

Answers to Chapters 6 & 7 Study Questions

1. a) $3(12.0) + 8(1.01) + 3(16.0) = 92.1 \text{ g/mole}$ b) 92.1 g c) $6.02 \times 10^{23} \text{ molecules}$
 d) $0.217 \text{ moles} \times \frac{92.1 \text{ g}}{1 \text{ mole}} = 20.0 \text{ g}$ e) $783 \text{ g} \times \frac{1 \text{ mole}}{92.1 \text{ g}} = 8.50 \text{ moles}$
2. a) 4 atoms (one N + 3 H)
 b) $1 \text{ mole } \text{NH}_3 \times \frac{6.02 \times 10^{23} \text{ molecules}}{1 \text{ mole } \text{NH}_3} \times \frac{4 \text{ atoms}}{1 \text{ molecule}} = 2.41 \times 10^{24} \text{ atoms}$
 c) $3.40 \text{ g } \text{NH}_3 \times \frac{1 \text{ mole } \text{NH}_3}{17.0 \text{ g } \text{NH}_3} \times \frac{6.02 \times 10^{23} \text{ molecules}}{1 \text{ mole } \text{NH}_3} \times \frac{4 \text{ atoms}}{1 \text{ molecule}} = 4.82 \times 10^{23} \text{ atoms}$
3. Molar mass of $\text{NaNO}_2 = 23.0 + 14.0 + 2(16.0) = 69.0 \text{ g/mole}$
 $\% \text{ Na} = 23.0/69.0 = 33.3\% \text{ Na}$; $\% \text{ N} = 14.0/69.0 = 20.3\% \text{ N}$; $\% \text{ O} = 2(16.0)/69.0 = 46.4\% \text{ O}$
33.3% Na, 20.3% N and 46.4% O.
4. a) In 100 g of this compound, there are 40.7 g C, 5.1 g H, and 54.2 g O
 $40.7 \text{ g C} \times \frac{1 \text{ mole C}}{12.0 \text{ g C}} = 3.39 \text{ moles C}$ $3.39/3.39 = 1 \times 2 = 2$
 $5.1 \text{ g H} \times \frac{1 \text{ mole H}}{1.0 \text{ g H}} = 5.1 \text{ moles H}$ $5.1/3.39 = 1.5 \times 2 = 3$
 $54.2 \text{ g O} \times \frac{1 \text{ mole O}}{16.0 \text{ g O}} = 3.39 \text{ moles O}$ $3.39/3.39 = 1 \times 2 = 2$
 empirical formula = $\text{C}_2\text{H}_3\text{O}_2$
- b) Molar mass of $\text{C}_2\text{H}_3\text{O}_2 = 2(12.0) + 3(1.0) + 2(16.0) = 59.0 \text{ g/mole}$
 $118/59.0 = 2 \rightarrow \text{molecular formula} = \text{C}_4\text{H}_6\text{O}_4$
5. a) In 25.0 g of compound, there are 7.20 g Mg, 3.55 g C and $25.0 - (7.20 + 3.55) = 14.25 \text{ g O}$.
 $7.20 \text{ g Mg} \times \frac{1 \text{ mole Mg}}{24.3 \text{ g Mg}} = 0.296 \text{ moles Mg}$ $0.296/0.296 = 1$
 $3.55 \text{ g C} \times \frac{1 \text{ mole C}}{12.0 \text{ g C}} = 0.296 \text{ moles C}$ $0.296/0.296 = 1$
 $14.25 \text{ g O} \times \frac{1 \text{ mole O}}{16.0 \text{ g O}} = 0.891 \text{ moles O}$ $0.891/0.296 = 3$
 formula = MgCO_3
- b) $\% \text{ Mg} = 7.20/25.0 = 28.8\% \text{ Mg}$; $\% \text{ C} = 3.55/25.0 = 14.2\% \text{ C}$; $\% \text{ O} = 14.25/25.0 = 57.0\% \text{ O}$.
28.8% Mg, 14.2% C and 57.0% O.

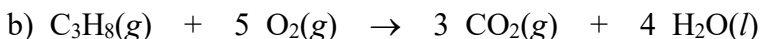
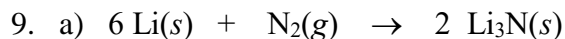
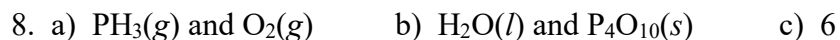
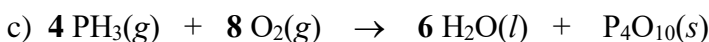
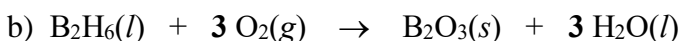
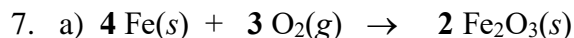
(You should get the same result if you used molar mass and atomic masses.)

$$\text{c) } 13.9 \text{ g cpd} \times \frac{28.8 \text{ g Mg}}{100 \text{ g compound}} = 4.00 \text{ g Mg}$$

$$\text{d) } 0.290 \text{ mol C} \times \frac{12.0 \text{ g C}}{1 \text{ mole C}} \times \frac{100 \text{ g compound}}{14.2 \text{ g C}} = 24.5 \text{ g compound}$$

6. Chemical reactions are frequently accompanied by:

- a) bubbles which show that a gas is one of the products of the reaction.
- b) heat changes; heat is evolved in exothermic reactions; heat is used up in endothermic reactions. Exothermic reactions also often result in the production of light and sound.
- c) color changes which often signify a change in chemical composition.
- d) the formation of a precipitate which represents the formation of an insoluble ionic compound from soluble ionic compounds.



10. mass of Zn = $33.64 \text{ g} - 32.00 \text{ g} = 1.64 \text{ g Zn}$

mass of O = $34.04 \text{ g} - 33.64 \text{ g} = 0.40 \text{ g O}$.

$$\# \text{ moles Zn: } 1.64 \text{ g Zn} \times \frac{1 \text{ mole Zn}}{65.4 \text{ g Zn}} = 0.0251 \text{ moles Zn} \quad 0.0251/0.025 = 1$$

$$\# \text{ moles O: } 0.40 \text{ g O} \times \frac{1 \text{ mole O}}{16.0 \text{ g O}} = 0.025 \text{ moles O} \quad 0.025/0.025 = 1$$

