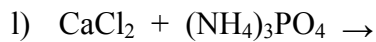
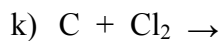
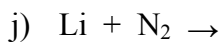
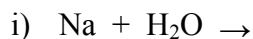
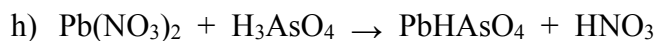
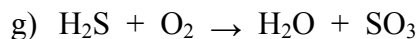
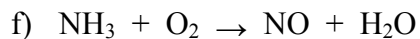
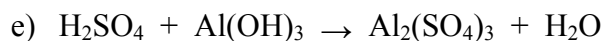
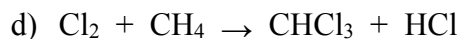
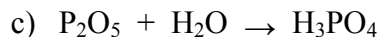
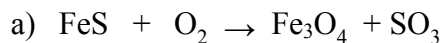


Balancing Equations - Practice Problems

Answers follow the problems.

1) Complete and/or balance the following reactions.



2) Write the formulas for the following compounds

- a) Titanium(IV) Chloride
- b) Tetraphosphorous decaoxide
- c) Sodium Carbonate
- d) Calcium Fluoride
- e) Iron (III) Nitrate
- f) Iodine Pentafluoride
- g) Aluminum Hydroxide

3) Provide names for the following compounds

- a) ZrO_2
- b) $(\text{NH}_4)_3\text{PO}_4$
- c) Na_2S
- d) SeF_4
- e) CCl_4
- f) CaCO_3
- g) Co_2O_3

4) Write the product formed and balance each reaction

- a) $\text{P} + \text{O}_2 \text{ ---->}$
- b) $\text{Mg} + \text{N}_2 \text{ ---->}$
- c) $\text{Sc} + \text{S}_8 \text{ ---->}$
- d) $\text{Li} + \text{N}_2 \text{ ---->}$
- e) $\text{N}_2 + \text{H}_2 \text{ ---->}$

5) Write the net ionic reaction that occurs when the following compounds are mixed.

Barium Nitrate and Ammonium Carbonate

Aluminum Nitrate and Sodium Hydroxide

Lead(II) Acetate and Potassium Iodide

Silver(I) Nitrate and Sodium Dichromate

Mercury(I) Perchlorate and Sodium Chloride

Ammonium Phosphate and Calcium Chloride

Phosphoric acid and Ammonium Hydroxide

6) Complete and balance the following reactions when the each compound is combusted with oxygen.

Fe_2S_3

NH_3

NaCN

CH_3SH

AgCH_3CO_2

7) When a 10.0 gram sample of an unknown organic acid is subjected to combustion analysis, 21.2 grams of CO_2 and 3.25 grams of H_2O are produced. What is the empirical formula of the oxygen-containing compound?

8) An 11.0 gram sample of a solid unknown was burned in oxygen producing 5.00 grams of water and 16.29 grams of carbon dioxide. What is the empirical formula of the oxygen-containing compound?

9) When a 15.0 gram sample of an acid is subjected to combustion analysis, 26.76 grams of carbon dioxide and 10.94 grams of water are formed. What is the empirical formula of the oxygen-containing compound?

10) A 15.25 gram sample of an organic acid was combusted in oxygen and produced 34.71 grams of carbon dioxide and 14.20 grams of water. What is the empirical formula of the oxygen-containing compound?

Balancing Equations - Practice Problems – Answers

1) Complete and/or balance the following reactions,

- a) $6 \text{FeS} + 13 \text{O}_2 \rightarrow 2 \text{Fe}_3\text{O}_4 + 6 \text{SO}_3$
- b) $\text{CO}_2 + 2 \text{H}_2\text{O} \rightarrow \text{CH}_4 + 2 \text{O}_2$
- c) $\text{P}_2\text{O}_5 + 3 \text{H}_2\text{O} \rightarrow 2 \text{H}_3\text{PO}_4$
- d) $3 \text{Cl}_2 + \text{CH}_4 \rightarrow \text{CHCl}_3 + 3 \text{HCl}$
- e) $3 \text{H}_2\text{SO}_4 + 2 \text{Al}(\text{OH})_3 \rightarrow \text{Al}_2(\text{SO}_4)_3 + 6 \text{H}_2\text{O}$
- f) $4 \text{NH}_3 + 5 \text{O}_2 \rightarrow 4 \text{NO} + 6 \text{H}_2\text{O}$
- g) $\text{H}_2\text{S} + 2 \text{O}_2 \rightarrow \text{H}_2\text{O} + \text{SO}_3$
- h) $\text{Pb}(\text{NO}_3)_2 + \text{H}_3\text{AsO}_4 \rightarrow \text{PbHAsO}_4 + 2 \text{HNO}_3$
- i) $2 \text{Na} + 2 \text{H}_2\text{O} \rightarrow 2 \text{NaOH} + \text{H}_2$
- j) $3 \text{Li} + 2 \text{N}_2 \rightarrow 2 \text{Li}_3\text{N}$
- k) $\text{C} + 2 \text{Cl}_2 \rightarrow \text{CCl}_4$
- l) $\text{CaCl}_2 + (\text{NH}_4)_3\text{PO}_4 \rightarrow \text{Ca}_3(\text{PO}_4)_2 + 6 \text{NH}_4\text{Cl}$
- m) $2 \text{C}_3\text{H}_8\text{O} + 9 \text{O}_2 \rightarrow 3 \text{CO}_2 + 4 \text{H}_2\text{O}$
- n) $3 \text{CaCl}_2 + 2 \text{H}_3\text{PO}_4 \rightarrow \text{Ca}_3(\text{PO}_4)_2 + 6 \text{HCl}$

2) Write the formulas for the following compounds

- | | | |
|----|----------------------------|----------------------------|
| a) | Titanium(IV) Chloride | TiCl_4 |
| b) | Tetraphosphorous decaoxide | P_4O_{10} |
| c) | Sodium Carbonate | Na_2CO_3 |
| d) | Calcium Fluoride | CaF_2 |
| e) | Iron(III) Nitrate | $\text{Fe}(\text{NO}_3)_3$ |
| f) | Iodine Pentafluoride | IF_5 |
| g) | Aluminum Hydroxide | $\text{Al}(\text{OH})_3$ |

3) Provide names for the following compounds.

- a) ZrO_2 Zirconium(IV) Oxide
- b) $(\text{NH}_4)_3\text{PO}_4$ Ammonium Phosphate
- c) Na_2S Sodium Sulfide
- d) SeF_4 Selenium Tetrafluoride
- e) CCl_4 Carbon Tetrachloride
- f) CaCO_3 Calcium Carbonate
- g) Co_2O_3 Cobalt(III) Oxide

4) Write the product formed and balance each reaction

- a) $4 \text{P} + 5 \text{O}_2 \rightarrow 2 \text{P}_2\text{O}_5$
- b) $3 \text{Mg} + \text{N}_2 \rightarrow \text{Mg}_3\text{N}_2$
- c) $3 \text{Sc} + 3/8 \text{S}_8 \rightarrow \text{Sc}_2\text{S}_3$
- d) $6 \text{Li} + \text{N}_2 \rightarrow 2 \text{Li}_3\text{N}$
- e) $\text{N}_2 + 3 \text{H}_2 \rightarrow 2 \text{NH}_3$

5) Write the net ionic reaction that occurs when the following compounds are mixed.

- | | |
|--|---|
| Barium Nitrate and Ammonium Carbonate | $\text{Ba}^{2+} + \text{CO}_3^{2-} \rightarrow \text{BaCO}_3$ |
| Aluminum Nitrate and Sodium Hydroxide | $\text{Al}^{3+} + 3 \text{OH}^- \rightarrow \text{Al(OH)}_3$ |
| Lead(II) Acetate and Potassium Iodide | $\text{Pb}^{2+} + 2 \text{I}^- \rightarrow \text{PbI}_2$ |
| Silver(I) Nitrate and Sodium Dichromate | $2 \text{Ag}^+ + \text{Cr}_2\text{O}_7^{2-} \rightarrow \text{Ag}_2\text{Cr}_2\text{O}_7$ |
| Mercury(I) Perchlorate and Sodium Chloride | $\text{Hg}_2^{2+} + 2 \text{Cl}^- \rightarrow \text{Hg}_2\text{Cl}_2$ |
| Ammonium Phosphate and Calcium Chloride | $3 \text{Ca}^{2+} + 2 \text{PO}_4^{3-} \rightarrow \text{Ca}_3(\text{PO}_4)_2$ |
| Phosphoric acid and Ammonium Hydroxide | $\text{H}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O}$ |

6) Complete and balance the following reactions when the each compound is combusted with oxygen.

- $\text{Fe}_2\text{S}_3 + 6 \text{O}_2 \rightarrow \text{Fe}_2\text{O}_3 + 3 \text{SO}_3$
- $2 \text{NH}_3 + 4 \text{O}_2 \rightarrow \text{N}_2\text{O}_5 + 3 \text{H}_2\text{O}$
- $2 \text{NaCN} + 5 \text{O}_2 \rightarrow \text{Na}_2\text{O} + 2 \text{CO}_2 + \text{N}_2\text{O}_5$
- $\text{CH}_3\text{SH} + 7/2 \text{O}_2 \rightarrow \text{CO}_2 + 2 \text{H}_2\text{O} + \text{SO}_3$
- $2 \text{AgCH}_3\text{CO}_2 + 4 \text{O}_2 \rightarrow \text{Ag}_2\text{O} + 4 \text{CO}_2 + 3 \text{H}_2\text{O}$

7) When a 10.0 gram sample of an unknown organic acid is subjected to combustion analysis, 21.2 grams of CO₂ and 3.25 grams of H₂O are produced. What is the empirical formula of the oxygen-containing compound?

$$\begin{array}{l} \frac{21.2 \text{ g CO}_2}{44 \text{ g/mol}} = 0.4818 \text{ mol CO}_2 \implies 0.4818 \text{ mol C} \quad 0.4818 \text{ mol C} \times 12 \text{ g/mol} = 5.7816 \text{ g C} \\ \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad 0.3610 \text{ mol H} \times 1 \text{ g/mol} = \underline{0.3610 \text{ g H}} \\ \quad 6.1426 \text{ g Total} \\ \frac{3.25 \text{ g H}_2\text{O}}{18 \text{ g/mol}} = 0.1805 \text{ mol H}_2\text{O} \implies 0.3610 \text{ mol H} \quad 10 \text{ g} - 6.1426 \text{ g} = 3.8574 \text{ g of oxygen} \\ \frac{3.8574 \text{ g O}}{16 \text{ g/mol}} = 0.244 \text{ mol O} \\ \frac{0.4818 \text{ mol C}}{0.2440 \text{ mol O}} = \frac{2 \text{ C}}{1 \text{ O}} \quad \quad \quad \frac{0.3610 \text{ mol H}}{0.2440 \text{ mol O}} = \frac{1.5 \text{ H}}{1 \text{ O}} \end{array}$$

The formula is C₂H_{1.5}O but you cannot have a fraction so, 2(C₂H_{1.5}O) = C₄H₃O₂

8) An 11.0 gram sample of a solid unknown was burned in oxygen producing 5.00 grams of water and 16.29 grams of carbon dioxide. What is the empirical formula of the oxygen-containing compound?

$$\begin{array}{l} \frac{16.29 \text{ g CO}_2}{44 \text{ g/mol}} = 0.3702 \text{ mol CO}_2 \implies 0.3702 \text{ mol C} \quad 0.3702 \text{ mol C} \times 12 \text{ g/mol} = 4.4424 \text{ g C} \\ \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad 0.5556 \text{ mol H} \times 1 \text{ g/mol} = \underline{0.5556 \text{ g H}} \\ \quad 4.998 \text{ g Total} \\ \frac{5.00 \text{ g H}_2\text{O}}{18 \text{ g/mol}} = 0.2777 \text{ mol H}_2\text{O} \implies 0.5556 \text{ mol H} \quad 11 \text{ g} - 4.998 \text{ g} = 6.002 \text{ g of oxygen} \\ \frac{6.002 \text{ g O}}{16 \text{ g/mol}} = 0.3751 \text{ mol O} \\ \frac{0.5556 \text{ mol H}}{0.3702 \text{ mol C}} = \frac{1.5 \text{ H}}{1 \text{ C}} \quad \quad \quad \frac{0.3751 \text{ mol O}}{0.3702 \text{ mol C}} = \frac{1 \text{ O}}{1 \text{ C}} \end{array}$$

The formula is CH_{1.5}O but you cannot have a fraction so, 2(CH_{1.5}O) = C₂H₃O₂

9) When a 15.0 gram sample of an acid is subjected to combustion analysis, 26.76 grams of carbon dioxide and 10.94 grams of water are formed. What is the empirical formula of the oxygen-containing compound?

$$\begin{array}{l} \frac{26.76 \text{ g CO}_2}{44 \text{ g/mol}} = 0.6082 \text{ mol CO}_2 \implies 0.6082 \text{ mol C} \\ 0.6082 \text{ mol C} \times 12 \text{ g/mol} = 7.2984 \text{ g C} \\ 1.2160 \text{ mol H} \times 1 \text{ g/mol} = \underline{1.2160 \text{ g H}} \\ \hline 8.5144 \text{ g Total} \end{array}$$

$$\begin{array}{l} \frac{10.94 \text{ g H}_2\text{O}}{18 \text{ g/mol}} = 0.6080 \text{ mol H}_2\text{O} \implies 1.2160 \text{ mol H} \\ 15 \text{ g} - 8.5144 \text{ g} = 6.4856 \text{ g of oxygen} \end{array}$$

$$\frac{6.4856 \text{ g O}}{16 \text{ g/mol}} = 0.4050 \text{ mol O}$$

$$\frac{0.6082 \text{ mol C}}{0.4050 \text{ mol O}} = \frac{1.5 \text{ C}}{1 \text{ O}} \qquad \frac{1.2160 \text{ mol H}}{0.4050 \text{ mol O}} = \frac{3 \text{ H}}{1 \text{ C}}$$

The formula is $C_{1.5}H_3O$ but you cannot have a fraction so, $2(C_{1.5}H_3O) = C_3H_6O_2$

10) A 15.25 gram sample of an organic acid was combusted in oxygen and produced 34.71 grams of carbon dioxide and 14.20 grams of water. What is the empirical formula of the oxygen-containing compound?

$$\begin{array}{l} \frac{34.71 \text{ g CO}_2}{44 \text{ g/mol}} = 0.7889 \text{ mol CO}_2 \implies 0.7889 \text{ mol C} \\ 0.7889 \text{ mol C} \times 12 \text{ g/mol} = 9.4668 \text{ g C} \\ 1.5778 \text{ mol H} \times 1 \text{ g/mol} = \underline{1.5778 \text{ g H}} \\ \hline 11.0446 \text{ g Total} \end{array}$$

$$\begin{array}{l} \frac{14.20 \text{ g H}_2\text{O}}{18 \text{ g/mol}} = 0.7889 \text{ mol H}_2\text{O} \implies 1.5778 \text{ mol H} \\ 15.25 \text{ g} - 11.0446 \text{ g} = 4.2054 \text{ g of oxygen} \end{array}$$

$$\frac{4.2054 \text{ g O}}{16 \text{ g/mol}} = 0.2628 \text{ mol O}$$

$$\frac{0.7889 \text{ mol C}}{0.2628 \text{ mol O}} = \frac{3 \text{ C}}{1 \text{ O}} \qquad \frac{1.5778 \text{ mol H}}{0.2628 \text{ mol O}} = \frac{6 \text{ H}}{1 \text{ C}}$$

The formula is C_3H_6O .