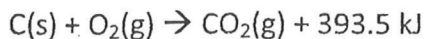


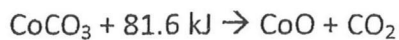
Thermal Stoichiometry

Heat gained or released during a chemical reaction (heat of reaction) can be expressed in a chemical equation.

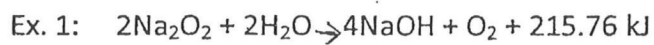
Heat released: exothermic



Heat gained: endothermic



The amount of heat gained or lost depends on the amount of reactants used.



How much heat is released by the reaction of 5.0 moles of Na_2O_2 ?

$$5.0 \text{ moles } \cancel{\text{Na}_2\text{O}_2} \times \frac{215.76 \text{ kJ}}{2 \text{ mole } \cancel{\text{Na}_2\text{O}_2}} = 539.4 \text{ kJ}$$

Ex. 2: The decomposition of potassium chlorate is an endothermic reaction.



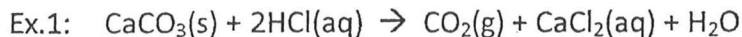
How much heat is absorbed to decompose 1.50 grams of solid KClO_3 ?

$$1.50 \text{ g } \cancel{\text{KClO}_3} \times \frac{1 \text{ mole } \cancel{\text{KClO}_3} \times 89.5 \text{ kJ}}{122.5 \text{ g } \cancel{\text{KClO}_3} \quad 2 \text{ mole } \cancel{\text{KClO}_3}} = .548 \text{ kJ}$$

Gas Stoichiometry

1 mole of any gas at STP takes up 22.4L volume.

S.T.P.= Standard Temperature (0°C or 273K) and Pressure (1 atm or 101.3kPa)



What is the volume of 2.0 moles of CO_2 at STP?

$$2.0 \text{ mole CO}_2 \times \frac{22.4\text{L}}{1 \text{ mole CO}_2} = 44.8\text{L}$$

What volume of CO_2 , at STP, will be formed from 1.0 mole HCl?

$$1.0 \text{ mole HCl} \times \frac{1 \text{ mole CO}_2}{2 \text{ mole HCl}} \times \frac{22.4\text{L}}{1 \text{ mole CO}_2} = 11.2 \text{ L}$$

Ex.2: What volume of CO_2 , measured at STP, will be produced when 80.0g of CaCO_3 reacts?

$$80.0\text{g CaCO}_3 \times \frac{1 \text{ mole CaCO}_3}{100.1 \text{ g CaCO}_3} \times \frac{1 \text{ mole CO}_2}{1 \text{ mole CaCO}_3} \times \frac{22.4\text{L}}{1 \text{ mole CO}_2} = 17.9\text{L}$$

Ex. 3: How many molecules would be in 7.0L of O_2 gas at STP?

$$7.0\text{L O}_2 \times \frac{1 \text{ mole O}_2}{22.4 \text{ L}} \times \frac{6.02 \times 10^{23} \text{ molecules}}{1 \text{ mole O}_2} = 1.88 \times 10^{23} \text{ molecules}$$

Name _____

Date _____

Thermal Stoichiometry

Use the following balanced equation to answer the questions below.



1. If 3.00 moles of C_2H_6 react completely with oxygen, how many kilojoules of energy will form?
2. If 5.50 moles of CO_2 form, how many kilojoules of energy will form?
3. If 15.0g of C_2H_6 react totally with oxygen, how many joules of energy will be liberated?
4. If 15.0g of C_2H_6 is combined with 64.0g of oxygen present, how many kilojoules of energy will be formed?
5. Is this an exothermic or endothermic reaction?

Gas Stoichiometry

At STP (0°C or 273K, and 1 atm pressure) one mole of any gas occupies 22.4L.

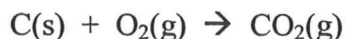
This is another conversion factor: 1 mole gas = 22.4L (@ STP)

1. At STP, what is the volume of 2.5 mole O₂?

2. What is the volume of 2.5g of O₂ at STP?

3. What is the volume of 56.0g of nitrogen gas at STP?

4. In the reaction:



How many grams of carbon are required to react completely with 44.8L of oxygen at STP?

5. In the reaction:



What volume of hydrogen can be produced at STP from 4.0 moles of HCl?

6. What is the volume of 3.01×10^{23} molecules of NO₂ gas at STP?