

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 0.16dm^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:

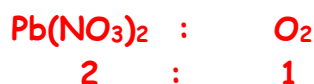
At r.t.p.; 1 mole occupies 24dm^3

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 =

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

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

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 =

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

Percentage yield (yield means product)

Unit: grams/kilograms

Percentage yield tells us how much percent product was formed.

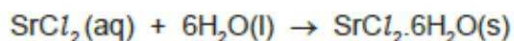
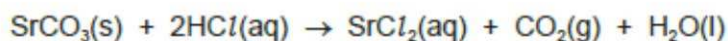
% Yield = Actual yield ÷ Predicted yield.

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.



- (c) In the above experiment, 50.0 cm³ of hydrochloric acid of concentration 2.0 mol/dm³ was used. 6.4 g of SrCl₂·6H₂O was made. Calculate the percentage yield.

number of moles of HCl used =

number of moles of SrCl₂·6H₂O which could be formed =

mass of one mole of SrCl₂·6H₂O is 267 g

theoretical yield of SrCl₂·6H₂O =g

percentage yield =%

[4]

Solution:

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

Ideal mole ratio is

HCl	:	SrCl ₂ ·6H ₂ O
2	:	1

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

Hence: No. of moles of SrCl₂·6H₂O that could be formed = 0.05

Theoretical yield(calculated mass) of SrCl₂·6H₂O

$$= \text{Moles} \times M_r = 0.05 \times 267 = 13.35\text{g}$$

Percentage yield = Actual yield ÷ Predicted yield

$$= (6.4 \div 13.35) \times 100 = 47.94\% = 47.9\%$$
