

Stoichiometry

Section 11.1 Defining Stoichiometry

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Practice Problems

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1. Interpret the following balanced chemical equations in terms of particles, moles, and mass. Show that the law of conservation of mass is observed.



1 molecule N_2 + 3 molecules H_2

H_2 \rightarrow 2 molecules NH_3

1 mole N_2 + 3 moles H_2 \rightarrow 2 moles NH_3

Mass:

$$\text{N}_2: (2 \text{ mol})(14.007 \text{ g/mol}) = 28.014 \text{ g}$$

$$3\text{H}_2: (6 \text{ mol})(1.008 \text{ g/mol}) = 6.048 \text{ g}$$

$$2\text{NH}_3: (2 \text{ mol})(14.007 \text{ g/mol}) +$$

$$(6 \text{ mol})(1.008 \text{ g/mol}) = 34.062 \text{ g}$$

$$28.014 \text{ g } \text{N}_2 + 6.048 \text{ g } \text{H}_2 \rightarrow 34.062 \text{ g } \text{NH}_3$$

34.062 g reactants = 34.062 g products



1 molecule HCl + 1 formula unit KOH \rightarrow

1 formula unit KCl + 1 molecule H_2O

1 mole HCl + 1 mole KOH \rightarrow

1 mole KCl + 1 mole H_2O

Mass:

$$\text{HCl: } (1 \text{ mol})(36.461 \text{ g/mol}) + (1 \text{ mol})(35.453 \text{ g/mol}) = 36.461 \text{ g}$$

$$\text{KOH: } (1 \text{ mol})(39.098 \text{ g/mol}) + (1 \text{ mol})(15.999 \text{ g/mol}) + (1 \text{ mol})(1.008 \text{ g/mol}) = 56.105 \text{ g}$$

$$\text{KCl: } (1 \text{ mol})(39.098 \text{ g/mol}) + (1 \text{ mol})(35.453 \text{ g/mol}) = 74.551 \text{ g}$$

$$\text{H}_2\text{O: } (2 \text{ mol})(1.008 \text{ g/mol}) + (1 \text{ mol})(15.999 \text{ g/mol}) = 18.015 \text{ g}$$

$$36.461 \text{ g } \text{HCl} + 56.105 \text{ g } \text{KOH} \rightarrow 74.551 \text{ g } \text{KCl} + 18.015 \text{ g } \text{H}_2\text{O}$$

92.566 g reactants = 92.566 g products



2 atoms Mg + 1 molecule O_2

$\text{O}_2 \rightarrow$ 2 formula units MgO

2 moles Mg + 1 mole $\text{O}_2 \rightarrow$ 2 moles MgO

Mass:

$$2\text{Mg: } (2 \text{ mol})(24.305 \text{ g/mol}) = 48.610 \text{ g}$$

$$\text{O}_2: (2 \text{ mol})(15.999 \text{ g/mol}) = 31.998 \text{ g}$$

$$2\text{MgO: } (2 \text{ mol})(24.305 \text{ g/mol}) +$$

$$(2 \text{ mol})(15.999 \text{ g/mol}) = 80.608 \text{ g}$$

$$48.610 \text{ g } \text{Mg} + 31.998 \text{ g } \text{O}_2 \rightarrow 80.608 \text{ g } \text{MgO}$$

80.608 g reactants = 80.608 g products

2. **Challenge:** For each of the following, balance the chemical equation; interpret the equation in terms of particles, moles, and mass; and show that the law of conservation of mass is observed.



2 atoms Na + 2 molecules $\text{H}_2\text{O} \rightarrow$

2 formula units NaOH + 1 molecule H_2

2 mol Na + 2 mol $\text{H}_2\text{O} \rightarrow$

2 mol NaOH + 1 mol H_2

Mass:

$$2\text{Na: } (2 \text{ mol})(22.990 \text{ g/mol}) = 45.980 \text{ g}$$

$$2\text{H}_2\text{O: } (4 \text{ mol})(1.008 \text{ g/mol}) + (2 \text{ mol})(15.999 \text{ g/mol}) = 36.030 \text{ g}$$

$$2\text{NaOH: } (2 \text{ mol})(22.990 \text{ g/mol}) + (2 \text{ mol})(15.999 \text{ g/mol}) + (2 \text{ mol})(1.008 \text{ g/mol}) = 79.994 \text{ g}$$

$$\text{H}_2: (2 \text{ mol})(1.008 \text{ g/mol}) = 2.016 \text{ g}$$

$$45.980 \text{ g } \text{Na} + 36.030 \text{ g } \text{H}_2\text{O} \rightarrow$$

$$79.994 \text{ g } \text{NaOH} + 2.016 \text{ g } \text{H}_2$$

82.01 g reactants = 82.01 g products

Solutions Manual Chemistry Matter And Change

Stoichiometry

Deborah Wiegand

Solutions Manual Chemistry Matter And Change Stoichiometry:

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