

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 0.16dm^3 measured at r.t.p. The impurities did not decompose. Calculate the percentage of lead(II) nitrate in the sample.



Number of moles of O_2 formed =

Number of moles of $\text{Pb}(\text{NO}_3)_2$ in the sample =

Mass of one mole of $\text{Pb}(\text{NO}_3)_2 = 331\text{g}$

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:

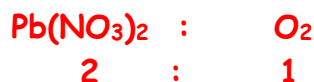
At r.t.p.; 1 mole occupies 24dm^3

x moles occupy 0.16dm^3

$$24x = 0.16$$

$$x = 0.16 \div 24 = 0.0067 = \text{Number of moles of } \text{O}_2 \text{ formed:}$$

Ideal mole ratio



Experimental mole ratio

$$0.0067 \times 2 = 0.0134 : 0.0067$$

Mass of lead (II) nitrate in the sample =

$$\begin{aligned} &\text{moles of lead (II) nitrate} \times M_r \text{ of lead (II) nitrate} \\ &= 0.0134 \times 331 = 3.972 = 4.4\text{g} \end{aligned}$$

Percentage of lead (II) nitrate in the sample = $[4.4 \div 5] \times 100 = 88\%$

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 =

$$\begin{aligned} &\{[\text{Mass of pure product}] \div [\text{Mass of impure product}]\} \times 100 \\ &= 4.4/5 = 88\% \end{aligned}$$