$1 cm^3 = 1 mL$ $1 dm^3 = 1 L$

Worksheet: Law of Combining Volumes

Q1

1:3 ratio

How many liters of ammonia gas is generated with 1 L of nitrogen gas reacts with 3 L of hydrogen gas via the following reaction (assuming no changing pressure and temperature):

$N2(g)+3H2(g)\rightarrow 2NH3(g)$ $N_2 + 3H_2 \rightarrow 2NH_3$

$1 L N_2 \times \frac{2 L NH_3}{1 L N_2} = 2 L NH_3$ no excess Rs

Q2

How many liters of water vapor is generated after 2 L of hydrogen gas react with 1 L of oxygen gas (assuming no changing pressure and temperature)?

$2H2(g)+O2(g)\rightarrow 2H2O(g)$ $2L H_2 \times \frac{2 L H_2O}{2 L H_2} = 2 L H_2$

$2H_2 + O_2 \rightarrow 2H_2O$ no excess Rs

Q3

$50 m^3 \times \frac{10 dm}{1 m} \times \frac{10 dm}{1 m} \times \frac{10 dm}{1 m} =$

What is the theoretical volume of air required to completely burning 50 cubic meters of acetylene gas (C2H2) if the air contains 21% of oxygen (assuming no changing pressure and temperature)? $C_2H_2 + 2O_2 \rightarrow 2CO_2 + H_2O$

$50\,000 dm^3 = 50\,000 L$

$50 m^3 C_2H_2 \times \frac{2 m^3 O_2}{1 m^3 C_2H_2} \times \frac{100 m^3 air}{21 m^3 O_2} = 476 m^3 air$

Q4

In a combustion chamber containing 5 L of carbon monoxide and 2.5 L of oxygen is ignited at 298 K and 1 atmosphere pressure. Assuming complete combustion and no loss of gas, what will be the volume of carbon dioxide formed at 298 K and 1 atmosphere pressure?

$2CO + O_2 \rightarrow 2CO_2$

$5 L CO \times \frac{2 L CO_2}{2 L CO} = 5 L CO_2$ $2.5 L O_2 \times \frac{2 L CO_2}{1 L O_2} = 5 L CO_2$

Q5

Consider the combustion reaction of hydrogen (assuming no changing pressure and temperature)::

$2H2(g)+O2(g)\rightarrow 2H2O(g)$ $2H_2 + O_2 \rightarrow 2H_2O$

1. What volume of steam is formed from 50 cm3 of hydrogen and 50 cm3 of oxygen mixed together? O_2 by $25 cm^3 O_2$
2. What gas(s) is in excess and by how much?

$50 cm^3 H_2 \times \frac{2 cm^3 H_2O}{2 cm^3 H_2} = 50 cm^3 H_2O$

$50 cm^3 O_2 \times \frac{2 cm^3 H_2O}{1 cm^3 O_2} = 100 cm^3 H_2O$

$C_3H_6 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

Q6

What volume of propane C3H6(g) reacts with 100cm3 of oxygen used in the complete combustion reaction, assuming no changing pressure and temperature: (hint: construct the balanced combustion reaction).

C3H6(g)+5O+2→3CO2+4H−2O

$100cm^3O_2 \times \frac{1cm^3C_3H_6}{5cm^3O_2} = 20cm^3C_3H_6$

Q7

Liquid water can be decomposed into hydrogen and oxygen under suitable conditions (e.g., electrolysis) via the balanced reaction:

2H2O(l)→2H2(g)+O2(g) $2H_2O \rightarrow 2H_2 + O_2$

If an experiment generates 2500 cm3 of H2 gas, what volume of O2 is generated under the same conditions of temperature and pressure?

$2500cm^3H_2 \times \frac{1cm^3O_2}{2cm^3H_2} = 1250cm^3O_2$