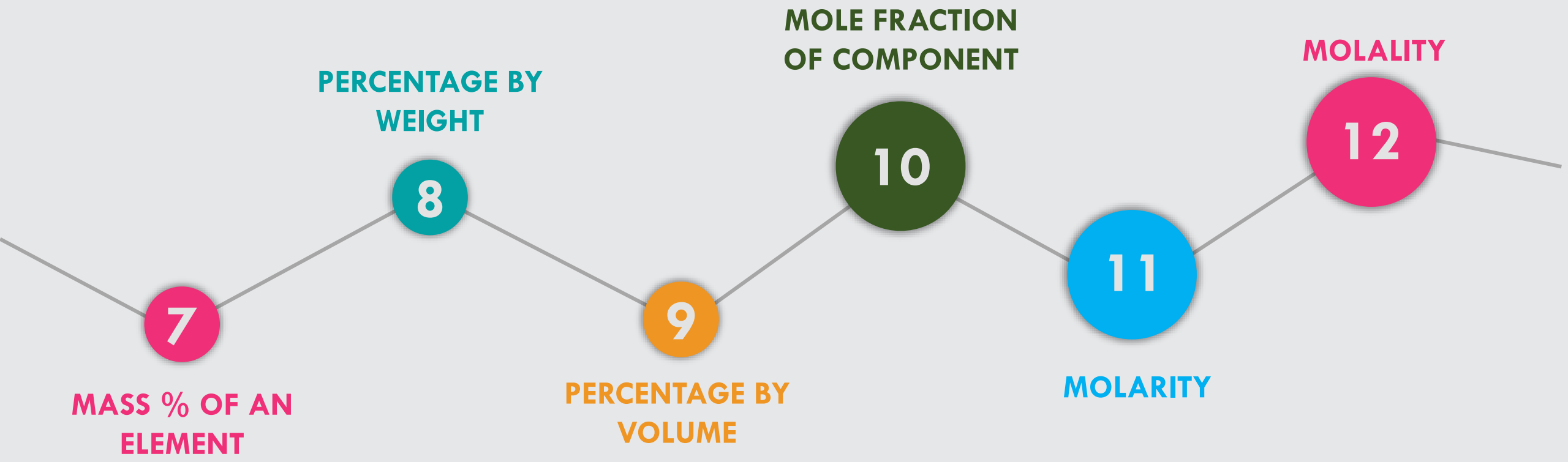
PURITY

BASICS OF CHEMISTRY

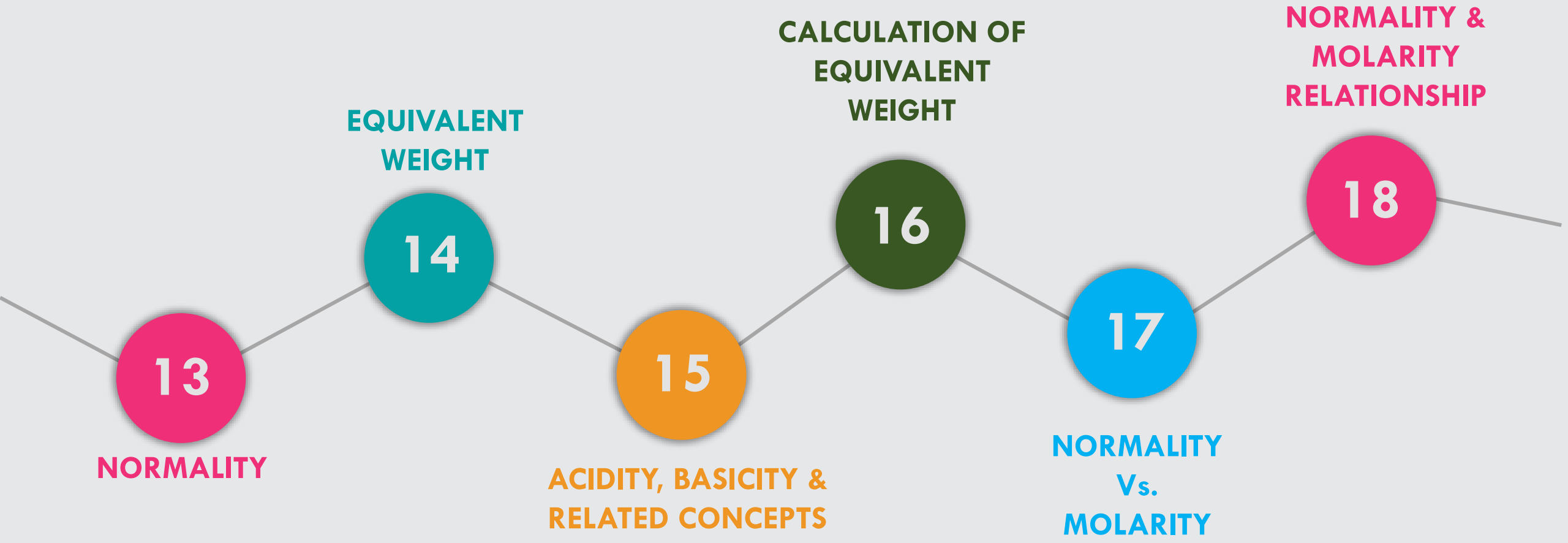
RECAP

1. UNITS FOR PHYSICAL MEASUREMENT
2. MASS, VOLUME, DENSITY & TEMPERATURE
3. ATOMIC MASS
4. MOLECULAR MASS
5. MOLE CONCEPT
   Mole, Avogadro Number, amu & gram
6. MOLAR MASS

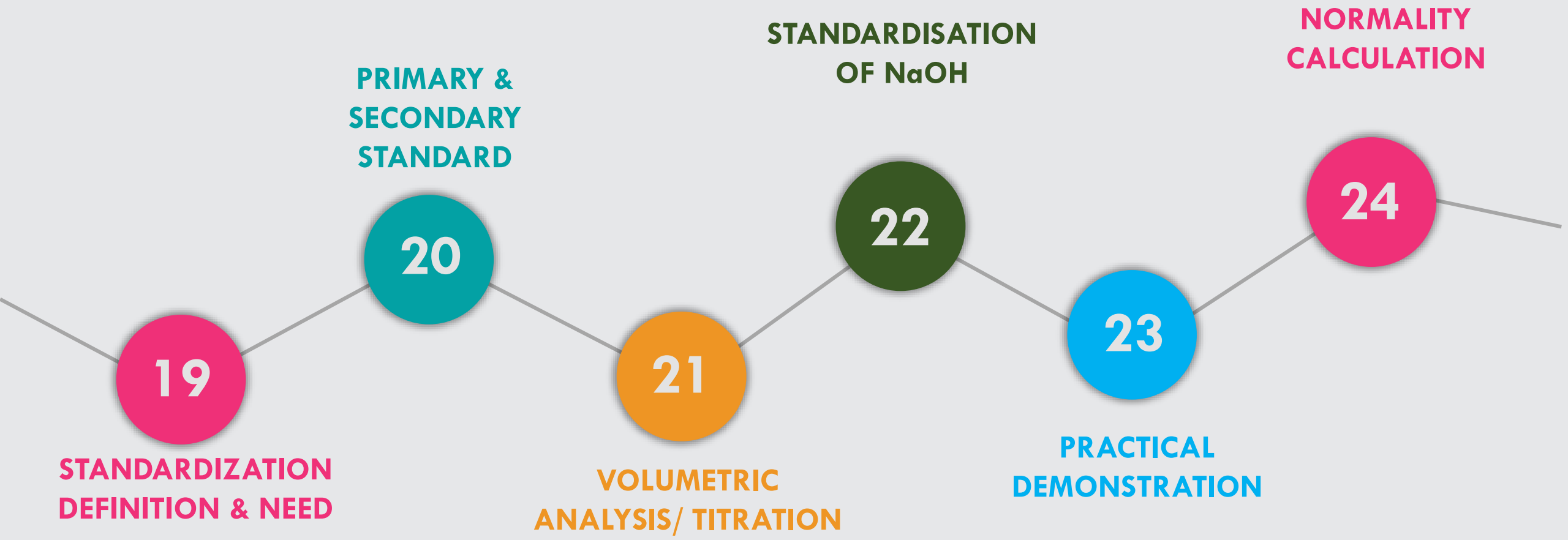
RECAP


7
MASS % OF AN ELEMENT
8
PERCENTAGE BY WEIGHT
9
PERCENTAGE BY VOLUME
10
MOLE FRACTION OF COMPONENT
11
MOLARITY
12
MOLALITY

RECAP


13
NORMALITY
14
EQUIVALENT WEIGHT
15
ACIDITY, BASICITY & RELATED CONCEPTS
16
CALCULATION OF EQUIVALENT WEIGHT
17
NORMALITY Vs. MOLARITY
18
NORMALITY & MOLARITY RELATIONSHIP

RECAP


19
STANDARDIZATION DEFINITION & NEED
20
PRIMARY & SECONDARY STANDARD
21
VOLUMETRIC ANALYSIS/ TITRATION
22
STANDARDISATION OF NaOH
23
PRACTICAL DEMONSTRATION
24
NORMALITY CALCULATION

01
% PURITY DEFINITION

02
COMMON FORMULA & TITRATION FORMULA

03
EXAMPLES OF % PURITY

04
IMPORTANCE OF % PURITY

05
EXPERIMENT FOR % PURITY OF HCL

06
PREPARATION OF 1 N NaOH SOLUTION & HCL SOLUTION

07
PRACTICAL SIMULATION

08
CALCULATION

PURITY

Percentage Purity Is The Percentage Of A Pure Compound In An Impure Sample.

Pure Substances Are Defined As Substances That Are Made Of Only One Type Of Atom Or Only One Type Of Molecule.

The Measure Of Whether A Substance Is Pure Is Known As Purity.

HOW TO CALCULATE PURITY ?

There Are 2 Methods For Calculating Purity Of Any Substance.

COMMON FORMULA

PRACTICAL TITRATION FORMULA

COMMON FORMULA

$$\%\ PURITY\ = \frac{Mass\ Of\ Pure\ Product\ \times 100}{Total\ Mass\ Of\ Product}$$

$$\%\ PURITY\ = \frac{Mass\ Of\ Pure\ Compound\ In\ Sample\ \times 100}{Total\ Mass\ Of\ Sample}$$

$$\%\ \mathbf{PURITY} = \frac{\text{  }}{\text{  }} \times 100$$

EXAMPLE

150 gm Sample Of Gold Ore Contains 87.3 Gm Of Pure Gold. Calculate The Percentage Purity.

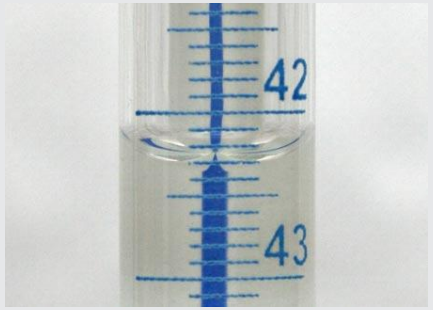
$$\%\ PURITY = \frac{Mass\ Of\ Pure\ Product \times 100}{Total\ Mass\ Of\ Product} \qquad \%\ PURITY = \frac{87.3 \times 100}{150} \qquad = 58.2\ \%\ Pure\ Gold$$

$$\%\ \mathbf{PURITY} = \frac{\text{  }}{\text{  }} \times 100 = \mathbf{58.2\ \%}$$

PURE GOLD

PRACTICAL TITRATION FORMULA

$$\%\ PURITY\ = \frac{Burette\ Reading\ (Titrant) \times Normality\ (Titrant) \times Eq.Wt.\ (Analyte)}{10\ \times Weight\ OR\ Volume\ (Analyte)}$$

$$\%\ \text{PURITY} = \frac{\text{  } \times \text{N} \times \text{EW}}{10 \times \text{  }\ \text{OR}\ \text{  }}$$

EXAMPLE

Find The % Purity Of Potassium Hydrogen Phthalate (KHP) Against 1.030 N NaOH Solution, Volume Of NaOH (B.R.) 19 ml, Weight Of KHP 4.002 gm.

SOLUTION:

Normality Of NaOH = 1.030 N

Weight Of KHP = 4.002 Gm.

G.M.M. Of KHP = $KHC_8H_4O_4$ = 39 + 1 + 8 (12) + 4 (1) + 4 (16)

= 40 + 96 + 4 (1) + 4 + 64

= 204 Gm./Eq.

Eq. Wt. Of KHP = G.M.M./Basicity = 204 /1 = 204 gm. /Eq

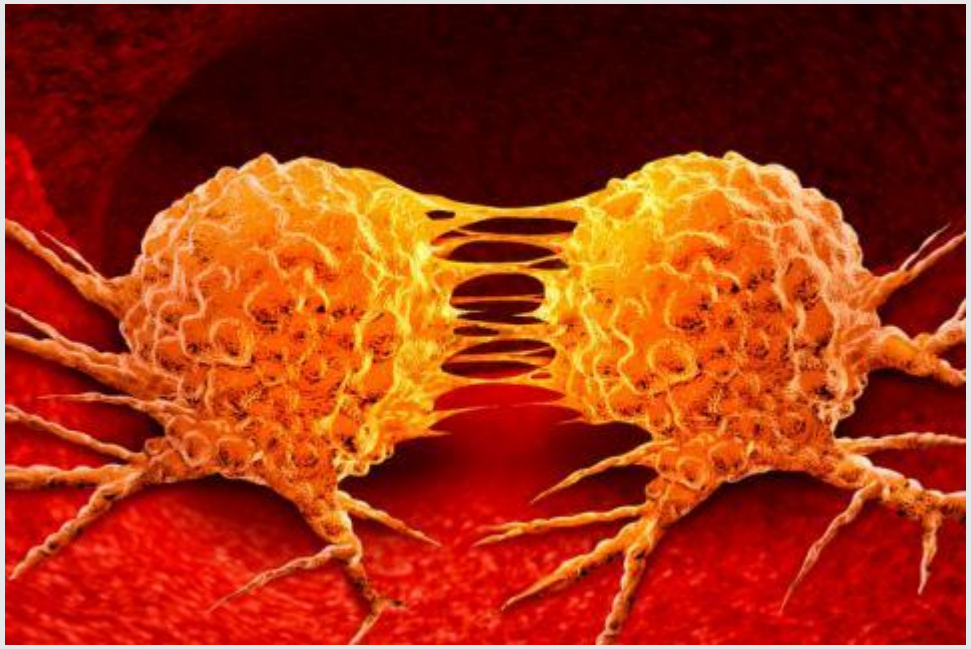
$$\%\ PURITY = \frac{Burette\ Reading\ (Titrant) \times Normality\ (Titrant) \times Eq.Wt.\ (Titrand)}{10 \times Weight\ OR\ Volume\ (Titrand)}$$

$$\%\ PURITY\ OF\ KHP = \frac{19 \times 1.030 \times 204}{10 \times 4.002} = 99.76\ \%\ Pure\ KHP$$

IMPORTANCE OF PURITY

Unknown Impurities Can Cause A Wide Range Of Issues Like,

The Impurity, N-nitrosodimethylamine (NDMA), Is Classified As A Probable Human Carcinogen, And Is A Known Environmental Contaminant Found In Water And Foods, Including Meats, Dairy Products, And Vegetables. It Is Also Detected In Ranitidine Hydrochloride Tablets & Can Cause Cancer.



IMPORTANCE OF PURITY

Unknown Impurities Can Cause A Wide Range Of Issues Like,

Impurities In The Metal Use For Manufacturing Can Cause Break Down And Significant Reduction in Equipment Life.

IMPORTANCE OF PURITY

Unknown Impurities Can Cause A Wide Range Of Issues Like,

Impurities In Construction Material Also Can Cause The Structure To Collapse.

IMPORTANCE OF PURITY

1. In Any Chemical Process It Is Almost Impossible To Get 100% Purity And So Samples Are Always Analyzed In Industry To Monitor The Quality Of The Product.
2. The More A Product Is Processed By Distillation Or Crystallization, The More Costly The Process, But The Purer The Product Gets.
3. It Is Important That Before Sale, The Product Is Assayed Or Analyzed As To Its Percentage Purity.
4. An Assay Is Any Procedure Used To Analyze And Test For Its Purity Of The % Content Of A Specified Component In A Mixture Of An Element Or Ion etc.

EXPERIMENT - 2

Determine % Purity of HCl

We Will Make Two Types Of Solution For Determine %Purity Of HCl.

Preparation of 500 ml of 1 N NaOH Solution As In Previous Experiment

Preparation of HCl Solution (≡ 2gm HCl approximately)

EXPERIMENT - 2

Preparation of 500 ml of 1 N NaOH Solution (As In Previous Experiment)

$$NaOH + KHC_8H_4O_4 \longrightarrow KNaC_8H_4O_4 + H_2O$$

SOLUTION:

1. GMM of NaOH = 23 + 16 + 1 = 40 gm./mol
2. Eq. of NaOH = GMM / Acidity = 40 /1 = 40 gm./Eq.
3. For 1000 ml 1 N NaOH Solution, 40 gm of NaOH is Required.
4. For Preparation of 500 ml 1N NaOH Solution 20 gm of NaOH is Required.
5. But NaOH Has 96% Purity, So We Take 22 gm Approximately & Dissolve In Water Then Making 500 ml Solution By SMF (Standard Measuring Flask).
6. Then Standardize That NaOH Solution With 99% Pure KHP (As Previous Day's Experiment)

Preparation Of HCl Solution (≡ 2 gm HCl Approximately)

Why Only 2 gm HCL?

We Have To Plan The Experiment So That Burette Reading Should Be Between 20 ml. to 30 ml. If The Burette Reading Is Less Than 10 ml., It Can Cause Major Errors, Hence To Avoid This Issue, (Assuming 1 N NaOH) Quantity Of 2 gm. HCl Should Be Used.

$NaOH + HCl \longrightarrow NaCl + H_2O$

GMM of HCl = 1 + 35.5 = 36.5 gm./mol

Eq. Wt. of HCl = GMM / Basicity = 36.5 /1 = 36.5 gm./Eq.

Wt. of HCL = ? gm (for 20 ml NaOH)

NaOH			HCl
1 mole		neutralize with	1 mole
40 gm		neutralize with	36.5 gm
1000 ml	(40gm)	neutralize with	36.5 gm
20 ml		neutralize with	?

$$= \frac{20 \times 36.5}{1000} = 0.73 \text{ gm HCl}$$

Above Calculation (ml and gm) Is Directly Proportional As One Amount Increases, Another Amount Increases.

EXPERIMENT - 2

CALCULATION of % PURITY OF HCL

% Purity of HCl	Wt. of HCl
100 %	0.73 gm
37% (Actual Purity of HCL)	?

$$= \frac{100 \times 0.73}{37} = 1.97 \equiv 2 \text{ gm HCl}$$

Above Calculation (% And gm) Is Inversely Proportional

As One Amount Increases, Another Amount Decreases

So We Take 100/37 Instead Of 37/100

We Take Wt. Of HCl = 2 gm Approximately

2 gm HCl Approx. + 80 ml Water = HCl Solution

Instead Of 80 ml Water, We Can Take 100 ml But It Should Not Exceed Volume By 150 ml.

Then Titrate It Against ……..N NaOH Solution.

CALCULATION

B.R. (NaOH) = 22 ml

Normality of NaOH = 0.9930 N

Weight of HCl = 2.1721 gm.

Eq. Wt. of HCl = 36.5 gm. /eq

$$\% \text{ purity} = \frac{Burette\ Reading(titrant) \times Normality\ (titrant) \times Eq.Wt.\ (titrand)}{10 \times Weight\ or\ Volume\ (titrand)}$$

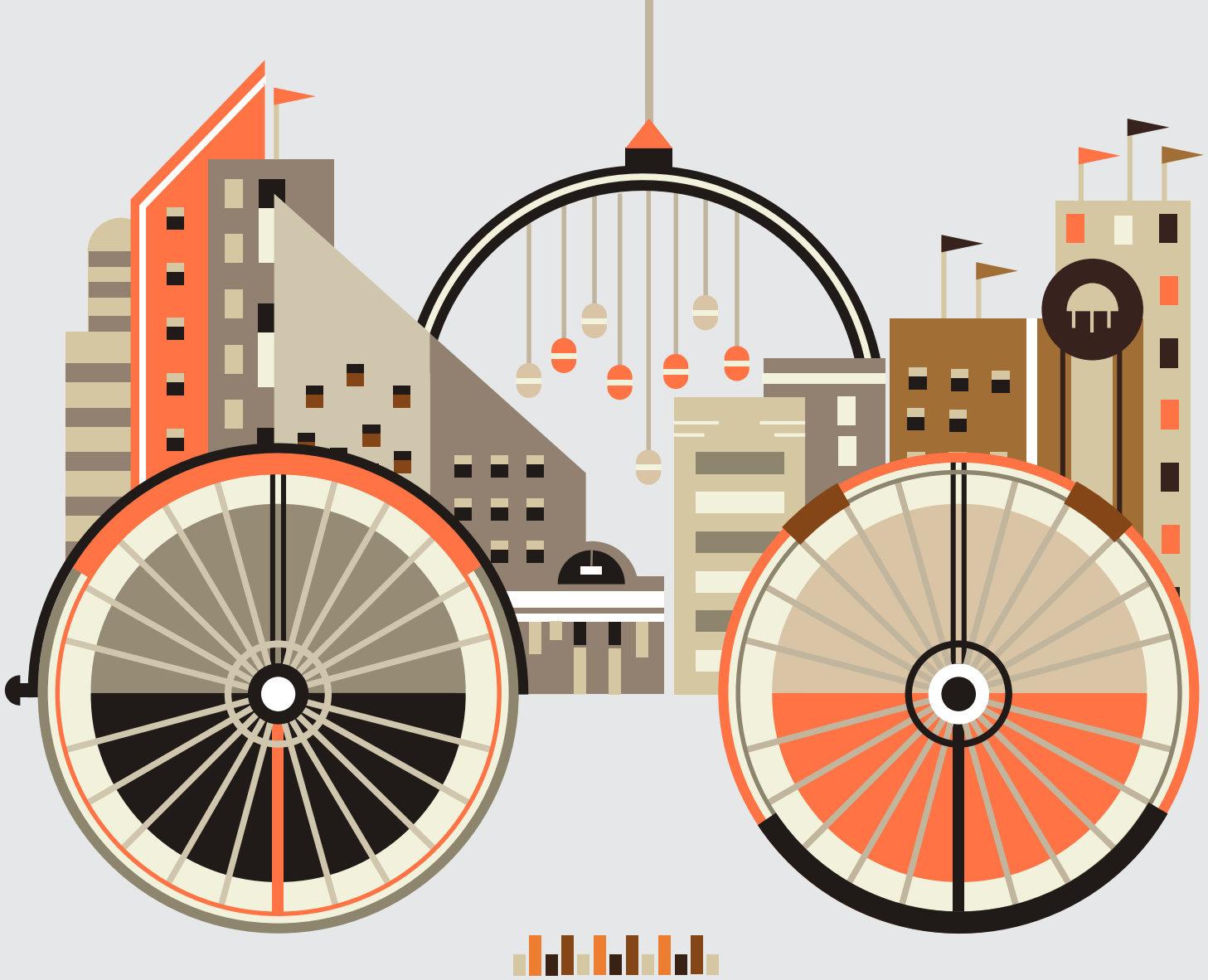
$$\% \text{ purity of HCl} = \frac{22 \times 0.9930 \times 36.5}{10 \times 2.1721} = 36.71\% \quad \text{(Actual purity of HCl = 37\%)}$$

% Purity of HCl = 37% , it means 100 ml of HCl solution contain only 37% pure HCl, other 63% is impurity or water.

This Calculation Is % Purity is the example of w/w%

SUMMARY

- % PURITY DEFINITION
- COMMON FORMULA & TITRATION FORMULA
- EXAMPLES OF % PURITY
- IMPORTANCE OF % PURITY
- EXPERIMENT : DETERMINE % PURITY OF HCL
- PREPARATION OF 1 N NAOH SOLUTION & HCL SOLUTION
- CALCULATION



THANK YOU VERY MUCH