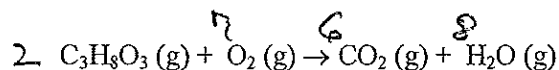


Chapter 4 Review

Multiple Choice

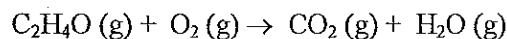
Identify the choice that best completes the statement or answers the question.

1. When the following equation is balanced, the coefficient of $C_3H_8O_3$ is _____.



- a. 1
- b. 2
- c. 3
- d. 7
- e. 5

2. When the following equation is balanced, the coefficient of O_2 is _____.



- a. 2
- b. 3
- c. 4
- d. 5
- e. 1

3. What is the empirical formula of a compound that contains 29% Na, 41% S, and 30% O by mass?

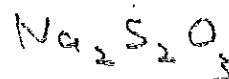
Assume 100g

- a. $Na_2S_2O_3$
- b. $NaSO_2$
- c. $NaSO$
- d. $NaSO_3$
- e. $Na_2S_2O_6$

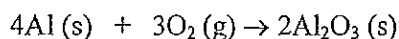
$$Na \rightarrow 29/23 \approx 1.26/1.26 = 1 \times 2 = 2$$

$$S \rightarrow 41/32 = 1.28/1.26 \approx 1 \times 2 = 2$$

$$O \rightarrow 30/16 = 1.88/1.26 = 1.5 \times 2 = 3$$



4. Solid aluminum and gaseous oxygen react in a combination reaction to produce aluminum oxide:



The maximum amount of Al_2O_3 that can be produced from 2.5 g of Al and 2.5 g of O_2 is _____ g.

- a. 9.4
- b. 7.4
- c. 4.7
- d. 5.3
- e. 5.0

$$\frac{2.5g Al}{27g Al} \left| \frac{1 mol Al}{4 mol Al} \right| \frac{2 mol Al_2O_3}{1 mol Al_2O_3} \left| \frac{101.96g}{1 mol Al_2O_3} \right| = 4.72g$$

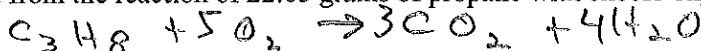
$$\frac{2.5g O}{32g O_2} \left| \frac{1 mole O_2}{3 mole O_2} \right| \frac{2 mol Al_2O_3}{1 mol Al_2O_3} \left| \frac{101.96g}{1 mol Al_2O_3} \right| = 5.3g$$

5. The total number of atoms in 0.111 mol of $Fe(CO)_3(PH_3)_2$ is _____.

- a. 15.0
- b. 1.00×10^{24}
- c. 4.46×10^{21}
- d. 1.67
- e. 2.76×10^{-24}

6. There are _____ oxygen atoms in 30 molecules of $C_{20}H_{42}S_3O_2$
- a. 6.0×10^{23}
 b. 1.8×10^{25}
 c. 3.6×10^{25}
 d. 1.2×10^{24}
 e. 60
7. Propane (C_3H_8) reacts with oxygen in the air to produce carbon dioxide and water. In a particular experiment, 38.0 grams of carbon dioxide are produced from the reaction of 22.05 grams of propane with excess oxygen. What is the % yield in this reaction?
- a. 38.0
 b. 57.6
 c. 66.0
 d. 86.4
 e. 94.5
8. Which of the following are strong acids?
 HI
 HNO₃
 HF
 HBr
- a. HF, HBr
 b. HI, HNO₃, HF, HBr
 c. HI, HF, HBr
 d. HNO₃, HF, HBr
 e. HI, HNO₃, HBr
9. The concentration of chloride ions in a 0.193 M solution of potassium chloride is _____.
- a. 0.0643 M
 b. 0.386 M
 c. 0.0965 M
 d. 0.579 M
 e. 0.193 M
10. The net ionic equation for formation of an aqueous solution of NiI_2 accompanied by evolution of CO_2 gas via mixing solid $NiCO_3$ and aqueous hydriodic acid is _____.
- a. $2NiCO_3(s) + HI(aq) \rightarrow 2H_2O(l) + CO_2(g) + 2Ni^{2+}(aq)$
 b. $NiCO_3(s) + I^-(aq) \rightarrow 2H_2O(l) + CO_2(g) + Ni^{2+}(aq) + HI(aq)$
 c. $NiCO_3(s) + 2H^+(aq) \rightarrow H_2O(l) + CO_2(g) + Ni^{2+}(aq)$
 d. $NiCO_3(s) + 2HI(aq) \rightarrow 2H_2O(l) + CO_2(g) + NiI_2(aq)$
 e. $NiCO_3(s) + 2HI(aq) \rightarrow H_2O(l) + CO_2(g) + Ni^{2+}(aq) + 2I^-(aq)$
11. Which one of the following compounds is insoluble in water?
- a. Na_2CO_3
 b. K_2SO_4
 c. $Fe(NO_3)_3$
 d. ZnS
 e. $AgNO_3$

$$\frac{30 \text{ molecules } C_{20}H_{42}S_3O_2}{1 \text{ molecule } C_{20}H_{42}S_3O_2} \times 2 \text{ atoms O} = 60$$



$$\frac{22.05g C_3H_8}{44.1g C_3H_8} \times \frac{1 \text{ mole } C_3H_8}{1 \text{ mole } C_3H_8} \times \frac{3 \text{ mole } CO_2}{1 \text{ mole } C_3H_8} \times \frac{44.0g CO_2}{1 \text{ mole } CO_2} = 67.5g CO_2$$

$$\frac{38.0g}{66g} \times 100\% = 57.6$$

Know your strong Acids

$$0.193M KCl = 0.193M Cl^-$$

Know your Solubility Rule

12. In which reaction does the oxidation number of oxygen increase?

- a. $\text{Ba}(\text{NO}_3)_2(\text{aq}) + \text{K}_2\text{SO}_4(\text{aq}) \rightarrow \text{BaSO}_4(\text{s}) + 2\text{KNO}_3(\text{aq})$ Precipitation
 b. $\text{HCl}(\text{aq}) + \text{NaOH}(\text{aq}) \rightarrow \text{NaCl}(\text{aq}) + \text{H}_2\text{O}(\text{l})$ Acid-Base
 c. $\text{MgO}(\text{s}) + \text{H}_2\text{O}(\text{l}) \rightarrow \text{Mg}(\text{OH})_2(\text{s})$ Synthesis
 d. $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{SO}_3(\text{g})$ Redox
 e. $2\text{H}_2\text{O}(\text{l}) \rightarrow 2\text{H}_2(\text{g}) + \text{O}_2(\text{g})$ Redox

13. Which of these metals will be oxidized by the ions of cobalt? (Cobalt will gain electrons)

- a. nickel
 b. tin
 c. iron
 d. copper
 e. silver

14. Zinc is more active than cobalt and iron but less active than aluminum. Cobalt is more active than nickel but less active than iron. Which of the following correctly lists the elements in order of increasing activity?

- a. $\text{Co} < \text{Ni} < \text{Fe} < \text{Zn} < \text{Al}$
 b. $\text{Ni} < \text{Fe} < \text{Co} < \text{Zn} < \text{Al}$
 c. $\text{Ni} < \text{Co} < \text{Fe} < \text{Zn} < \text{Al}$
 d. $\text{Fe} < \text{Ni} < \text{Co} < \text{Al} < \text{Zn}$
 e. $\text{Zn} < \text{Al} < \text{Co} < \text{Ni} < \text{Fe}$

Al
 Zn
 Fe
 Co
 Ni

15. What are the respective concentrations (M) of Fe^{3+} and I^- afforded by dissolving 0.200 mol FeI_3 in water and diluting to 725 mL?

- a. 0.276 and 0.828
 b. 0.828 and 0.276
 c. 0.276 and 0.276
 d. 0.145 and 0.435
 e. 0.145 and 0.0483

$$\frac{0.200 \text{ mol}}{0.725 \text{ L}} = 0.276 \text{ M FeI}_3$$

$$0.276 \text{ M FeI}_3 = 0.276 \text{ M Fe}^{3+} \text{ ion}$$

$$0.276 \text{ M} \times 3 = 0.828 \text{ M I}^- \text{ ion}$$

16. What are the respective concentrations (M) of Cu^{2+} and Cl^- afforded by dissolving 0.200 mol CuCl_2 in water and diluting to 345 mL?

- a. 0.200 and 0.200
 b. 0.580 and 1.16
 c. 0.200 and 0.400
 d. 1.16 and 2.32
 e. 0.580 and 0.290

$$\frac{0.200 \text{ mol CuCl}_2}{0.345 \text{ L}} = 0.580 \text{ M CuCl}_2$$

$$0.580 \text{ M CuCl}_2 = 0.580 \text{ M Cu}^{2+} \text{ ion}$$

$$0.580 \text{ M} \times 2 = 1.16 \text{ M I}^- \text{ ion}$$

17. Which solution contains the largest number of moles of chloride ions?

- a. 10.0 mL of 0.500M BaCl_2 $0.01 \times 0.5 = 0.005 \text{ mol} \times 2 = 0.010 \text{ mol}$
 b. 4.00 mL of 1.000M NaCl $0.004 \times 1 = 0.004 \text{ mol} \times 1 = 0.004 \text{ mol}$
 c. 7.50 mL of 0.500M FeCl_3 $0.0075 \times 0.5 = 0.00375 \text{ mol} \times 3 = 0.01125 \text{ mol}$
 d. 25.00 mL of 0.400M KCl $0.025 \times 0.4 = 0.01 \text{ mol} \times 1 = 0.01 \text{ mol}$
 e. 30.00 mL of 0.100M CaCl_2 $0.030 \times 0.1 = 0.003 \text{ mol} \times 2 = 0.006 \text{ mol}$

18. What mass (g) of barium iodide is contained in 250 mL of a barium iodide solution that has an iodide ion concentration of 0.193 M?

- a. 9.44
 b. 18.9
 c. 0.024
 d. 0.048
 e. 37.7

$$\frac{0.193 \text{ mole I}^-}{\text{L}} \times \frac{0.250 \text{ L}}{1} \times \frac{1 \text{ mol BaI}_2}{2 \text{ mol I}^-} \times \frac{391.14 \text{ g}}{1 \text{ mol BaI}_2}$$

$$= 9.44 \text{ g BaI}_2$$

19. Pure acetic acid ($\text{HC}_2\text{H}_3\text{O}_2$) is a liquid and is known as glacial acetic acid. Calculate the molarity of a solution prepared by dissolving 10.00 mL of glacial acetic acid at 25°C in sufficient water to give 500.0 mL of solution. The density of glacial acetic acid at 25°C is 1.05 g/mL.

- a. 1.26×10^3
 b. 21.0
 c. 0.0210
 d. 0.350
 e. 3.50×10^4

$$\frac{1.05 \text{ g HC}_2\text{H}_3\text{O}_2}{\text{mL}} \left| \frac{10 \text{ mL}}{1} \right| \left| \frac{1 \text{ mol}}{60 \text{ g}} \right| \left| \frac{1}{0.500 \text{ L}} \right|$$

$$= 0.350 \text{ M}$$

Tips

Oxygen

2- mostly

1- in peroxides (H_2O_2) (Na_2O_2) (Li_2O_2)

1+ - with Fluorine

Colored Solutions

- These ions form colored solutions:

Ni - Green

$\text{CrO}_4^{2-} \rightarrow$ yellow

$\text{MnO}_4^- \rightarrow$ purple

$\text{Cu}^{2+} \rightarrow$ Blue

$\text{Fe}^{3+} \rightarrow$ yellow-orange

Group I and II - No Color

Gas Formation

*Metal carbonates, when heated, form Metal Oxides + CO_2

\rightarrow Metal Sulfides + Acid \rightarrow Salt + H_2S gas

1 mol of Zn can reduce the greatest no. of moles of which of the following ions

Al^{3+}

Pb^{2+}

Ag^+

