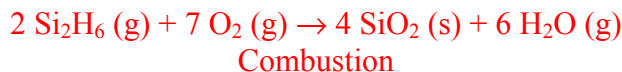


WKS
Comprehensive Stoichiometry

NAME Answer Key
Period _____ Date _____

- 1) When gaseous disilane (disilicon hexahydride) reacts with oxygen gas, solid silicon dioxide and water vapor are produced.
- a) Write and balance the equation with the lowest whole number coefficients. What kind of reaction is it?



- b) How many moles of oxygen would be used to completely react with 12.5 moles of disilane?

$$? \text{ mol O}_2 = 12.5 \cancel{\text{ mol Si}_2\text{H}_6} \times \frac{7 \text{ mol O}_2}{2 \cancel{\text{ mol Si}_2\text{H}_6}} = \boxed{43.8 \text{ mol O}_2}$$

- c) How many grams of disilane would be needed to react with sufficient oxygen to produce 50.0 g of silicon dioxide?

$$? \text{ g Si}_2\text{H}_6 = 50.0 \cancel{\text{ g SiO}_2} \times \frac{1 \cancel{\text{ mol SiO}_2}}{60.09 \cancel{\text{ g SiO}_2}} \times \frac{2 \cancel{\text{ mol Si}_2\text{H}_6}}{4 \cancel{\text{ mol SiO}_2}} \times \frac{62.22 \text{ g Si}_2\text{H}_6}{1 \cancel{\text{ mol Si}_2\text{H}_6}} = \boxed{25.9 \text{ g Si}_2\text{H}_6}$$

0.832 mol SiO₂ 0.416 mol Si₂H₆

- d) When 75.0 g disilane reacts with 100. g oxygen, which reactant is limiting?

$$75.0 \cancel{\text{ g Si}_2\text{H}_6} \times \frac{1 \text{ mol Si}_2\text{H}_6}{62.22 \cancel{\text{ g Si}_2\text{H}_6}} = 1.21 \text{ mol Si}_2\text{H}_6; 100. \cancel{\text{ g O}_2} \times \frac{1 \text{ mol O}_2}{32.00 \cancel{\text{ mol O}_2}} = 3.13 \text{ mol O}_2$$

$$\text{mol eq. Si}_2\text{H}_6 = \frac{1.21 \text{ mol Si}_2\text{H}_6}{2 \text{ mol Si}_2\text{H}_6} = 0.605; \text{ mol eq. O}_2 = \frac{3.13 \text{ mol O}_2}{7 \text{ mol O}_2} = 0.447$$

$$0.605 > 0.447, \text{ so } \boxed{\text{O}_2 \text{ is limiting.}}$$

- e) How many grams of the excess reactant are used after the reaction is complete?

$$? \text{ g Si}_2\text{H}_6 \text{ used} = 3.13 \cancel{\text{ mol O}_2} \times \frac{2 \cancel{\text{ mol Si}_2\text{H}_6}}{7 \cancel{\text{ mol O}_2}} \times \frac{62.23 \text{ g Si}_2\text{H}_6}{1 \cancel{\text{ mol Si}_2\text{H}_6}} = \boxed{55.6 \text{ g Si}_2\text{H}_6 \text{ used}}$$

0.893 mol Si₂H₆

- f) How many grams of the excess reactant remain after the reaction is complete?

$$? \text{ g Si}_2\text{H}_6 \text{ remaining} = 75.0 \text{ g Si}_2\text{H}_6 \text{ present} - 55.6 \text{ g Si}_2\text{H}_6 \text{ used} = \boxed{19.4 \text{ g Si}_2\text{H}_6 \text{ remaining}}$$

- g) What is the theoretical yield of silicon dioxide from these reactants?

$$? \text{ g SiO}_2 = 3.13 \cancel{\text{ mol O}_2} \times \frac{4 \cancel{\text{ mol SiO}_2}}{7 \cancel{\text{ mol O}_2}} \times \frac{60.09 \text{ g SiO}_2}{1 \cancel{\text{ mol SiO}_2}} = \boxed{107 \text{ g SiO}_2}$$

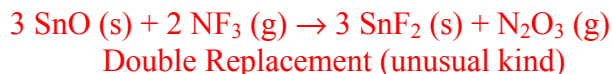
1.79 mol SiO₂

- h) After the reaction, you find that you have collected 97.8 g silicon dioxide. What is the percent yield?

$$\% \text{ Yield} = \frac{97.8 \text{ g SiO}_2}{107 \text{ g SiO}_2} \times 100\% = \boxed{91.4\%}$$

2) When solid tin(II) oxide reacts with nitrogen trifluoride gas, solid tin(II) fluoride and gaseous dinitrogen trioxide are produced.

a) Write and balance the equation with the lowest whole number coefficients. What kind of reaction is it?



b) How many moles of tin(II) oxide would be needed to form 29.4 moles of tin(II) fluoride?

$$? \text{ mol NF}_3 = 29.4 \text{ mol SnF}_2 \times \frac{3 \text{ mol SnO}}{3 \text{ mol SnF}_2} = \boxed{29.4 \text{ mol SnO}}$$

c) How many grams of tin(II) oxide would be needed to completely react with 128 g of nitrogen trifluoride?

$$? \text{ g SnO} = 128 \text{ g NF}_3 \times \frac{1 \text{ mol NF}_3}{71.01 \text{ g NF}_3} \times \frac{3 \text{ mol SnO}}{2 \text{ mol NF}_3} \times \frac{134.7 \text{ g SnO}}{1 \text{ mol SnO}} = \boxed{364 \text{ g SnO}}$$

1.80 mol NF₃ 2.70 mol SnO

d) When 158.9 g tin(II) oxide reacts with 62.5 g nitrogen trifluoride, which reactant is limiting?

$$158.9 \text{ g SnO} \times \frac{1 \text{ mol SnO}}{134.7 \text{ g SnO}} = 1.180 \text{ mol SnO}; 62.5 \text{ g NF}_3 \times \frac{1 \text{ mol NF}_3}{71.01 \text{ g NF}_3} = 0.880 \text{ mol NF}_3$$

$$\text{mol eq. SnO} = \frac{1.180 \text{ mol SnO}}{3 \text{ mol SnO}} = 0.3933; \text{ mol eq. NF}_3 = \frac{0.880 \text{ mol NF}_3}{2 \text{ mol NF}_3} = 0.440$$

$$0.3933 < 0.440 \text{ so } \boxed{\text{SnO is limiting}}$$

e) How many grams of the excess reactant are used after the reaction is complete?

$$? \text{ g NF}_3 \text{ used} = 1.180 \text{ mol SnO} \times \frac{2 \text{ mol NF}_3}{3 \text{ mol SnO}} \times \frac{71.01 \text{ g NF}_3}{1 \text{ mol NF}_3} = \boxed{55.86 \text{ g NF}_3 \text{ used}}$$

0.7867 mol NF₃

f) How many grams of the excess reactant remain after the reaction is complete?

$$? \text{ g NF}_3 \text{ remaining} = 62.5 \text{ g NF}_3 \text{ present} - 55.86 \text{ g NF}_3 \text{ used} = \boxed{6.6 \text{ g NF}_3 \text{ remaining}}$$

g) What is the theoretical yield of dinitrogen trioxide from these reactants?

$$? \text{ g N}_2\text{O}_3 = 1.180 \text{ mol SnO} \times \frac{1 \text{ mol N}_2\text{O}_3}{3 \text{ mol SnO}} \times \frac{76.02 \text{ g N}_2\text{O}_3}{1 \text{ mol N}_2\text{O}_3} = \boxed{29.90 \text{ g N}_2\text{O}_3}$$

0.3933 mol N₂O₃

h) After the reaction, you isolate 24.8 g dinitrogen trioxide. What is the percent yield?

$$\% \text{ Yield} = \frac{24.8 \text{ g N}_2\text{O}_3}{29.90 \text{ g N}_2\text{O}_3} \times 100\% = \boxed{82.9\%}$$