

# Stoichiometry Exercises:

name: SOLUTIONS

1)

The reaction caused by the burning of butane in air is represented by the following equation:



During a laboratory experiment you reacted 29 g of butane ( $\text{C}_4\text{H}_{10}$ ) in the presence of oxygen. What mass of oxygen was needed for this reaction?

$$n = \frac{m}{M}$$

2 moles  
 $m = n \cdot M$   
 $m = 2(58)$   
 $m = 116\text{g}$

13 moles  
 $m = n \cdot M$   
 $m = 13(32)$   
 $m = 416\text{g}$

$$\frac{116x}{116} = \frac{416(29)}{116}$$

$$x = 104\text{g of O}_2$$

29g

x

2)

What mass of carbon dioxide is needed in the neutralization of 100 g of nitric acid given the equation:



2 moles  
 $m = n \cdot M$   
 $m = 2(63)$   
 $m = 126\text{g}$

1 mole  
 $m = n \cdot M$   
 $m = 1(44)$   
 $m = 44\text{g}$

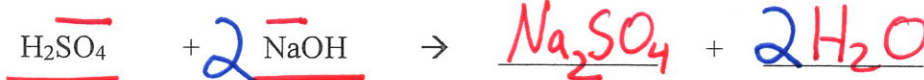
100g

x

$$x = 34.9\text{g CO}_2$$

3)

Calculate the mass of sodium hydroxide that neutralizes 14.7 g of sulfuric acid. The equation of this reaction is: *Hint: Begin by completing and balancing the chemical equation!*



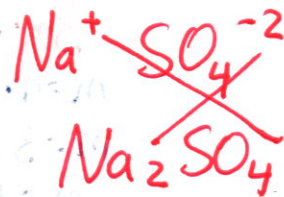
1 mole  
 $m = n \cdot M$   
 $m = 1(98)$   
 $m = 98\text{g}$

2 moles  
 $m = n \cdot M$   
 $m = 2(40)$   
 $m = 80\text{g}$

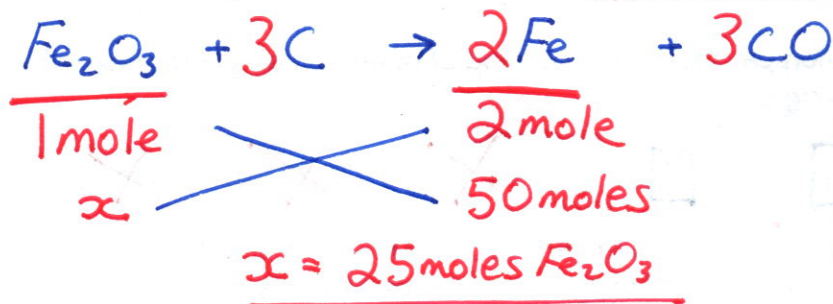
14.7g

x

$$x = 12\text{g}$$



- 4) Iron, Fe, and carbon monoxide, CO, are produced when iron oxide  $\text{Fe}_2\text{O}_3$ , reacts with carbon, C. You would like to produce 50 moles of iron. What mass of iron oxide is required?



$$\begin{aligned} n &= \frac{m}{M} \\ m &= n \cdot M \\ m &= 25(160) \\ m &= 4000\text{g} \end{aligned}$$

- 5) Octane,  $\text{C}_8\text{H}_{18}$ , is one of the main components of gasoline. When a car engine is running, octane burns by reacting with oxygen gas,  $\text{O}_2$ , in the air. Carbon dioxide,  $\text{CO}_2$ , and water vapour,  $\text{H}_2\text{O}$ , are produced during this combustion reaction. The balanced equation for this reaction is;



$$n = \frac{m}{M}$$

The car engine ran for a certain period of time and 57 g of octane were burned. What mass of carbon dioxide was released into the atmosphere?

$$\begin{array}{ll} \text{2 mole} & \text{16 moles} \\ m = n \cdot M & m = n \cdot M \\ m = 2(114) & m = 16(44) \\ m = 228\text{g} & m = 704\text{g} \end{array}$$

$$x = 176\text{g of CO}_2$$

57g

- 6) One of the substances responsible for acid rain is nitrogen dioxide ( $\text{NO}_2$ ). In the atmosphere, nitrogen dioxide reacts with water vapour in the air to produce nitric acid,  $\text{HNO}_3$ , according to the following balanced equation:



If 1000 g of  $\text{NO}_2$  reacts in the atmosphere during a certain period of time, what mass of nitric acid is produced?

$$\begin{array}{ll} \text{3 moles} & \text{2 moles} \\ m = n \cdot M & m = n \cdot M \\ m = 3(46) & m = 2(63) \\ m = 138\text{g} & m = 126\text{g} \end{array}$$

$$x = 913\text{g HNO}_3$$

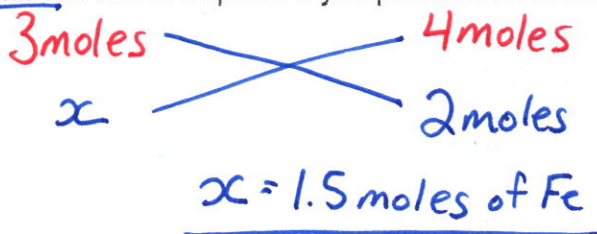
1000g

7)

In industry, water vapour is decomposed by passing the water vapour over hot iron.



The iron reacts with the water to form an oxide of iron,  $\text{Fe}_3\text{O}_4$ , and hydrogen gas,  $\text{H}_2$ . What mass of iron is required if you produced 2 moles of hydrogen?



$$n = \frac{m}{M}$$

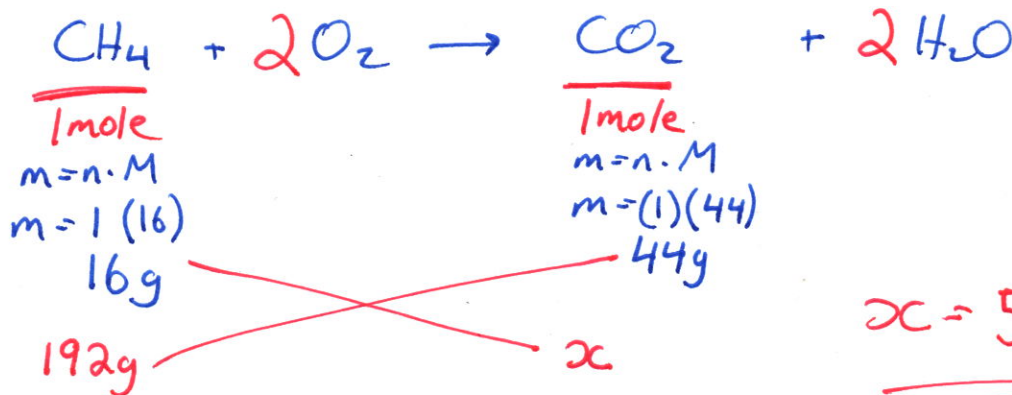
$$m = n \cdot M$$

$$m = 1.5(55.8)$$

$$m = 84 \text{ g of Fe}$$

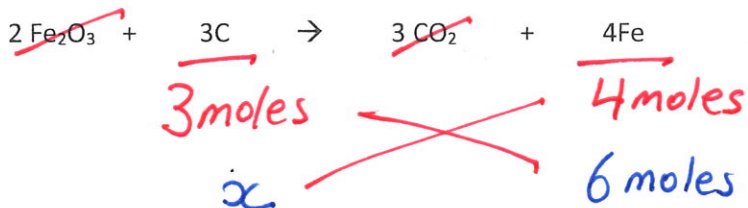
8)

By burning methane,  $\text{CH}_4$ , in air containing oxygen gas,  $\text{O}_2$ , you produce carbon dioxide,  $\text{CO}_2$ , and water vapour,  $\text{H}_2\text{O}$ . You are to burn 192 g of methane. What mass of carbon dioxide gas will be produced?



9)

How many grams of carbon would be needed to produce 6 moles of Iron?



$$\underline{x = 4.5 \text{ moles of C}}$$

$$n = \frac{m}{M}$$

$$m = n \cdot M$$

$$m = 4.5(12)$$

$$m = 54 \text{ g of C}$$