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NEET FASTRACK 2024

Lecture No. - 02

Chemistry

Some Basic Concept of Chemistry

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TODAYS TARGETS

1. Units and Measurements
2. Scientific Notation
3. Significant Figures
4. Dalton's Atomic Theory

Revision

- Formula of Compound ⇒ Rules → Use → in the Cal. of moles
- Matter and its Classification
  - Elements
    - atoms
  - Compounds
    - molecules

Question

Write the formula of following compounds:

1. Sodium Oxalate → $Na_2C_2O_4$
2. Potassium Bicarbonate ⇒ $KHCO_3$
3. Zinc Sulphite → $ZnSO_3$
4. Ferric Sulphate ⇒ $Fe_2(SO_4)_3$
5. Magnesium Hypophosphite ⇒ $Mg(H_2PO_2)_2$
6. Copper (II) Perchlorate ⇒ $Cu(ClO_4)_2$
7. Stannic Oxide ⇒ SnO_2
8. Calcium Phosphate ⇒ $Ca_3(PO_4)_2$
9. Strontium Chromate ⇒ $SrCrO_4$
10. Ammonium Peroxide

$Sr^{2+}\ CrO_4^{2-}$

$NH_4^+ \times O_2^{2-} \rightarrow (NH_4)_2O_2$

⇒ $Na^{+1}\ C_2O_4^{2-}$

⇒ $K^{+1}\ HCO_3^{-1}$

⇒ $Zn^{2+}\ SO_3^{2-}$

⇒ $Fe^{3+}\ SO_4^{2-}$

⇒ $Mg^{2+}\ H_2PO_2^{-1}$

⇒ $Cu^{2+}\ ClO_4^{-1}$

H_3PO_2

$-H^+$

$H_2PO_2^-$

Hypophosphite

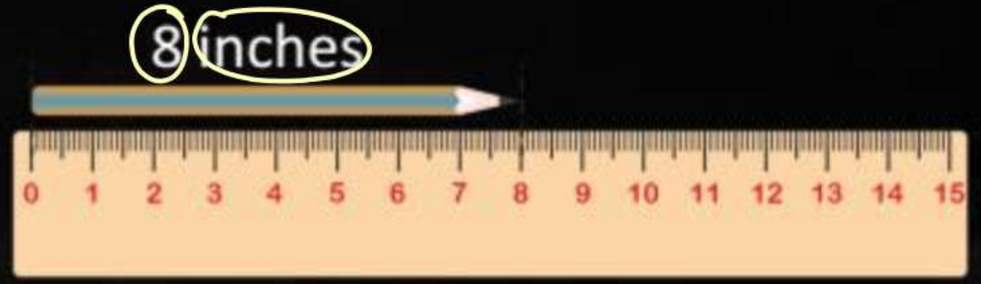
$Sn^{4+}\ O^{2-}$

$Ca^{2+}\ PO_4^{3-}$

Measurement

Any quantitative observation represented by a number followed by a unit in which it is measured is called measurement.

2 Kilogram



S.I Units

Fundamental Quantities	SI unit	Symbol
Length	Meter	m
Mass	Kilogram	kg
Time	Second	s
Electric current	Ampere	A
Amount of substance	mole	mol
Luminous intensity	Candela	cd
Temperature	Kelvin	K

Subsidiary Units

→ large Quantity

→ very small Quantity

Units

Expression of very large/small amount of substance can be expressed in terms of Base units

Table 1.3 Prefixes used in the SI System

Multiple	Prefix	Symbol
10^{-24}	yocto	y
10^{-21}	zepto	z
10^{-18}	atto	a
10^{-15}	femto	f
10^{-12}	pico	p
10^{-9}	nano	n
10^{-6}	micro	μ
10^{-3}	milli	m
10^{-2}	centi	c
10^{-1}	deci	d
10	deca	da
10^{2}	hecto	h
10^{3}	kilo	k
10^{6}	mega	M
10^{9}	giga	G
10^{12}	tera	T
10^{15}	peta	P
10^{18}	exa	E
10^{21}	zeta	Z
10^{24}	yotta	Y

$1\mu m = 10^{-6}$ (m)

$1 nm = 10^{-9} m$

$1 pm = 10^{-12}$ (m)

pm → S.U

B.U

$1 km \Rightarrow 10^{3}$ (m)

$1 Mm \rightarrow 10^{6}$ (m)

Question

1.15 Match the following prefixes with their multiples:

	Prefixes	Multiples
(i)	micro	10^{6}
(ii)	deca	10^{9}
(iii)	mega	10^{-6}
(iv)	giga	10^{-15}
(v)	femto	10

Derived Units

→ (Quantities derived from fundamental quantities)

Quantity	Symbol	Base SI units	Derived unit
Area	A	m × m	m^2
Volume	V	m × m × m	m^3
Density	ρ	Kg m^{-3}	Kg m^{-3}
Force	F	Kg m s^{-2}	N (newton)
Pressure	P	Kg m^{-1} s^{-2}	N m^{-2} (Pa)

(l x b)

(l x b x h)

M/V

M x a

F/A

Dimensional Analysis → Unit Conversions

It involves following steps :

1. Determination of unit conversion factor (UCF)
2. Multiplication of quantity with unit conversion factor
3. In a multistep conversion cancel out the units of preceding factor

Conversions

atm, Pa, torr, bar
mm of Hg

* 1 torr = 1 mm of Hg

1 atm = 1.01325 bar

Mass

SI unit - kilogram (kg)

1 kg = 2.2046 lb

1 lb = 453.59 g

1 amu = $1.6605402 \times 10^{-24}$ g

Pressure (derived)

SI unit - Pascal (Pa)

1 Pa = 1 N m^{-2}
= 1 kg $m^{-1}s^{-2}$

1 atm = 101325 Pa
= 760 torr

1 bar = 10^5 Pa

1 atm
↓
760 mm of Hg
||
760 torr

Conversions

$$\frac{°C - 0}{100} = \frac{K - 273.15}{100} = \frac{°F - 32}{180}$$

SI unit - Kelvin

$K = °C + 273.15$

$°C = 5/9(°F - 32°)$

$°F = 9/5°C + 32°$

$0\ K = -273.15°C$
$= -459.67°F$

Energy (derived)

SI unit - joule (J)

$1J = 1\ kg\ m^2s^{-2}$

$1\ Cal = 4.184\ J$

$1\ eV = 1.602 \times 10^{-19}\ J$

Question

(Unit conversions)

A vessel contains 2L water. The volume of water in m^3 is

Volume →

$$1\ m^3 = 10^3\ dm^3 = 10^3\ L = 10^6\ cm^3 = 10^6\ mL = 10^9\ mm^3$$

$1\ dm^3 = 1\ L$

$1\ cm^3 = 1\ mL$

A 2×10^{-3}

B 2×10^{3}

C 2×10^{-6}

D 2×10^{6}

⇒ Unit Conversions → ① Calculate VCF

$$1\,m^3 = 10^3\,L$$

$$\frac{1\,m^3}{10^3\,L} = 1 = \frac{10^3\,L}{1\,m^3}$$ VCF

② Multiplication of VCF with given Quantity

$$2\,L \times \frac{1\,m^3}{10^3\,L} \Rightarrow 2 \times 10^{-3}\,m^3$$

⇒ Question → (i) Convert 1.5 atm into mm of Hg.

H.W

(ii) Convert 273°C into K.

(iii) Convert 2 Kg/m³ into g/cm³

$1\,Kg = 10^3\,g$

$1\,m^3 = 10^6\,cm^3$

$= \frac{2 \times 10^3\,g}{10^6\,cm^3}$

$= 2 \times 10^{3-6}\,g/cm^3$

$2 \times 10^{-3}\,g/cm^3$

(iv) Convert 1 Kg into amu

(v) Convert 760 atm into torr.

Precision and Accuracy

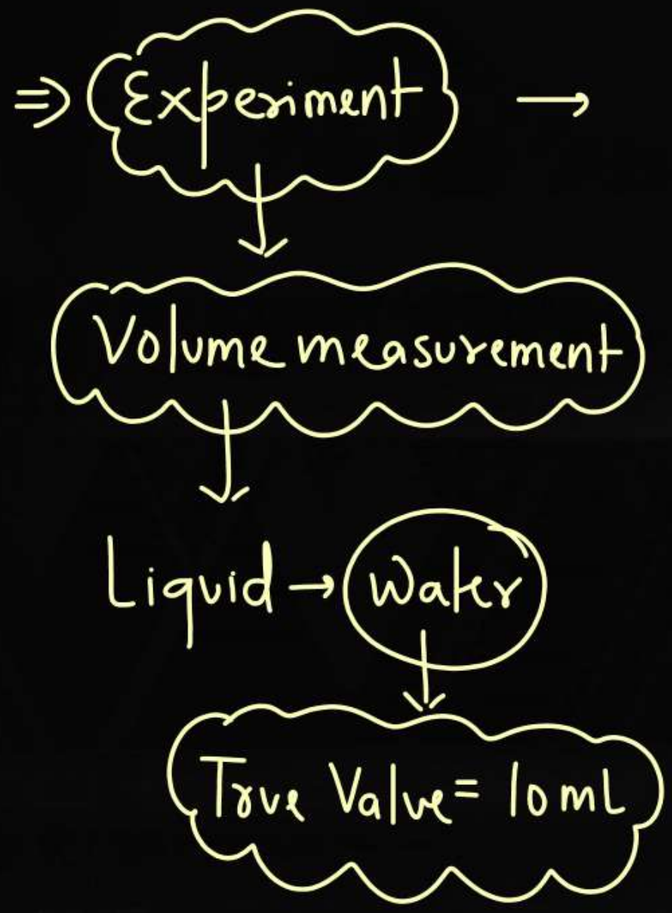
→ (2) Measurement values
↳ Values obtained in experiment

(1) True Value of Result

Actual value of that measurement

If the values of different measurements are close to each other and close to the average value, the measurement is said to be precise.

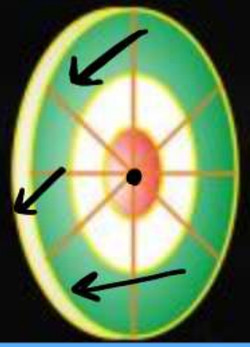
If the average value of different measurements is close to the true value, the measurement is said to be accurate.



	Sonu (B-1)	Titu (B-2)	Sweety (B-3)
	9.5 mL	10.5 mL	9.9 mL
	9.4 mL	10.9 mL	10.1 mL
	9.3 mL	11.8 mL	10.0 mL
Avr. Value =	$\frac{28.2}{3} = 9.4$	$\frac{33.2}{3} = 11.06$ mL	= 10 mL (Avr. Value)

Precision and Accuracy

Sonu

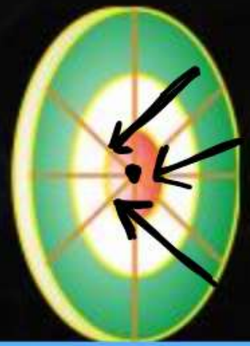


(a) Low accuracy
Low precision

Titu

(b) Low accuracy
High precision

Sweety



(c) High accuracy
Low precision

Arpit

(d) High accuracy
High precision

Scientific Notation

→ (to express large/small Quantities)

Chemistry

- Macroscopic
- Microscopic

Quantities → Very large Quantity, Very small Quantity

Scientific or exponential notation is a way of writing very large or very small numbers in which number can be represented in the form of $A \times 10^n$, where n is an exponent having positive or negative values and A can vary between 1 and 10.

Scientific Notation

Large Numbers: → (n = positive)

$A \times 10^{n}$

602000000000000000000000 m

L ← R

6.02×10^{23}

Small Numbers: → n → negative

0.00000000000000000000000000000091 kg

L → R

9.1×10^{-32} kg

Scientific Notation

$3.14 \times 10^2 \times 10$

$\frac{3.14}{10} \times 10^3 = 0.314 \times 10^3$

1. **Addition and Subtraction** → (make sure that the exponents are same while add^n/sub^n)

$(6.02 \times 10^3) + (3.14 \times 10^2)$

$= (6.02 \times 10^3) + (0.314 \times 10^3)$

$= 6.334 \times 10^3$

(2) $\Rightarrow \quad 1.5 \times 10^{-2} - 1.5 \times 10^{-3}$

$\frac{1.5 \times 10^{-3} \times 10^1}{10}$

$\frac{1.5}{10} \times 10^{-2}$

0.15×10^{-2}

$1.5 \times 10^{-2} - 0.15 \times 10^{-2}$

$(1.5 - 0.15)10^{-2} \Rightarrow 1.35 \times 10^{-2}$

Scientific Notation

2. **Multiplication and Division** → (add the exponent (Rest is same))

$(3.1 \times 10^4) \times (2 \times 10^3)$

$= (3.1 \times 2) \times 10^{4+3}$

$= 6.2 \times 10^7$

$3.1 \times 10^4 / 2 \times 10^3$

$\frac{3.1}{2} \times \frac{10^4}{10^3} \Rightarrow \frac{3.1}{2} \times 10^4 \times 10^{-3}$

$= 1.55 \times 10^1$

$\Rightarrow \frac{3.3 \times 10^3}{6.6 \times 10^{-3}} \Rightarrow \frac{3.3}{6.6} \times 10^3 \times 10^3$

$= \frac{1}{2} \times 10^6 = 0.5 \times 10^6$

$= 5 \times 10^5$

Question

Homework

1.18 Express the following in the scientific notation:

(i) 0.0048

(ii) 234,000

(iii) 8008

(iv) 500.0

(v) 6.0012


THANK You