_2 ?

- A) 8.18×10^{21} anions
- B) 1.64×10^{22} anions
- C) 4.43×10^{25} anions
- D) 8.87×10^{25} anions

Answer: B

Diff: 3 Type: MC Var: 5 Page Ref: 3.6

32) Which of the following has the greatest mass?

- A) 3.88×10^{22} molecules of O_2
- B) 1.00 g of O_2
- C) 0.0312 mol of O_2
- D) All of the above have the same mass.

Answer: A

Diff: 3 Type: MC Var: 5 Page Ref: 3.6

33) Which of the following has the smallest mass?

- A) 3.50×10^{23} molecules of I_2
- B) 85.0 g of Cl_2
- C) 2.50 mol of F_2
- D) 0.050 kg of Br_2

Answer: D

Diff: 3 Type: MC Var: 5 Page Ref: 3.6

34) The molecular weight of sucrose ($C_{12}H_{22}O_{11}$), table sugar, is _____ amu (rounded to one decimal place).

- A) 330.3
- B) 29.0
- C) 342.3
- D) 45.0
- E) 182.0

Answer: C

Diff: 3 Type: MC Var: 9 Page Ref: 3.6

35) A sample of pure lithium nitrate contains 10.1% lithium by mass. What is the % lithium by mass in a sample of pure lithium carbonate that has twice the mass of the first sample?

- A) 5.05%
- B) 10.1%
- C) 20.2%
- D) 40.4%

Answer: B

Diff: 2 Type: MC Var: 5 Page Ref: 3.7

36) A sample of pure calcium fluoride with a mass of 15.0 g contains 7.70 g of calcium. How much calcium is contained in 40.0 g of calcium fluoride?

- A) 2.27 g
- B) 7.70 g
- C) 15.0 g
- D) 20.5 g

Answer: D

Diff: 2 Type: MC Var: 5 Page Ref: 3.7

37) Which one of the following contains 39% carbon by mass?

- A) C_2H_2
- B) CH_4
- C) CH_3NH_2
- D) CO_2

Answer: C

Diff: 2 Type: MC Var: 5 Page Ref: 3.7

38) Determine the mass percent (to the hundredths place) of H in sodium bicarbonate (NaHCO_3).

Answer: 1.20

Diff: 2 Type: SA Var: 4 Page Ref: 3.7

39) What is the empirical formula of a compound that is 62.0% C, 10.4% H, and 27.5% O by mass?

A) C_3HO

B) C_6HO_3

C) $\text{C}_6\text{H}_{12}\text{O}_2$

D) $\text{C}_5\text{H}_{10}\text{O}_2$

E) $\text{C}_3\text{H}_6\text{O}$

Answer: E

Diff: 3 Type: MC Var: 11 Page Ref: 3.7

40) How many Fe(II) ions are there in 20.0 g of FeSO_4 ?

A) 2.19×10^{-25} iron(II) ions

B) 7.92×10^{22} iron(II) ions

C) 4.57×10^{24} iron(II) ions

D) 1.82×10^{27} iron(II) ions

Answer: B

Diff: 3 Type: MC Var: 5 Page Ref: 3.7

41) How many oxygen atoms are there in 7.00 g of sodium dichromate, $\text{Na}_2\text{Cr}_2\text{O}_7$?

A) 0.187 oxygen atoms

B) 2.30×10^{21} oxygen atoms

C) 1.60×10^{22} oxygen atoms

D) 1.13×10^{23} oxygen atoms

Answer: D

Diff: 3 Type: MC Var: 5 Page Ref: 3.7

42) How many chloride ions are there in 4.50 mol of aluminum chloride?

A) 3.00 chloride ions

B) 13.5 chloride ions

C) 2.71×10^{24} chloride ions

D) 8.13×10^{24} chloride ions

Answer: D

Diff: 3 Type: MC Var: 5 Page Ref: 3.7

43) How many cations are there in 10.0 g of sodium phosphate?

A) 3.67×10^{22} cations

B) 1.10×10^{23} cations

C) 9.87×10^{24} cations

D) 2.96×10^{25} cations

Answer: B

Diff: 3 Type: MC Var: 5 Page Ref: 3.7

44) What is the empirical formula of a substance that contains 2.64 g of C, 0.887 g of H, and 3.52 g of O?

- A) CH₄O
- B) C₂H₄O₂
- C) C₂H₄O₃
- D) C₃H₄O₄

Answer: A

Diff: 3 Type: MC Var: 5 Page Ref: 3.8

45) Which one of the following is NOT an empirical formula?

- A) CHO
- B) CH₂O
- C) C₂H₄O
- D) C₂H₄O₂

Answer: D

Diff: 3 Type: MC Var: 5 Page Ref: 3.8

46) Methane and oxygen react to form carbon dioxide and water. What mass of water is formed if 0.80 g of methane reacts with 3.2 g of oxygen to produce 2.2 g of carbon dioxide?

- A) 1.8 g
- B) 2.2 g
- C) 3.7 g
- D) 4.0 g

Answer: A

Diff: 3 Type: MC Var: 5 Page Ref: 3.8

47) Combustion analysis of an unknown compound containing only carbon and hydrogen produced 0.2845 g of CO₂ and 0.1451 g of H₂O. What is the empirical formula of the compound?

- A) CH₂
- B) C₂H₅
- C) C₄H₁₀
- D) C₅H₂

Answer: B

Diff: 3 Type: MC Var: 5 Page Ref: 3.8

48) Combustion analysis of 1.200 g of an unknown compound containing carbon, hydrogen, and oxygen produced 2.086 g of CO₂ and 1.134 g of H₂O. What is the empirical formula of the compound?

- A) C₂H₅O
- B) C₂H₅O₂
- C) C₂H₁₀O₃
- D) C₃H₈O₂

Answer: D

Diff: 3 Type: MC Var: 5 Page Ref: 3.8

49) A certain alcohol contains only three elements, carbon, hydrogen, and oxygen. Combustion of a 50.00 g sample of the alcohol produced 95.50 g of CO_2 and 58.70 g of H_2O . What is the empirical formula of the alcohol?

Answer: $\text{C}_2\text{H}_6\text{O}$

Diff: 3 Type: SA Var: 6 Page Ref: 3.8

Matching Questions

Match the following.

- A) $\text{H}(g)$
- B) $\text{Ca}_2(s)$
- C) $\text{I}(s)$
- D) $\text{Ne}_2(g)$
- E) $\text{I}_2(s)$
- F) $\text{Ne}(g)$
- G) $\text{Cl}_2(g)$
- H) $\text{Cl}(g)$
- I) $\text{Ca}(s)$
- J) $\text{H}_2(g)$
- K) $\text{O}(g)$
- L) $\text{O}_2(g)$

1) oxygen

Diff: 1 Type: MA Var: 1 Page Ref: 3.1

2) hydrogen

Diff: 1 Type: MA Var: 1 Page Ref: 3.1

3) chlorine

Diff: 1 Type: MA Var: 1 Page Ref: 3.3

4) neon

Diff: 1 Type: MA Var: 1 Page Ref: 3.3

5) calcium

Diff: 1 Type: MA Var: 1 Page Ref: 3.3

6) iodine

Diff: 1 Type: MA Var: 1 Page Ref: 3.3

Answers: 1) L 2) J 3) G 4) F 5) I 6) E

Short Answer Questions

1) How can one compound contain both ionic and covalent bonds? Give an example.

Answer: An ionic compound that contains a polyatomic ion, such as NaNO_3 , has both ionic bonds (that hold the sodium and nitrate ions together) as well as covalent bonds (that hold the atoms within the nitrate ion together).

Diff: 1 Type: SA Var: 1 Page Ref: 3.4

2) Describe the difference between a molecular formula and an empirical formula. Give an example.

Answer: A molecular formula is the exact number of each type of atom necessary to build a specific molecule. An empirical formula is simply the smallest whole number ratio between atoms in a compound. For example, C_2H_4 is the molecular formula for ethene. The empirical formula for ethene is CH_2 , the smallest whole number ratio between the elements.

Diff: 1 Type: SA Var: 1 Page Ref: 3.4

3) Define empirical formula.

Answer: An empirical formula gives relative numbers of atoms of each element.

Diff: 2 Type: SA Var: 1 Page Ref: 3.4

4) Describe a structural formula

Answer: In a structural formula, lines are used to represent covalent bonds to show how the atoms in the molecule are connected to each other.

Diff: 2 Type: SA Var: 1 Page Ref: 3.4

5) Describe the difference between ionic and molecular compounds. Give an example of each.

Answer: An ionic compound is formed between a metal and a nonmetal (or polyatomic ions) and is held together through the attraction of opposite charges. An example is NaCl . A molecular compound is usually formed between two or more nonmetals and is held together through the sharing of electrons between atoms. An example is CO_2 .

Diff: 1 Type: SA Var: 1 Page Ref: 3.4

6) Describe the difference between an atomic element and a molecular element.

Answer: Atomic elements exist in nature with a single atom as their basic unit; molecular elements do not exist in nature with a single atom as their basic unit.

Diff: 1 Type: SA Var: 1 Page Ref: 3.4

7) What is the structure of the covalent compound formed by nitrogen and oxygen? Is this the only possibility? Explain.

Answer: Since nitrogen and oxygen are both nonmetals, they combine by sharing electrons. This can be done in multiple ways. Some possible compounds are N_2O , N_2O_3 , NO_2 .

Diff: 2 Type: SA Var: 1 Page Ref: 3.4

8) Why aren't prefixes used in naming ionic compounds?

Answer: The charges on the ions dictate how many must be present to form a neutral unit. Molecular compounds do not have such constraints and therefore must use prefixes to denote the number of atoms present.

Diff: 1 Type: SA Var: 1 Page Ref: 3.4

9) Give the name for HNO_2 .

Answer: nitrous acid

Diff: 2 Type: SA Var: 1 Page Ref: 3.4

10) Calculate the mass percent composition of oxygen in $\text{Al}_2(\text{SO}_4)_3$.

Answer: 56.11%

Diff: 2 Type: SA Var: 1 Page Ref: 3.8