Chapter03 : Calculations with Chemical Formulas & Equations

Question Bank

1.How many moles of NH_4^+ are there in 88.5g of $(NH_4)_2CO_3$.

(M.w $(NH_4)_2CO_3$ = 96.1; M.w (NH_4) = 18)

a) 23.2 b) 1.84 c) 22.14 d) 33.15 e) 96.1

2. Calculate number of moles of cobalt (Co) (Mw=59 g/mol) **in a sample containing 1.0×10^{21} Co atom?**

a) 4.15×10^{-3} mol b) 3.32×10^{-3} mol

c) 9.8×10^{-3} mol d) 1.66×10^{-3} mol

3. Mole of X reacts with 10 moles of Y to form Z and W, calculate the excess moles according to this balanced equation:

$$3\,X + 3\,Y \rightarrow 2\,Z + W$$

a) 9 moles of Y b) Zero c) 3 moles of Y

d) 3moles of X e) 9 moles of X

4. When 12.0 g of $Ca_3(PO_4)_2$ and 12.0 g of H_2SO_4 were allowed to react according to the equation, 6.00 g of $CaSO_4$ were produced. Calculate the % yield of $CaSO_4$. (Molar masses (g/mol): $Ca_3(PO_4)_2$ = 310.2; H_2SO_4 = 98.1; $CaSO_4$ =136.1 and H_3PO_4 = 98.0

$$Ca_3(PO_4)_2(s) + 3H_2SO_4\,(aq) \rightarrow 3\,CaSO_4\,(s) + 2H_3PO_4\,(aq)$$

a) 63.3 b) 76.0 c) 88.6 d) 50.6 e) 38.0

5. What is the mass in grams of H atoms present in 6 molecules of water?

(Atomic mass of H = 1.008; amu; Avogadro No. = 6.02×10^{23})

a) 1.67×10^{-23} b) 6.70×10^{-24} c) 1.34×10^{-23}

d) 1.00×10^{-23} e) 2.01×10^{-23}

6. The total number of atoms in 0.10 mol of NO_2 is …….. (Select one)

a) 1.81×10^{23} b) 2.05×10^{22} c) 6.02×10^{22}

d) 3.06×10^{23} e) 3.67×10^{-23}

7. 10g of Ca reacted with 15g of HCl to form $CaCl_2$ and H_2, calculate the mass of H_2 (Mw of Ca =40 g/mol; Mw of H_2= 2g/mol; Mw of HCl = 36.5g/mol)

Note: you need to write the balance equation before doing any calculation

a) 0.1g b) 0.21g c) 0.31g

d) 0.41g e) 0.5g

8. How many moles of NH_3 will be produced from the reaction of (0.50 mol of N_2) with (1.2 mol of H_2) according to the following equation?

$$N_2 + 3\ H_2 \rightarrow 2\ NH_3$$

a) 0.80 b) 1.33 c) 1.67 d) 0.67 e) 1.01

9. If 6.91 grams of ZnO are obtained from a reaction of 6.54 g Zn with excess of oxygen. What is the percent yield of the reaction? (Select one)

(Molar mass: Zn = 65.38 g/mol; O= 16.00 g/mol)

a) 90% b) 65% C) 85% d) 70% e) 75%

10. A 12.39 g of phosphorus reacts with 52.54 g of chlorine to form only phosphorus trichloride (PCl3), what mass of PCl3 is formed?

$2P\ (g) + 3Cl_2\ (g) \rightarrow 2PCl_3\ (g)$

a. 91.86 g

b. 140.0 g

c. 30.15g

d. 54.93 g

e. 79.91 g

11. How many chromium atoms are contained in 7.00 g of $Na_2Cr_2O_7$? The molar mass of $Na_2Cr_2O_7$ is 261.97 g/mol.

a. 1.13×10^{23} Cr atoms

b. 1.60×10^{22} Cr atoms

c. 0.187 Cr atoms

d. 3.22×10^{22} Cr atoms

e. 6.15×10^{18} Cr atoms

12. Consider the following reaction:

2A + B → 3C + D

3.0 mol A and 2.0 mol B react to form 4.0 mol C. What is the? percent yield of this reaction?

a. % 75

b. % 67

c. % 50

d. % 89

e. % 100

13. A 1.74 g sample of an element contains 7.887 x10^{21} atoms. What is the element symbol?

a. I

b. Cs

c. Cd

d. Sb

e. In

14. Combustion analysis of 2.796 g of an unknown compound containing carbon, hydrogen, and oxygen produced 4.033 g of CO2 and 2.076 g of H2O. What is the empirical formula of the compound?

a. $C_2H_5O_2$

b. C_2H_5O

c. $C_2H_{10}O_3$

d. C_2H_4O

e. C_3H_8O

15. In 0.266 mol of trimellitic acid, $C_6H_3(COOH)_3$, there are:

a. 2.67 x 10^{23} hydrogen atoms.

b. 1.60 x 10^{22} molecules.

c. 4.80 x 10^{23} oxygen atoms.

d. 6.41 x 10^{24} molecules.

e. 1.44 x 10^{24} carbon atoms.

16. The amount of calcium in a 15.0-g sample was determined by converting the calcium-to-calcium oxalate, CaC_2O_4. The CaC_2O_4 weighed 10.3 g. What is the percent of calcium in the original sample?

a. 12.1 %

b. 68.7 %

c. 21.5 %

d. 8.8 %

e. 27.5 %

17. How many moles of Na_2SO_4 are contained in a 35.0-g sample of this substance?

A) 0.292 mol

B) 0.990 mol

C) 0.278 mol

D) 2.16 mol

E) 0.246 mol

18. A 2.50 g of $C_7H_6O_3$ (138.12 g/mol) is reacted with 10.31 g of CH_3OH (32.04 g/mol) according to the following reaction: $C_7H_6O_3 + CH_3OH \rightarrow C_8H_8O_3 + H_2O$. The yield of $C_8H_8O_3$ (152.14 g/mol) is 12.7 g. What is the percentage yield $C_8H_8O_3$?

A) 46.1%

B) 32.4%

C) 75.0%

D)71.3%

E) 23.05%

19. What is the mass of one atom of zinc in grams ? ($N_A = 6.022 \times 10^{23}$)

A) 6.35×10^{-22}

B) 3.20×10^{-22}

C) 5.89×10^{-22}

D) 1.09×10^{-22}

E) 4.05×10^{-22}

20. How many moles of C_3H_8 that contain 3.17x 10^{25} of hydrogen atoms? (N_A = 6.022x10^{23})

A) 8.22 mol

B) 6.58 mol

C) 1.03 mol

D) 3.09 mol

E) 9.73 mol

21. An organic compound contains by mass. Its composition is 68.85% C, 4.95% H, and 26.2% O, and its molecular weight is 122.12 g/mol. What is its molecular formula ?

A) $C_6H_7O_2$

B) $C_7H_6O_2$

C) $C_{14}H_{16}O_4$

D) $C_{20}H_{12}O_2$

E) $C_{18}H_{20}O_2$

22. A 6.00 g of CaF_2 (78.07 g/mol) are treated with 15.0 g of H_2SO_4 (98.07 g/mol) and yield 2.86 g of HF (20.0 g/mol) in the following reaction: CaF2+ H2SO4→ CaSO4 + 2HF. Calculate the percent yield of HF ?

A) 46.1%

B) 32.4%

C) 93.0%

D) 71.3%

E) 33.0%

23. A sample of an unknown compound containing 3.46 g C, 0.39 g H, and 6.15 g O. Determine the empirical formula of this compound.

a. $C_3H_5O_2$

b. C_3H_3O.

c. $C_3H_4O_2$

d. $C_3H_4O_4$

e. CHO_2

24. How many oxygen atoms are there in 3.15 g of $Al_2(S_2O_8)_3$ (MW $Al_2(S_2O_8)_3$ = 630.34 amu)

a. 9.03×10^{21}

b. 1.25×10^{20}

c. 3.01×10^{21}

d. 7.23×10^{22}

e. 2.41×10^{22}

25. Considering the chemical equation below

$3NO_2(g) + H_2O(l) \rightarrow 2HNO_3(aq) + NO(g)$

How many grams of nitrogen dioxide are required in this reaction to produce 4.30 g of HNO_3?

a. 9.42 g NO_2

b. 4.71 g NO_2

c. 2.09 g NO_2

d. 1.57 g NO_2

e. 3.14 g NO_2

26.Considering the chemical equation below

$4KO_2(s) + 2H_2O(l) \rightarrow 4KOH(s) + 3O_2(g)$

When 4.50 g of KO_2 was reacted, the percent yield of oxygen was 73.2 %. What was the actual yield of oxygen?

a. 1.11 g

b. 8.77 g

c. 5.85 g

d. 2.78 g

e. 3.90 g

27. Which of the following substances contains the greatest mass of chlorine:

a. 20.0 g $AlCl_3$

b. 15.0 g Cl_2

c. 0.40 mol KCl

d. 15.0 g $MgCl_2$

e. 0.56 mol $NaClO_3$

28. What is the masses of CO_2 and H_2O produced by the combustion of 1.397 g of a compound with empirical formula $C_3H_6O_2$ (molar mass = 74.079 g/mol)

a. 2.489 g CO_2, 1.018 g H_2O

b. 3.166 g CO_2, 1.295 g H_2O

c. 2.236 g CO_2, 0.915 g H_2O

d. 1.757 g CO_2, 0.719 g H_2O

e. 2.710 g CO_2, 1.109 g H_2O

29. How many sodium ions are contained in 99.6 mg of Na_2SO_3 (126.05 g/mol)? N_A = $6.022x10^{23}$

a) 9.52×10^{20} sodium ions

b) 2.10×10^{21} sodium ions

c) $1.05x10^{21}$ sodium ions

d) 1.52×10^{27} sodium ions

e) 4.76×10^{20} sodium ions

30. What is the percent yield of the following reaction if 19.7 g of Li is heated with 23.8 g of N_2 to produce 15.87 g of Li_3N?

$6\ Li(s) + N_2(g) \rightarrow 2Li_3N(s)$

a. 58.2 %

b. 38.2 %

c. 68.2 %

d. 48.2 %

e. 28.2 %

31. A 2.30 g sample of CaO (56.1 g/mol) is reacted with excess water and 2.14 g of $Ca(OH)_2$ (74.1 g/mol) is produced. What is the percent yield of the reaction?

$CaO(s) + H_2O(l) \rightarrow Ca(OH)_2(s)$

a) 81.0

b) 77.2

c) 73.6

d) 70.4

e) 67.5

32. A compound contains only carbon, hydrogen, and Oxygen. Combustion or 10.68 mg of the compound yields 22.11 mg CO_2 and 5.65 mg H_2O. The empirical formula of the compound is:

(Molar masses (g/mol) are: C = 12.01: H = 1.01 and O = 16.00)

a) $C_4H_5O_2$

b) $C_4H_4O_3$

c) $C_3H_6O_3$

d) $C_3H_5O_2$

e) $C_4H_3O_2$

33. When 5.00 g of P_4O_6 (Molar mass = 219.89 g/mol) was treated with excess I_2. 2.95 g of P_2I_4 (Molar mass = 569.57 g/mol) was obtained.

Use the following equation to calculate the percentage yield of P_2I_4

$$5P_4O_6 + 8I_2 \rightarrow 4\ P_2I_4 + 3\ P_4O_{10}$$

a) 41.0 %

b) 36.2 %

c) 33.3 %

d) 30.4 %

e) 28.5 %

34. What is the mass of Al_2O_3 (M. Mass = 101.96 g/mol) that contains $2.39x10^{23}$ oxygen atoms? (Avogadro's number = 6.022×10^{23})

a) 3.50 g

b) 5.25 g

c) 13.5 g

d) 6.75 g

c) 11.5 g

35. A compound contains only carbon. hydrogen and oxygen. The compound is 48.0% C and 4.04% H by mass, and its molar mass is 100. g/mol. What is the molecular formula of the compound?

(Molar masses (g/mol) are: C = 12.01: H = 1.01 and O = 16.00)

a) $C_8H_{16}O_4$

b) $C_{10}H_8O_3$

c) $C_{12}H_{18}O$

d) $C_6H_8O_6$

e) $C_4H_4O_3$

36. The molar mass of a compound is 142 g/mol. Calculate the number of molecules in 3.26 g of this compound.

a) 1.38×10^{22}

b) 1.81×10^{22}

e) $2.23\ x10^{22}$

d) $2.65x10^{22}$

e) $3.08x10^{22}$

37. The total number of oxygen atoms in 1.93 g of $CaCO_3$ is

a. $2.24\ x\ 10^{23}$

b. $1.92\ x\ 10^{23}$

c. $5.81\ \times\ 10^{22}$

d. $3.49\ x\ 10^{22}$

e. $4.65\ x\ 10^{22}$

38. a compound is composed of 57.0 % copper (Cu), 40.0% zinc (Zn) and 3.0% lead (Pb). If you have 15.0 g of this compound, how many milli moles of lead does it contain?

a. 1.00 mmol

b. 2.17 mmol

c. 0.54 mmol

d. 0.00 mmol

e. 1.10 mmol

39. If a sample of N_2O_2 decomposes to produce 1.381 g O_2, how many grams of NO_2 are formed? (Molar mass of NO_2 = 46.01 g/mol, O_2 = 32.00 g/mol).

$2\ N_2O_2(g) \rightarrow 4NO_2(g) + O_2(g)$

a. 4.625

b. 3.967

c. 5.520

d. 7.942

e. 1.438

40. If 2.89 g of an osmium oxide contains 2.16 g of osmium (molar mass = 190.23 g/mol). what is the empirical formula of the oxide?

a. OsO_3

b. OsO_4

c. OsO_5

d. OsO

e. OsO_2

41. The mass of one molecule of a compound is 2.03×10^{-22} g. Calculate the molar mass of the compound (in g/mol), (Avogadro's Number = 6.02×10^{23}).

a. 122

b. 158

c. 192

d. 146

e. 134

42. If 2.00 moles of SiO_2 and 4.00 moles of C reacted according to the equation below, calculate the theoretical yield of CO produced (molar mass of CO = 28.0 g/mol).

$$SiO_2 + 3C \rightarrow SiC + 2CO$$

a. 112g

b. 18.7g

c. 56.0g

d. 74.7 g

e. 14.0g

Answers:

1. (b)	2. (d)	3. (a)	4. (e)	5. (e)
6. (a)	7. (d)	8. (a)	9. (c)	10. (d)
11.(d)	12.(d)	13.(b)	14.(a)	15. (e)
16. (c)	17. (e)	18. (a)	19.(d)	20.(b)
21.(b)	22.(c)	23.(d)	24.(d)	25. (b)
26.(a)	27.(b)	28.(a)	29.(a)	30. (d)
31.(d)	32.(a)	33.(e)	34.(c)	35. (e)
36.(a)	37.(d)	38.(b)	39.(d)	40. (b)
	41.(a)	42.(d)		

ملاحظة: الحل بالتفصيل في الصفحات التالية، كل سؤال حسب رقمه بالترتيب.

Detailed solutions:

Q_1: $n_{(NH_4)_2CO_3} = \frac{88.5\ g}{96.1\ g/mol} = 0.921\ mol.$

→ 1 mol $(NH_4)_2CO_3$ ⟶ 2 mol NH_4^+

0.921 mol ⟶ χ → $\chi = 1.84\ mol.$ (b)

Q_2: $n_{Co} = \frac{\text{number of Co atoms}}{\text{avogadro's number}} = \frac{1 \times 10^{21}}{6.022 \times 10^{23}} = 1.66 \times 10^{-3}\ mol.$ (d)

Q_3: $3X + 3Y \longrightarrow 2Z + W$

1 mol 10 mol

بعيك أسئلة الكوميا ال coefficients
ال reagents متساوية بكونه ال limiting هو اللي ال
عدد مولات أقل فلحق نعرف ال excess moles بنطلع مباشرة.

3 mol X ⟶ 3 mol Y → n_y = 1 mol (required)

1 mol ⟶ n_y

→ X is limiting reagent → n_y (excess) = 10 − 1 =

= 9 mol (a)

حليته بالتفصيل لحتى تعرفوا طريقة الحل لو الـ coefficients ماتساووا

Q_4: $Ca_3(PO_4)_2 + 3H_2SO_4 \longrightarrow 3CaSO_4 + 2H_3PO_4$

moles: $\frac{12}{310.2} = 0.0387$ ⋮ $\frac{12}{98.1} = 0.122$

$m_{produced} = 6\ g$ (actual)

1 mol $Ca_3(PO_4)_2$ ⟶ 3 mol $CaSO_4$ theoretical

0.0387 mol ⟶ χ → $\chi = 0.116$ = $\frac{m_{theoretical}}{136.1} = 15.8\ g$

3 mol H_2SO_4 ⟶ 3 mol $CaSO_4$

0.122 mol ⟶ y → $y = 0.122$

→ % yield = $\frac{m_{actual}}{m_{theoretical}} \times 100\% = \frac{6\ g}{15.8\ g} \times 100\% = 38\%$ (e)

Q_5: $n_{H_2O} = \frac{6}{6.022 \times 10^{23}} = 9.96 \times 10^{-24}$ mol.

1 mol H_2O ⟶ 2 mol H

9.96×10^{-24} ⟶ n_H → $n_H = 2 \times 10^{-23} = \frac{m}{1.008}$ ⇒ $m = 2.01 \times 10^{-23}$ g

(e)

Q_6: total number of atoms = 3 × 0.1 mol × 6.022×10^{23} / mol = 1.801×10^{23}

(1N+2O) NO_2 عدد الذرات الموجودة بال ↓ n_{NO_2} ↓ avogadro's number.

(a)

Q_7: $Ca + 2HCl \longrightarrow CaCl_2 + H_2$

1 mol Ca ⟶ 1 mol H_2

$\frac{10\,g}{40\,g/mol}$ ⟶ x ⇒ $x = 0.25$ mol

2 mol HCl ⟶ 1 mol H_2

$\frac{15\,g}{36.5\,g/mol}$ ⟶ y ⇒ $y = 0.21$ mol $= \frac{m_{H_2}}{2\,g/mol}$ ⇒ $m_{H_2} = 0.41$ g (d)

Q_8: $N_2 + 3H_2 \longrightarrow 2NH_3$

1 mol N_2 ⟶ 2 mol NH_3

0.5 mol ⟶ X ⇒ X = 1 mol

3 mol H_2 ⟶ 2 mol NH_3

1.2 mol ⟶ Y ⇒ Y = 0.8 mol → (a)

Q_9: 1 mol Zn ⟶ 1 mol ZnO

$\frac{6.54\ g}{65.38\ g/mol}$ ⟶ x_{ZnO} → $n_{ZnO} = 0.1\ mol = \frac{m_{theoretical}}{65.38 + 16}$

→ $m_{theoretical} = 8.14\ g$

→ % yield = $\frac{6.91}{8.14} \times 100\% = 84.9\% = 85\%$ ⓒ

Q_{10}: $2P + 3Cl_2 \longrightarrow 2PCl_3$ Mw : P = 31 g/mol, Cl_2 = 35.5 g/mol

PCl_3 = 137.3 g/mol.

بنقدروا تطلعو هم من الجدول الدوري لما مايعطوكم اياهم.

2 mol P ⟶ 2 mol PCl_3

$\frac{12.39}{31}$ ⟶ x → x = 0.399 mol = $\frac{m}{137.3}$ → m = 54.8 g ⓓ

الاجابة ما طلعت زي ماهي بالزبط
لاني قربت أرقام فجعلش المهم تكون الاجابة
اللي بتطلع قريبة.

3 mol Cl_2 ⟶ 2 mol PCl_3

$\frac{52.54}{35.5}$ ⟶ y → y = 0.987 mol

Q_{11}: 1 mol $Na_2Cr_2O_7$ ⟶ 2 mol Cr

$\frac{7\ g}{261.97\ g/mol}$ ⟶ n_{Cr} → $n_{Cr} = 0.0534 \times 6.022 \times 10^{23}$

$= 3.22 \times 10^{22}$ atoms ⓓ

Q_{12}: $2A + B \longrightarrow 3C + D$

2 mol A ⟶ 3 mol C

3 mol ⟶ X → X = 4.5 mol (theoretical) → % yield = $\frac{4}{4.5} \times 100\% = 89\%$

ⓓ

1 mol B ⟶ 3 mol C

2 mol ⟶ y → y = 6 mol

Q_{13}: $n = \frac{\text{mass}}{\text{molar mass}} = \frac{\text{number of atoms}}{\text{avogadro's number}}$ *

$\rightarrow \frac{1.74}{M_w} = \frac{7.887 \times 10^{21}}{6.022 \times 1023} \rightarrow M_w = 132.86\ g/mol$

لما صارت معنا الـ Mw بنقدر نرجع للجدول الدوري ونشوف مين من الخيارات الـ Mw مساوية للي معنا

→ (Cs) (b)

Q_{14}: $1\ mol\ CO_2 \longrightarrow 1\ mol\ C$

$\frac{4.033}{44} \longrightarrow n_C \rightarrow n_C = 0.0917\ mol = \frac{m_C}{12} \rightarrow m_C = 1.10\ g.$

$1\ mol\ H_2O \longrightarrow 2\ mol\ H$

$\frac{2.076}{18} \longrightarrow n_H \rightarrow n_H = 0.231 = \frac{m_H}{1} \rightarrow m_H = 0.231\ g.$

$m_O = 2.796 - (1.10 + 0.231) = 1.465 \rightarrow n_O = \frac{1.465}{16} = 0.0916\ mol$

$C_{\frac{0.0917}{0.0916}}\ H_{\frac{0.231}{0.0916}}\ O_{\frac{0.0916}{0.0916}} \rightarrow C_1H_{2.5}O_1 \Rightarrow (C_2H_5O_2)$ (a)

Q_{15}: $n_{C_6H_3(CO_2H)_3} = \frac{\text{number of } C_6H_3(CO_2H)_3 \text{ molecules} \rightarrow X}{\text{avogadro's number}}$

$\Rightarrow X = 0.266 \times 6.022 \times 10^{23} = 1.60 \times 10^{25}$ molecule $\Rightarrow$ b, d لأ

→ number of H atoms = $\underset{\text{عدد الـ H's بالمركب}}{6} \times 0.266 \times 6.022 \times 10^{23} = 9.61 \times 10^{23} \Rightarrow$ a ✗

→ number of O atoms = $\underset{\text{عدد الـ O بالمركب}}{6} \times 0.266 \times 6.022 \times 10^{23} = 9.61 \times 10^{23} \rightarrow$ c ✗

→ number of C atoms = $\underset{\text{عدد الـ C's بالمركب}}{9} \times 0.266 \times 6.022 \times 10^{23} = 1.44 \times 10^{25} \Rightarrow$ (e) ✓

Q_{16}: 1 mol CaC_2O_4 ⟶ 1 mol Ca

$\frac{10.3}{128.097}$ ⟶ n_{Ca} ⇒ $n_{Ca} = 0.0804\ mol = \frac{m_{Ca}}{40.078}$

⇒ $m_{Ca} = \boxed{3.22\ g}$

⇒ % Ca in orginal sample = $\frac{3.22}{15} \times 100\% = \boxed{21.5\ \%}$ ©

Q_{17}: moles = $\frac{\text{mass}}{\text{molar mass}}$ ⇒ $n = \frac{35\ g}{142.04\ g/mol} = \boxed{0.246\ mol}$ (e)

Q_{18}: $C_7H_6O_3 + CH_3OH \longrightarrow C_8H_8O_3 + H_2O$

1 mol $C_7H_6O_3$ ⟶ 1 mol $C_8H_8O_3$

$\frac{2.5}{138.12}$ ⟶ x ⇒ $\boxed{x = 0.181\ mol} = n_{\text{theoritical}} = \frac{m_{\text{theo.}}}{152.14}$ ⇒ $m_{\text{theo.}} = 27.5\ g$

$\boxed{X < Y}$

1 mol CH_3OH ⟶ 1 mol $C_8H_8O_3$

$\frac{10.31}{32.04}$ ⟶ y ⇒ $y = 0.322$

⇒ % $C_8H_8O_3 = \frac{12.7}{27.5} \times 100\% = \boxed{46.1\ \%}$ (a)

Q_{19}: $n = \frac{\text{mass}}{Mw} = \frac{\text{number of atoms}}{\text{avogadro's number}}$ → $\frac{m}{65.38} = \frac{1}{6.022 \times 10^{23}}$ → $m = \boxed{1.09 \times 10^{-22}}$ (d)

Q_{20}: 1 mol C_3H_8 ⟶ 8 mol H

$n_{C_3H_8}$ ⟶ $\frac{3.17 \times 10^{25}}{6.022 \times 10^{23}}$

⇒ $n_{C_3H_8} = \boxed{6.58\ mol.}$ (b)

Q21: mass of sample = 100g → فرضنا عدد عشان نحوّلها mass%.

$$\rightarrow n_C = \frac{68.85\ g}{12\ g/mol} = 5.74\ mol$$

$$n_H = \frac{4.95}{1} = 4.95\ mol$$

$$n_O = \frac{26.2}{16} = 1.64$$

$$\Rightarrow C_{\frac{5.74}{1.64}} H_{\frac{4.95}{1.64}} O_{\frac{1.64}{1.64}} \Rightarrow C_{3.5} H_3 O_1 \rightarrow \boxed{C_7H_6O_2} \quad (b)$$

empirical formula

بس هو طالب الـ Molecular formula ← لازم نحسب الـ Mw للـ empirical لحتى نتأكد إذا هي نفسها الـ molecular ولا لا

$$\Rightarrow Mw \text{ of } C_7H_6O_2 = 7\times12 + 6\times1 + 16\times2$$

$$= 122\ g/mol \rightarrow \text{empirical formula} \equiv \text{molecular formula}.$$

Q22: $1CaF_2 + 1H_2SO_4 \longrightarrow CaSO_4 + 2HF$

moles: $\frac{6}{78.07} = 0.077$: $\frac{15}{98.07} = 0.153$

1 mol CaF_2 ⟶ 2 mol HF

0.077 ⟶ n_{HF}

$$\rightarrow n_{HF} = 0.154\ mol = \frac{m_{theoretical}}{20}$$

$$\Rightarrow m_{theoretical} = 3.08g$$

$$\rightarrow \%\ yield = \frac{2.86}{3.08} \times 100\% = 92.9\% = \boxed{93\%} \quad (c)$$

Q_{23}: $n_C = \frac{3.46}{12} = 0.288$

$n_H = \frac{0.39}{1} = 0.39\ mol.$

$n_O = \frac{6.15}{16} = 0.384\ mol$

$C_{\frac{0.288}{0.288}}\ H_{\frac{0.39}{0.288}}\ O_{\frac{0.384}{0.288}} \Rightarrow C_{1}H_{1.35}O_{1.34} \xrightarrow[\times 3]{} C_3H_4O_4$ (d)

لحق تحصل على أرقام صحيحة.

Q_{24}: 1 mol $Al_2(S_2O_8)_3 \longrightarrow$ 24 mol O

$\frac{3.15g}{630.34\ g/mol} \longrightarrow n_O \Rightarrow n_O = 0.12\ mol = \frac{n_{atoms}}{6.022\times10^{23}}$

$\Rightarrow n_{atoms} = 7.23\times10^{22}$ (d)

Q_{25}: $3NO_2 + H_2O \longrightarrow 2HNO_3 + NO$

$m = ?$ $\quad$ $4.3g$

2 mol $HNO_3 \longrightarrow$ 3 mol NO_2

$\frac{4.3}{63.01} \longrightarrow n_{NO_2} \Rightarrow n_{NO_2} = 0.102\ mol = \frac{m_{NO_2}}{46} \Rightarrow m_{NO_2} = 4.7\ g$ (b)

Q_{26}: $4KO_2 + 2H_2O \longrightarrow 4KOH + 3O_2$

$4.5g$ $\quad$ 73.2%

4 mol $KO_2 \longrightarrow$ 3 mol O_2

$\frac{4.5}{71.1} \longrightarrow n_{O_2} \Rightarrow n_{O_2} = 0.0475\ mol = \frac{m_{theoretical}}{32\ g/mol}$

$\Rightarrow m_{theoretical} = 1.52g$

$\Rightarrow 73.2\% = \frac{m_{actual}}{1.52} \times 100\% \Rightarrow m_{actual} = 1.11\ g$ (a)

Q_{27}: a) 1 mol $AlCl_3$ ⟶ 3 mol Cl

$\frac{20}{133.33}$ ⟶ χ ⟶ $\chi = 0.45\ mol.$

b) 1 mol Cl_2 ⟶ 2 mol Cl

$\frac{15}{35.5}$ ⟶ χ ⟶ $\chi = 0.85\ mol.$

c) 1 mol KCl ⟶ 1 mol Cl

0.4 mol ⟶ χ ⟶ $\chi = 0.4\ mol.$

d) 1 mol $MgCl_2$ ⟶ 2 mol Cl

$\frac{15}{95.3}$ ⟶ χ ⟶ $\chi = 0.315\ mol$

e) 1 mol $NaClO_3$ ⟶ 1 mol Cl

0.56 mol ⟶ χ ⟶ $\chi = 0.56\ mol$

* $\chi : n_{Cl}$ بكل مركب
* ما احتجنا نطلع الـ mass لانه $n \propto m$ ← إذا حددنا χ بيروح أكبر m بيروح أعلى

⟶ (b) بتكون هي كانت حددنا

Q_{28}: 1 mol $C_3H_6O_2$ ⟶ 3 mol CO_2 (لانه فيها 3 C's)

$\frac{1.397}{74.079}$ ⟶ n_{CO_2} ⟶ $n_{CO_2} = 0.0566\ mol = \frac{m_{CO_2}}{44.01}$ ⟶ $m_{CO_2} = 2.49\ g$

1 mol $C_3H_6O_2$ ⟶ 3 mol H_2O (6 H's لهيك)

$\frac{1.397}{74.079}$ ⟶ n_{H_2O} ⟶ $n_{H_2O} = 0.0566\ mol = \frac{m_{H_2O}}{18}$ ⟶ $m_{H_2O} = 1.018\ g$

⟶ (a)

Q_{29}: 1 mol Na_2SO_3 ⟶ 2 mol Na

$\frac{99.6 \times 10^{-3}\ g}{126.05\ g/mol}$ ⟶ n_{Na} ⟶ $n_{Na} = 1.58 \times 10^{-3} = \frac{n_{ions}}{6.022 \times 10^{23}}$

⟶ $n_{ions} = 9.52 \times 10^{20}$ (a)

Q_{30}: $6Li + N_2 \longrightarrow 2Li_3N$

$6\ mol\ Li \longrightarrow 2\ mol\ Li_3N$

$\frac{19.7}{6.94} \longrightarrow x \Rightarrow x = 0.946\ mol = \frac{m_{Li_3N}\ (theoretical)}{34.83}$

$x < y$ $\Rightarrow m_{theoretical} = 32.95g$

$1\ mol\ N_2 \longrightarrow 2\ mol\ Li_3N$

$\frac{23.8}{28} \longrightarrow y \Rightarrow y = 1.7\ mol.$

$\Rightarrow \%\ yield = \frac{15.87}{32.95} \times 100\% = 48.2\ \%$ (d)

Q_{31}: $CaO + H_2O \longrightarrow Ca(OH)_2$

$1\ mol\ CaO \longrightarrow 1\ mol\ Ca(OH)_2$

$\frac{2.30}{56.1} \longrightarrow n_{Ca(OH)_2} \Rightarrow n_{Ca(OH)_2} = 0.041\ mol = \frac{m_{theoretical}}{74.1}$

$\Rightarrow m_{theoretical} = 3.04g \Rightarrow \%\ yield = \frac{2.14}{3.04} \times 100\%$

$= 70.4\%$ (d)

Q_{32}: $1\ mol\ CO_2 \longrightarrow 1\ mol\ C$

$\frac{22.11 \times 10^{-3}}{44} \longrightarrow n_C \Rightarrow n_C = 5.03 \times 10^{-4}\ mol = \frac{m_C}{12} \Rightarrow m_C = 6.03 \times 10^{-3}g$

$1\ mol\ H_2O \longrightarrow 2\ mol\ H$

$\frac{5.65 \times 10^{-3}}{18} \longrightarrow n_H \Rightarrow n_H = 6.28 \times 10^{-4}\ mol = m_H$

$\Rightarrow m_O = 10.68 \times 10^{-3} - (6.03 \times 10^{-3} - 6.28 \times 10^{-4}) = 4.022 \times 10^{-3}g \Rightarrow n_O = \frac{4.022 \times 10^{-3}}{16}$

$\Rightarrow n_O = 2.51 \times 10^{-4}\ mol$

$\Rightarrow C_{\frac{5.03 \times 10^{-4}}{2.51 \times 10^{-4}}} H_{\frac{6.28 \times 10^{-4}}{2.51 \times 10^{-4}}} O_{\frac{2.51 \times 10^{-4}}{2.51 \times 10^{-4}}} \Rightarrow C_{2^1} H_{2^{2.5}} O_{2^1} \Rightarrow C_4H_5O_2$ (a)

Q_{33}: $5\,P_4O_6 + 8\,I_2 \longrightarrow 4\,P_2I_4 + 3\,P_4O_{10}$

$5\ mol\ P_4O_6 \longrightarrow 4\ mol\ P_2I_4$

$\frac{5}{219.89} \longrightarrow n_{P_2I_4} \Rightarrow n_{P_2I_4} = 0.0182\ mol = \frac{m_{theoretical}}{569.57}$

$\Rightarrow m_{theoretical} = 10.37\ g \Rightarrow \%\ yield = \frac{2.95}{10.37} \times 100\%$

$= 28.5\%$ ⓔ

Q_{34}: $1\ mol\ Al_2O_3 \longrightarrow 3\ mol\ O$

$n_{Al_2O_3} \longleftarrow \frac{2.39 \times 10^{23}}{6.022 \times 10^{23}} \Rightarrow n_{Al_2O_3} = 0.132\ mol = \frac{m_{Al_2O_3}}{101.96}$

$\Rightarrow m_{Al_2O_3} = 13.5\ g$ ⓒ

Q_{35}: $n_C = \frac{48\ g}{12\ g/mol} = 4\ mol$

$n_H = \frac{4.04\ g}{1.01\ g/mol} = 4\ mol$

$n_O = 100 - (48 + 4.04) = 47.96\ g \Rightarrow n_O = \frac{47.96\ g}{16\ g/mol} = 3\ mol$

$\Rightarrow C_4H_4O_3 \rightarrow$ emperical formula

لحق نعرف إذا اللي حطيت معنا هي نفسها الـ molecular formula ولا لا بنحسب الـ Mw بعدها وبنقارنها

$\rightarrow Mw\,(C_4H_4O_3) = 4(12) + 4 + 16(3) = 100\ g/mol. \rightarrow$ emperical formula $\equiv$ molecular formula

بالعطاة بالسؤال.

$\rightarrow$ ⓔ

Q_{36}: $n = \frac{\text{mass}}{\text{molar mass}} = \frac{\text{number of molecules}}{\text{avogadro's number}}$

$\rightarrow \frac{3.26}{142} = \frac{n_{molecules}}{6.022\times10^{23}} \rightarrow n_{molecules} = 1.38\times10^{22}$ (a)

Q_{37}: 1 mol $CaCO_3$ $\longrightarrow$ 3 mol O

$\frac{1.93}{100} \longrightarrow n_O \rightarrow n_O = 0.0579\ mol = \frac{n_{atoms}}{6.022\times10^{23}}$

$\rightarrow n_{atoms} = 3.49\times10^{22}$ (d)

Q_{38}: $3\% = \frac{m_{Pb}}{15g\ (sample)} \times 100\% \Rightarrow m_{Pb} = 0.45g \rightarrow n_{Pb} = \frac{0.45}{207.2} = 2.17\times10^{-3}\ mol$

(3% = %Pb)

$\rightarrow n_{Pb} = 2.17\ mmol$ (b)

Q_{39}: 1 mol O_2 $\longrightarrow$ 4 mol NO_2

$\frac{1.381}{32} \longrightarrow n_{NO_2} \rightarrow n_{NO_2} = 0.173\ mol = \frac{m_{NO_2}}{46.01}$

$\rightarrow m_{NO_2} = 7.95\ g$ (d)

ما لحق نفس الرقم بالزبط بسبب التقريب .

Q_{40}: $n_{Os} = \frac{2.16}{193.23} = 0.0112\ mol$

$m_O = 2.89 - 2.16 = 0.73\ g \rightarrow n_O = \frac{0.73}{16} = 0.0456\ mol$

$Os_{\frac{0.0112}{0.0112}} O_{\frac{0.0456}{0.0112}} \rightarrow \boxed{Os_1O_4} \rightarrow$ (b)

Q_{41}: $\frac{2.03 \times 10^{-22} g}{M_w} = \frac{1}{6.022 \times 10^{23}} \rightarrow M_w =$ (122 g/mol) (a)

Q_{42}: $SiO_2 + 3C \longrightarrow SiC + 2CO$

1 mol SiO_2 ⟶ 2 mol CO

2 mol ⟶ x $\rightarrow x = 4\ mol$

3 mol C ⟶ 2 mol CO

4 mol ⟶ y $\Rightarrow y = 2.67\ mol = \frac{m_{theoretical}}{28}$

$m_{theoretical} =$ (74.7 g) (d)

CHAPTER 3

1. The total number of atoms in 0.10 mol of NO_2 is:

A)$2.0 * 10^{22}$

B)$1.8 * 10^{23}$

C)$3.0 * 10^{23}$

D)$3.6 * 10^{-23}$

E)$6.0 * 10^{22}$

2. The mass percent of oxygen in $C_7H_6O_2$ is:

A) 53

B) 40

C) 26

D) 69

E) 6.7

3. What is mass of chlorine in 14.6 g $CaCl_2$?

(atomic mass Cl = 35.45 g/mol & Ca = 40.08 g/mol)

A) 9.33 g

B) 6.77 g

C) 4.24 g

D) 8.05 g

4. The percent composition by mass of a compound is 76.0% C, 12.8% H, and 11.2% O. The molar mass of this compound is 284.5 g/mol. What is the molecular formula of the compound? Atomic mass: C=12.01; H=1.008; O=16.00

A) $C_{10}H_6O$

B) $C_9H_{18}O$

C) $C_{16}H_{28}O_4$

D) $C_{20}H_{12}O_2$

E) $C_{18}H_{36}O_2$

5. A compound of bromine and fluorine contains 58.37 mass percent bromine. Determine its empirical formula:

A) BrF_2

B) BrF_3

C) Br_2F_3

D) Br_3F

E) BrF

6. The number of oxygen atoms in 10.0 g of $Ca_3(PO_4)_23H_2O$ (molar mass = 364.3 g/mol) is:

A) $2.68 * 10^{23}$

B) $6.78 * 10^{23}$

C) $1.82 * 10^{23}$

D) $3.56 * 10^{23}$

E) $7.38 * 10^{23}$

7. How many grams of potassium are in 23.8 g of potassium dichromate $K_2Cr_2O_7$?

A) 2.02 g

B) 6.33 g

C) 4.04 g

D) 3.32 g

E) 5.15 g

8. One mole of H_2:

A) contains $6.0 * 10^{23}$ H atoms

B) contains $6.0 * 10^{23}$ H_2 molecules

C) contains 1 gram of H_2

D) is equivalent to $6.02 * 10^{23}$ g of H_2

E) none of the above

9. An unknown organic compound was analysed and the mass percent of the constituent atoms were: 64.3% carbon; 7.14% hydrogen; The empirical formula of this compound is:

A) $C_3H_4O_2$

B) C_6H_3O

C) C_3H_4O

D) C_3H_6O

E) $C_3H_6O_2$

10. Balance the following equation:

$$a\ Be_2C + b\ H_2O \rightarrow c\ Be(OH)_2 + d\ CH_4$$

The ratio of coefficients b/d in the balanced equation:

A) 1/2

B) 2/1

C) 1/4

D) 4/1

E) 3/1

11. All of the following are empirical formulas EXCEPT:

A) C_6H_5Cl

B) N_2O_4

C) Cr_2O_3

D) $Sn_3(PO_4)_4$

E) Na_2SO_4

12. The limiting reagent is the substance:

A) present in greatest quantity

B) limits the number of reagents present

C) determined by the amount of reactants present

D) that determines the maximum amount of possible product

13. What is the empirical formula of a substance that is 53.5% C, 15.5% H and 31.1% N by weight?

A) $C_4H_{14}N_2$

B) C_2H_7N

C) CH_4N_7

D) C_3HN_2

E) $C_{4.5}H_{15.5}N_{2.2}$

14. When it is correctly balanced, the correct coefficients for the equation below are:

$$PCl_3 + H_2O \rightarrow H_3PO_3 + HCl$$

A) 1, 3, 1, 1

B) 1, 3, 1, 3

C) 1, 1, 1, 3

D) 2, 3, 2, 3

15. Calculate the percent yield of iron if 950 g of Fe_3O_4 underwent the reaction shown in the chemical equation below and 533 g of Fe was isolated from the reaction mixture.

$$Fe_3O_4\,(s) + 2C\,(s) \rightarrow 2CO_2\,(g) + 3Fe\,(s)$$

A) 25.9%

B) 77.5%

C) 46.9%

D) 56.1%

16. Aluminium metal reacts with chlorine gas to form solid Aluminium chloride. What mass of chlorine gas (M.W Cl_2 = 70.9 g/mol) is needed to react completely with 163 g of aluminium (M.W Al = 26.9 g/mol)?

$$2Al_{(S)} + 3Cl_{2\,(g)} \rightarrow 2AlCl_{3\,(S)}$$

A) 324 g

B) 489 g

C) 214 g

D) 644 g

17. What is the mass of one Calcium (Ca) atom?

(Atomic mass of Ca = 40.08, NA = $6.022 * 10^{23}$)

A) $9.274 * 10^{-23}$ g

B) $6.656 * 10^{-23}$ g

C) $5.324 * 10^{-23}$ g

D) $4.037 * 10^{-23}$ g

18. What mass of copper (II) nitrate would be produced from the complete reaction of 45.6 g of copper, according to the chemical reaction shown below?

$$Cu + 2AgNO_3 \rightarrow Cu(NO_3)_2 + 2Ag$$

A) 0.72 g

B) 21.1 g

C) 98.7 g

D) 135 g

Principles of Chemistry: A Molecular Approach 2e **(Tro)**
Chapter 3 Molecules, Compounds and Chemical Equations

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 2 nonmetal atoms.
E) the attraction between 2 metal atoms.
Answer: B
Diff: 1 Page Ref: 3.2

2) 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 Page Ref: 3.2

3) Which of the following contains BOTH ionic and covalent bonds?
A) CaI_2
B) COS
C) $CaSO_4$
D) SF_6
E) None of the above contain both ionic and covalent bonds.
Answer: C
Diff: 2 Page Ref: 3.2

4) What is the empirical formula for $C_4H_{10}O_2$?
A) C_2H_5O
B) CHO
C) C_2H_4O
D) CHO_2
E) CH_2O
Answer: A
Diff: 1 Page Ref: 3.3

5) Write a possible molecular formula for C_4H_4O.
A) $C_8H_8O_2$
B) $C_{12}H_{12}O_2$
C) C_2H_2O
D) C_8H_8O
Answer: A
Diff: 1 Page Ref: 3.3

6) 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 Page Ref: 3.3

7) Which of the following is an atomic element?
A) Br
B) H
C) N
D) O
E) Mg
Answer: E
Diff: 1 Page Ref: 3.4

8) Which of the following is a molecular element?
A) Kr
B) Ag
C) S
D) Mg
E) Ti
Answer: C
Diff: 1 Page Ref: 3.4

9) Which of the following is a molecular element?
A) Mg
B) Ar
C) Xe
D) I
E) Li
Answer: D
Diff: 1 Page Ref: 3.4

10) 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 Page Ref: 3.4

11) 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 Page Ref: 3.4

12) 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 Page Ref: 3.4

13) Which of the following is an ionic compound?
A) SCl_2
B) $Mg_3(PO_4)_2$
C) Cl_2O
D) CH_2O
E) PF_5
Answer: B
Diff: 1 Page Ref: 3.4

14) Write the formula for the compound formed between potassium and sulfur.
A) KS
B) KS_2
C) K_2S
D) K_2SO_3
E) K_3S_2
Answer: C
Diff: 2 Page Ref: 3.5

15) Give the name for SnO.
A) tin (I) oxide
B) tin (II) oxide
C) tin (III) oxide
D) tin (IV) oxide
Answer: B
Diff: 2 Page Ref: 3.5

16) Give the name for $NaNO_3$.
A) sodium nitrite
B) sodium nitrate
C) sodium pernitrate
D) sodium hyponitrite
E) sodium hyponitrate
Answer: B
Diff: 2 Page Ref: 3.5

17) Write the formula for barium nitrite.
A) Ba_3N_2
B) $BaNO_3$
C) BN
D) $Ba(NO_2)_2$
E) $B(NO_2)_3$
Answer: D
Diff: 2 Page Ref: 3.5

18) Write the formula for strontium nitride.
A) Sr_3N_2
B) $Sr(NO_3)_2$
C) SrN
D) Sr_2N_3
E) $Sr(NO_2)_2$
Answer: A
Diff: 2 Page Ref: 3.5

19) 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 Page Ref: 3.5

20) Give the formula for sodium chlorate.
A) NaClO
B) $NaClO_2$
C) $NaClO_3$
D) $NaClO_4$
Answer: C
Diff: 2 Page Ref: 3.5

21) Write the name for $Sn(SO_4)_2$. 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 Page Ref: 3.5

22) Determine the name for $CoCl_2 \cdot 6H_2O$. 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 Page Ref: 3.5

23) Write the name for $Ca_3(PO_4)_2$.
A) calcium (III) phosphite
B) calcium (II) phosphite
C) calcium phosphate
D) tricalcium phosphorustetraoxide
E) calcium phosphite
Answer: C
Diff: 3 Page Ref: 3.5

24) Give the correct formula for aluminum sulfate.
A) Al_22SO_4
B) $Al(SO_4)_3$
C) $Al_3(SO_4)_2$
D) $Al_2(SO_4)_3$
Answer: D
Diff: 3 Page Ref: 3.5

25) Write the formula for copper (II) sulfate pentahydrate.
A) $Cu_2SO_3 \cdot H_5$
B) $Cu_2S \cdot H_2O$
C) $CuS \cdot 5H_2O$
D) $(CuSO_4)_5$
E) $CuSO_4 \cdot 5H_2O$
Answer: E
Diff: 3 Page Ref: 3.5

26) 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 Page Ref: 3.6

27) 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 Page Ref: 3.6

28) Give the formula for sulfurous acid.
A) H_2SO_3
B) HSO_3
C) H_2SO_4
D) HSO_4
Answer: A
Diff: 2 Page Ref: 3.6

29) Identify the formula for nitric acid.
A) HNO_3
B) HNO_2
C) HNO
D) HNO_4
Answer: A
Diff: 2 Page Ref: 3.6

30) 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 Page Ref: 3.6

31) 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 Page Ref: 3.6

32) 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 Page Ref: 3.6

33) Determine the name for $HClO_3$.
A) hydrochloric acid
B) hydrochlorus acid
C) chlorate acid
D) chloric acid
E) perchloric acid
Answer: D
Diff: 3 Page Ref: 3.6

34) Calculate the molar mass for $Mg(ClO_4)_2$.
A) 223.21 g/mol
B) 123.76 g/mol
C) 119.52 g/mol
D) 247.52 g/mol
E) 75.76 g/mol
Answer: A
Diff: 2 Page Ref: 3.7

35) Calculate the molar mass of $Al(C_2H_3O_2)_3$.
A) 86.03 g/mol
B) 204.13 g/mol
C) 56.00 g/mol
D) 258.09 g/mol
E) 139.99 g/mol
Answer: B
Diff: 2 Page Ref: 3.7

36) Calculate the molar mass of $Ca_3(PO_4)_2$.
A) 87.05 g/mol
B) 215.21 g/mol
C) 310.18 g/mol
D) 279.21 g/mol
E) 246.18 g/mol
Answer: C
Diff: 2 Page Ref: 3.7

37) Calculate the molar mass of $C_8H_6O_4$.
A) 166.13 g/mol
B) 182.09 g/mol
C) 150.18 g/mol
D) 172.13 g/mol
Answer: A
Diff: 2 Page Ref: 3.7

38) How many millimoles of $Ca(NO_3)_2$ contain 4.78×10^{22} formula units of $Ca(NO_3)_2$? The molar mass of $Ca(NO_3)_2$ is 164.10 g/mol.
A) 12.6 mmol $Ca(NO_3)_2$
B) 13.0 mmol $Ca(NO_3)_2$
C) 20.7 mmol $Ca(NO_3)_2$
D) 79.4 mmol $Ca(NO_3)_2$
E) 57.0 mmol $Ca(NO_3)_2$
Answer: D
Diff: 2 Page Ref: 3.7

39) 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 Page Ref: 3.7

40) How many N_2O_4 molecules are contained in 76.3 g N_2O_4? The molar mass of N_2O_4 is 92.02 g/mol.
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 Page Ref: 3.7

41) 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.
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 Page Ref: 3.7

42) 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.
A) 3.85 kg
B) 5.04 kg
C) 2.60 kg
D) 3.03 kg
E) 6.39 kg
Answer: B
Diff: 3 Page Ref: 3.7

43) What is the mass of 9.44×10^{24} molecules of NO_2? The molar mass of NO_2 is 46.01 g/mol.
A) 205 g
B) 294 g
C) 721 g
D) 341 g
E) 685 g
Answer: C
Diff: 3 Page Ref: 3.7

44) 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 Page Ref: 3.8

45) 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 Page Ref: 3.8

46) 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 Page Ref: 3.8

47) Two samples of potassium iodide are decomposed into their constituent elements. The first sample produced 13.0 g of potassium and 42.3 g of iodine. If the second sample produced 24.4 kg of potassium, how many kg of iodine were produced?
A) 13.3 kg
B) 22.5 kg
C) 79.4 kg
D) 44.4 kg
E) 92.4 kg
Answer: C
Diff: 2 Page Ref: 3.8

48) 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 Page Ref: 3.8

49) 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 Page Ref: 3.8

50) 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 Page Ref: 3.8

51) How many atoms of oxygen are contained in 47.6 g of $Al_2(CO_3)_3$? The molar mass of $Al_2(CO_3)_3$ is 233.99 g/mol.
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) 3.19×10^{24} O atoms
Answer: D
Diff: 4 Page Ref: 3.8

52) 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.
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: 4 Page Ref: 3.8

53) Determine the volume of hexane that contains 5.33×10^{22} molecules of hexane. The density of hexane is 0.6548 g/mL and its molar mass is 86.17 g/mol.
A) 8.59 mL
B) 13.5 mL
C) 7.40 mL
D) 12.4 mL
E) 11.6 mL
Answer: E
Diff: 4 Page Ref: 3.8

54) How many molecules are contained in 25.0 mL of butane? The density of butane is 0.6011 g/mL and the molar mass is 58.12 g/mol.
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: 4 Page Ref: 3.8

55) Determine the molecular formula of a compound that has a molar mass of 183.2 g/mol and an empirical formula of $C_2H_5O_2$.
A) $C_2H_5O_2$
B) $C_6H_{15}O_6$
C) $C_3H_7O_3$
D) $C_4H_{10}O_4$
E) $C_8H_{20}O_8$
Answer: B
Diff: 2 Page Ref: 3.9

56) Determine the molecular formula of a compound that has a molar mass of 92.0 g/mol and an empirical formula of NO_2.
A) N_2O_3
B) N_3O_6
C) N_2O_4
D) NO_2
E) N_2O_5
Answer: C
Diff: 2 Page Ref: 3.9

57) Determine the empirical formula for a compound that is 36.86% N and 63.14% O by mass.
A) NO
B) N_2O
C) NO_2
D) N_2O_3
E) NO_3
Answer: D
Diff: 3 Page Ref: 3.9

58) 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 Page Ref: 3.9

59) Determine the empirical formula for a compound that contains C, H and O. It contains 51.59% C and 35.30% 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 Page Ref: 3.9

60) Determine the empirical 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: 5 Page Ref: 3.9

61) 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: 5 Page Ref: 3.9

62) Write a **balanced** equation to show the reaction of sulfurous acid with lithium hydroxide to form water and lithium sulfite.
A) $H_2SO_4(aq) + LiOH(aq) \rightarrow H_2O(l) + Li_2SO_4(aq)$
B) $H_2SO_3(aq) + 2\ LiOH(aq) \rightarrow 2\ H_2O(l) + Li_2SO_3(aq)$
C) $HSO_3(aq) + LiOH(aq) \rightarrow H_2O(l) + LiSO_3(aq)$
D) $HSO_4(aq) + LiOH(aq) \rightarrow H_2O(l) + LiSO_4(aq)$
E) $H_2S(aq) + 2\ LiOH(aq) \rightarrow 2\ H_2O(l) + Li_2S(aq)$
Answer: B
Diff: 3 Page Ref: 3.10

63) Write a **balanced** equation to show the reaction of gaseous ethane with gaseous oxygen to form carbon monoxide gas and water vapor.
A) $2\ C_2H_6(g) + 7\ O_{2(g)} \rightarrow 4\ CO_2(g) + 6\ H_2O(g)$
B) $C_2H_6(g) + 5\ O_{(g)} \rightarrow 2\ CO(g) + 3\ H_2O(g)$
C) $2\ C_2H_6(g) + 5\ O_{2(g)} \rightarrow 4\ CO(g) + 6\ H_2O(g)$
D) $C_2H_6(g) + 7\ O_{(g)} \rightarrow 2\ CO_2(g) + 3\ H_2O(g)$
E) $2\ CH_3(g) + 5\ O_{(g)} \rightarrow 2\ CO(g) + 3\ H_2O(g)$
Answer: C
Diff: 3 Page Ref: 3.10

64) Write a **balanced** equation to show the reaction of aqueous aluminum acetate with aqueous ammonium phosphate to form solid aluminum phosphate and aqueous ammonium acetate.
A) $Al(C_2H_3O_2)_2(aq) + (NH_4)_2PO_4(aq) \rightarrow AlPO_{4(s)} + 2\ NH_4C_2H_3O_2(aq)$
B) $Al(C_2H_3O_2)_2(aq) + (NH_3)_2PO_4(aq) \rightarrow AlPO_{4(s)} + 2\ NH_3C_2H_3O_2(aq)$
C) $Al(CO_3)_2(aq) + (NH_3)_2PO_4(aq) \rightarrow AlPO_{4(s)} + 2\ NH_3CO_3(aq)$
D) $Al(C_2H_3O_2)_3(aq) + (NH_4)_3PO_4(aq) \rightarrow AlPO_{4(s)} + 3\ NH_4C_2H_3O_2(aq)$
E) $Al(CO_2)_3(aq) + (NH_4)_3PO_3(aq) \rightarrow AlPO_{3(s)} + 3\ NH_4CO_2(aq)$
Answer: D
Diff: 3 Page Ref: 3.10

65) Which of the following is one possible form of pentane?
A) $CH_3CH_2CH_2CH_2CH_3$
B) $CH_3CH{=}CHCH_2CH_3$
C) $CH_3CH_2CH_2CH_2CH_2CH_3$
D) $CH_3CH_2CH_2CH_2CH_2NH_2$
E) $CH_3CH_2\text{-}O\text{-}CH_2CH_2CH_3$
Answer: A
Diff: 2 Page Ref: 3.11

66) Identify the principal component of natural gas.
A) propane
B) ethane
C) n-butane
D) methane
E) n-pentane
Answer: D
Diff: 2 Page Ref: 3.11

Match the following.

A) Ca(s)
B) Ca_2(s)
C) O_2(g)
D) O(g)
E) Ne_2(g)
F) Cl_2(g)
G) I_2(s)
H) Ne(g)
I) I(s)
J) Cl(g)

67) oxygen
Diff: 1 Page Ref: 3.4

68) chlorine
Diff: 1 Page Ref: 3.4

69) neon
Diff: 1 Page Ref: 3.4

70) calcium
Diff: 1 Page Ref: 3.4

71) iodine
Diff: 1 Page Ref: 3.4

Answers: 67) C 68) F 69) H 70) A 71) G

72) 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 Page Ref: 3.2

73) 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 Page Ref: 3.3

74) Can you predict the chemical formula for a covalent compound between nitrogen and oxygen? Explain your answer.
Answer: No, since nitrogen and oxygen are both nonmetals, they combine by sharing electrons. This can be done in multiple different ways. Some possible compounds are N_2O, N_2O_3, NO_2.
Diff: 2 Page Ref: 3.3

75) Describe the difference between an atomic element and a molecular element.
Answer: Atomic elements exist in nature with a single atom at their basic unit; molecular elements do not exist in nature with a single atom as their basic unit.
Diff: 1 Page Ref: 3.4

76) 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 2 or more nonmetals and is held together through the sharing of electrons between atoms. An example is CO_2.
Diff: 1 Page Ref: 3.4

77) 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 Page Ref: 3.5

78) Give the name for HNO_2.
Answer: nitrous acid
Diff: 2 Page Ref: 3.6

79) Balance the following equation.

____ $C_{10}H_{12}$ + ____ O_2 → ____ H_2O + ____ CO_2

Answer: 1 $C_{10}H_{12}$ + 13 O_2 → 6 H_2O + 10 CO_2
Diff: 5 Page Ref: 3.10

80) List the elements in an hydrocarbon
Answer: hydrogen and carbon
Diff: 1 Page Ref: 3.11

81) 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 Page Ref: 3.5

82) 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 Page Ref: 3.6

83) Which one of the following compounds contains ionic bonds?
A) SrO
B) HBr
C) PBr_3
D) SiO_2
Answer: A
Diff: 1 Page Ref: 3.5

84) 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 Page Ref: 3.4

85) Which of the compounds, Li_3N , NH_3, C_3H_8, IF_3 are ionic compounds?
A) only C_3H_8
B) only Li_3N
C) Li_3N and NH_3
D) NH_3, C_3H_8, and IF_3
Answer: B
Diff: 1 Page Ref: 3.4

86) 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 Page Ref: 3.6

87) 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 Page Ref: 3.4

88) 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 Page Ref: 3.5

89) The solid compound, K_2SO_4, contains
A) K^+, S^{6+}, and O^{2-} ions.
B) K^+ and SO_4^{-2} ions.
C) K_2^+ and SO_4^{-2} ions.
D) K_2SO_4 molecules.
Answer: B
Diff: 3 Page Ref: 3.5

90) 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 Page Ref: 3.5

91) Rb_2S is named
A) rubidium disulfide.
B) rubidium sulfide.
C) rubidium(II) sulfide.
D) rubidium sulfur.
Answer: B
Diff: 3 Page Ref: 3.5

92) What is the chemical formula for calcium hydroxide?
A) CaH_2
B) CaOH
C) $CaOH_2$
D) $Ca(OH)_2$
Answer: D
Diff: 3 Page Ref: 3.5

93) What is the chemical formula for magnesium hydride?
A) MgH_2
B) MgOH
C) $MgOH_2$
D) $Mg(OH)_2$
Answer: A
Diff: 3 Page Ref: 3.5

94) The chemical formula for lithium peroxide is
A) LiOH.
B) LiO_2.
C) Li_2O.
D) Li_2O_2.
Answer: D
Diff: 3 Page Ref: 3.5

95) The compound, $Cu(IO_3)_2$, is named
A) copper iodate(II).
B) copper(I) iodate.
C) copper(I) iodate(II).
D) copper(II) iodate.
Answer: D
Diff: 3 Page Ref: 3.5

96) The compound, ClO , is named
A) chlorite.
B) hypochlorite.
C) chlorine monoxide.
D) chlorine (II) oxide.
Answer: C
Diff: 3 Page Ref: 3.5

97) The chemical formula for calcium nitride is
A) $Ca(NO_3)_2$.
B) $Ca(NO_2)_2$.
C) Ca_3N_2.
D) CaN_2.
Answer: C
Diff: 3 Page Ref: 3.5

98) An aqueous solution of H_2S is named
A) hydrosulfuric acid.
B) hydrosulfurous acid.
C) sulfuric acid.
D) sulfurous acid.
Answer: A
Diff: 3 Page Ref: 3.6

99) The chemical formula for the sulfite ion is
A) S^-.
B) S^{2-}.
C) SO_3^{2-}.
D) SO_4^{2-}.
Answer: C
Diff: 3 Page Ref: 3.5

100) 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 Page Ref: 3.5

101) The chemical formula for nitrous acid is
A) $H_3N(aq)$.
B) $H\ NO_2(aq)$.
C) $H\ NO_3(aq)$.
D) $H_2N_2O_6(aq)$.
Answer: B
Diff: 3 Page Ref: 3.6

102) What is the molar mass of nitrogen gas?
A) 14.0 g/mol
B) 28.0 g/mol
C) 6.02×10^{23} g/mol
D) 1.20×10^{23} g/mol
Answer: B
Diff: 3 Page Ref: 3.7

103) What is the mass of a single fluorine molecule, F_2?
A) 3.155×10^{-23} g
B) 6.310×10^{-23} g
C) 19.00 g
D) 38.00 g
Answer: B
Diff: 3 Page Ref: 3.7

104) What is the mass of 0.500 mol of dichlorodifluoromethane, CCl_2F_2?
A) 4.14×10^{-3} g
B) 60.5 g
C) 121 g
D) 242 g
Answer: B
Diff: 3 Page Ref: 3.7

105) How many moles are there in 3.00 g of ethanol, CH_3CH_2OH?
A) 0.00725 mol
B) 0.0652 mol
C) 15.3 mol
D) 138 mol
Answer: B
Diff: 3 Page Ref: 3.7

106) What is the mass of 8.50 x 10^{22} molecules of NH_3?
A) 0.00829 g
B) 0.417 g
C) 2.40 g
D) 121 g
Answer: C
Diff: 3 Page Ref: 3.7

107) What is the molar mass of 1-butene if 5.38×10^{16} molecules of 1-butene weigh 5.00 μg?
A) 56.0 g/mol
B) 178 g/mol
C) 224 g/mol
D) 447 g/mol
Answer: A
Diff: 3 Page Ref: 3.7

108) What mass of carbon dioxide, CO_2, contains the same number of molecules as 3.00 g of trichlorofluoromethane, CCl_3F?
A) 0.106 g
B) 0.961 g
C) 1.04 g
D) 9.37 g
Answer: B
Diff: 3 Page Ref: 3.7

109) 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 Page Ref: 3.7

110) 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 Page Ref: 3.7

111) 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 Page Ref: 3.7

112) 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 Page Ref: 3.7

113) The molecular weight of nitrous oxide (N_2O), known as laughing gas, is _____ amu (rounded to one decimal place).
A) 60.0
B) 30.0
C) 44.0
D) 3.0
E) 22.0
Answer: C
Diff: 3 Page Ref: 3.7

114) 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 Page Ref: 3.8

115) 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 Page Ref: 3.8

116) 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 Page Ref: 3.8

117) Determine the mass percent (to the hundredths place) of H in sodium bicarbonate ($NaHCO_3$).
Answer: 1.20
Diff: 2 Page Ref: 3.8

118) 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) $C_6H_{12}O_2$
D) $C_5H_{10}O_2$
E) C_3H_6O
Answer: E
Diff: 4 Page Ref: 3.9

119) 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: 4 Page Ref: 3.7

120) How many oxygen atoms are there in 7.00 g of sodium dichromate, $Na_2Cr_2O_7$?
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: 4 Page Ref: 3.7

121) 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: 4 Page Ref: 3.7

122) 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: 4 Page Ref: 3.7

123) What is the empirical formula of a substance that contains 2.64 g of C, 0.444 g of H, and 3.52 g of O?
A) CH_2O
B) $C_2H_4O_2$
C) $C_2H_4O_3$
D) $C_3H_4O_4$
Answer: A
Diff: 3 Page Ref: 3.9

124) Which one of the following is **not** an empirical formula?
A) CHO
B) CH_2O
C) C_2H_4O
D) $C_2H_4O_2$
Answer: D
Diff: 3 Page Ref: 3.9

125) 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: 4 Page Ref: 3.9

126) Combustion analysis of an unknown compound containing only carbon and hydrogen produced 0.2845 g of CO_2 and 0.1451 g of H_2O. What is the empirical formula of the compound?
A) CH_2
B) C_2H_5
C) C_4H_{10}
D) C_5H_2
Answer: B
Diff: 4 Page Ref: 3.9

127) Combustion analysis of 1.200 g of an unknown compound containing carbon, hydrogen, and oxygen produced 2.086 g of CO_2 and 1.134 g of H_2O. What is the empirical formula of the compound?
A) C_2H_5O
B) $C_2H_5O_2$
C) $C_2H_{10}O_3$
D) $C_3H_8O_2$
Answer: D
Diff: 4 Page Ref: 3.9

128) A certain alcohol contains only three elements, carbon, hydrogen, and oxygen. Combustion of a 50.00 gram sample of the alcohol produced 95.50 grams of CO_2 and 58.70 grams of H_2O. What is the empirical formula of the alcohol?
Answer: C_2H_6O
Diff: 4 Page Ref: 3.9

129) What is the stoichiometric coefficient for oxygen when the following equation is balanced using the lowest, whole-number coefficients?

_____ C_2H_6O (l) + _____ O_2(g) → _____ CO_2(g) + _____ H_2O(l)
A) 9
B) 7
C) 5
D) 3
Answer: D
Diff: 5 Page Ref: 3.10

130) Aluminum metal reacts with aqueous iron(II) chloride to form aqueous aluminum chloride and iron metal. What is the stoichiometric coefficient for aluminum when the chemical equation is balanced using the lowest, whole-number stoichiometric coefficients?
A) 1
B) 2
C) 3
D) 4
Answer: B
Diff: 5 Page Ref: 3.10

131) Calcium phosphate reacts with sulfuric acid to form calcium sulfate and phosphoric acid. What is the coefficient for sulfuric acid when the equation is balanced using the lowest, whole-numbered coefficients?
A) 1
B) 2
C) 3
D) none of these
Answer: C
Diff: 5 Page Ref: 3.10