PERCENTAGE PURITY AND PERCENTAGE YIELD

At r.t.p., one mole of a gas occupies 24dm^3. This is called as the molar gas volume.

Examples: **[M/J/2010-P32-Q8c]**

(c) A 5.00 g sample of impure lead(II) nitrate was heated. The volume of oxygen formed was 0.16 dm^3 measured at r.t.p. The impurities did not decompose.
Calculate the percentage of lead(II) nitrate in the sample.

$$2Pb(NO_3)_2 \rightarrow 2PbO + 4NO_2 + O_2$$

Number of moles of O_2 formed = ...

Number of moles of $Pb(NO_3)_2$ in the sample = ...

Mass of one mole of $Pb(NO_3)_2$ = 331 g

Mass of lead(II) nitrate in the sample = ... g

Percentage of lead(II) nitrate in sample = ... [4]

Solution:

Note: The statement that the impurities did not decompose indicates that the 5.00g sample was not entirely made of lead (II) nitrate and that it contained impurities.

Number of moles of O_2 formed:

At r.t.p.;1 mole occupies 24dm^3

x moles occupy 0.16dm^3

24x =0.16

x=0.16÷24 =0.0067= Number of moles of O_2 formed:

Ideal mole ratio $Pb(NO_3)_2$: O_2

2 : 1

Experimental mole ratio 0.0067x2=0.0134 : 0.0067

Mass of lead (II) nitrate in the sample=

moles of lead (II) nitrate x M_r of lead (II) nitrate

=0.0134 x 331 =3.972= 4.4g

Percentage of lead (II) nitrate in the sample= [4.4 ÷5] x 100 =88%

Note: This question could have also been asked as "Calculate the percentage purity of Lead nitrate sample". % of lead (II) nitrate in other means % of pure lead (II) nitrate which in turns means % purity.

Percentage purity=

{[Mass of pure product] ÷ [Mass of impure product]} x 100

=4.4/5 =88%

Percentage yield (yield means product)

Unit: grams/kilograms

Percentage yield tells us how much percent product was formed.

% Yield = Actual yield ÷ Predicted yield.

Note: Actual yield is the yield (Product) we get through our experiment and Predicted yield is the yield(product) that we get via calculations.

Example **[O/N/2012-P31-Q7c]**

(b) Strontium chloride-6-water can be made from the insoluble compound, strontium carbonate, by the following reactions.

$SrCO_3(s) + 2HCl(aq) \rightarrow SrCl_2(aq) + CO_2(g) + H_2O(l)$

$SrCl_2(aq) + 6H_2O(l) \rightarrow SrCl_2.6H_2O(s)$

(c) In the above experiment, 50.0 cm^3 of hydrochloric acid of concentration 2.0 mol/dm^3 was used. 6.4 g of $SrCl_2.6H_2O$ was made.
Calculate the percentage yield.

number of moles of HCl used = ...

number of moles of $SrCl_2.6H_2O$ which could be formed = ...

mass of one mole of $SrCl_2.6H_2O$ is 267 g

theoretical yield of $SrCl_2.6H_2O$ = ...g

percentage yield = ...% [4]

Solution:

No. of moles of HCl formed=conc of HCl x Vol of HCl = 2 x 0.050 = 0.1

Ideal mole ratio is HCl : $SrCl_2.6H_2O$

2 : 1

Experimental mole ratio 0.1 : (half of HCl moles) =0.05

Hence: No. of moles of $SrCl_2.6H_2O$ that could be formed = 0.05

Theoretical yield(calculated mass) of $SrCl_2.6H_2O$

=Moles x M_r= 0.05 x 267=13.35g

Percentage yield= Actual yield ÷ Predicted yield

=(6.4 ÷13.35) x 100=47.94% =47.9%
