MOLAR GAS VOLUME

7.   Molar gas volume and Percentage purity

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.

$$2Pb(NO_3)_2 \rightarrow 2PbO + 4NO_2 + O_2$$
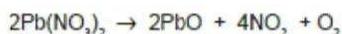
Number of moles of O_2 formed = ...

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 O₂ 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 O₂ formed:

Ideal mole ratio   Pb(NO₃)₂ :   O₂

                                                    2   :   1
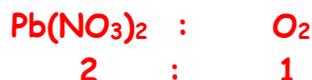
Experimental mole ratio   0.0067x2=0.0134   :   0.0067

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%