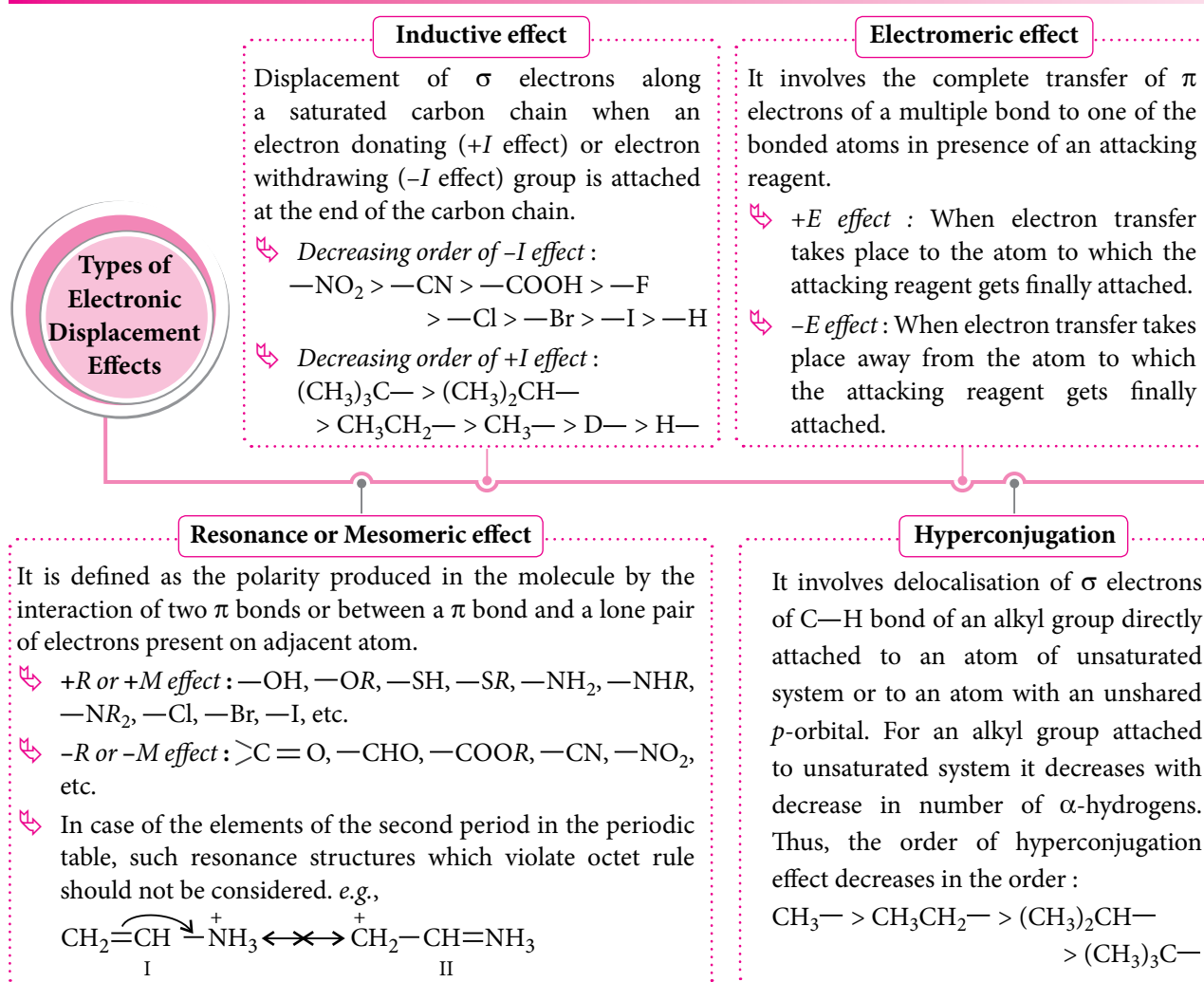


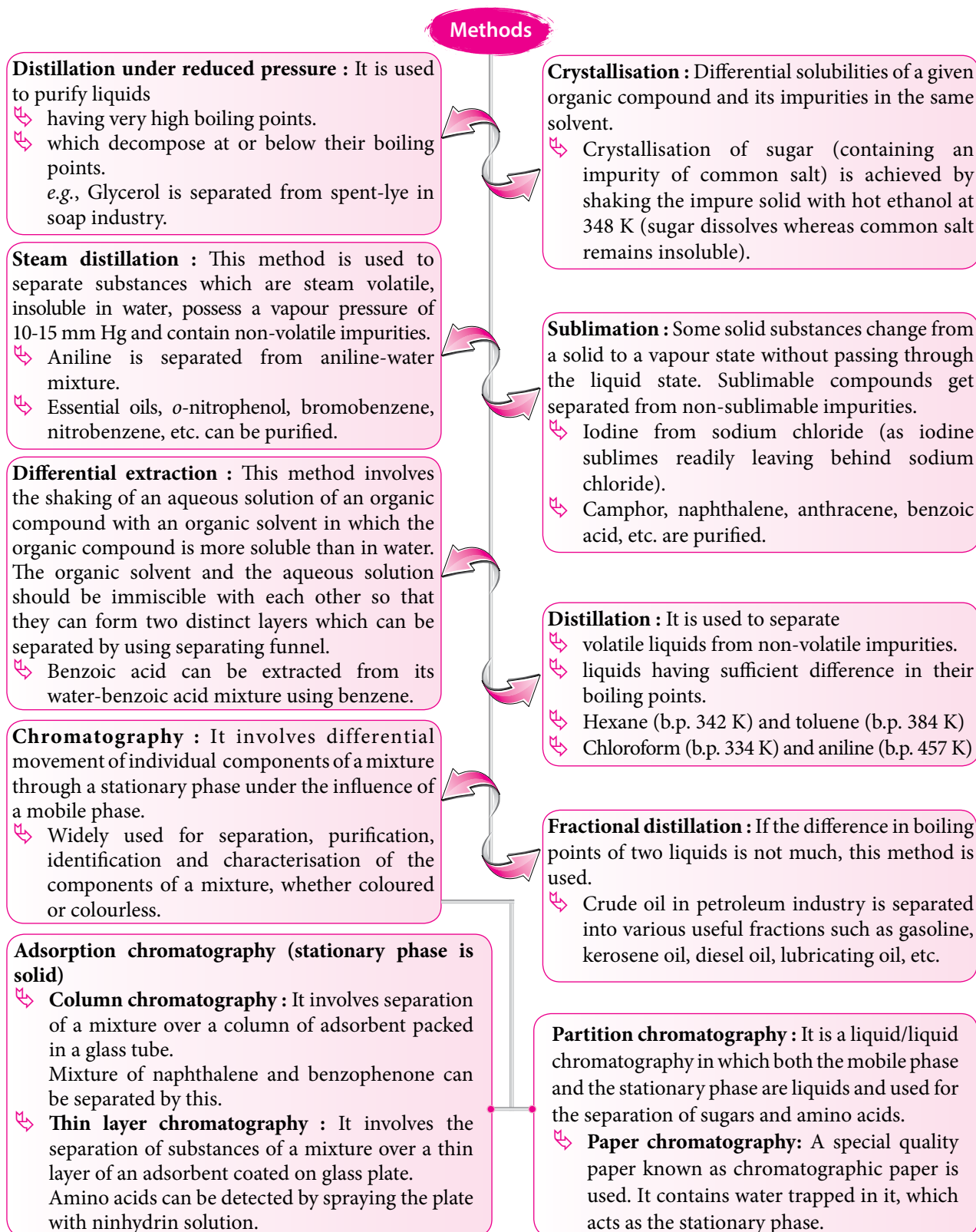
## ATTACKING REAGENTS

Electrophiles	Nucleophiles	Ambiphiles
<p>They are positively charged or neutral molecules having electron deficient atom, seeking a site of high electron density to attack. Electrophiles have incomplete outer shells and are also called <i>Lewis acids</i> (electron-pair acceptors).</p> <p>Charged : <math>\text{H}_3\text{O}^+</math>, <math>\text{X}^+</math> (where <math>\text{X} = \text{Cl}, \text{Br}, \text{I}</math>), <math>\text{NO}_2^+</math>, <math>\text{NO}^+</math>, <math>\text{NH}_4^+</math>, <math>\text{SO}_3\text{H}^+</math>, <math>\text{C}_6\text{H}_5\text{N}_2^+</math>, <math>\text{R}^+</math>, <math>\text{RCO}^+</math>.</p> <p>Neutral : <math>\text{BF}_3</math>, <math>\text{AlCl}_3</math>, <math>\text{FeCl}_3</math>, <math>\text{SiCl}_4</math>, <math>\text{BeCl}_2</math>, <math>\text{ZnCl}_2</math>, <math>\text{SO}_3</math>, <math>\text{CO}_2</math>, <math>\text{CS}_2</math>, <math>\text{CX}_4</math>, <math>\text{RCOCl}</math>, <math>&gt;\text{C}=\text{O}</math>, <math>:\text{CCl}_2</math>.</p>	<p>They are negatively charged or neutral molecules having electron-rich atom with unshared electron pair, seeking electron deficient site to attack. They are also called <i>Lewis bases</i> (electron-pair donors).</p> <p>Charged : <math>\text{H}^-</math>, <math>\text{OH}^-</math>, <math>\text{X}^-</math>, <math>\text{CN}^-</math>, <math>\text{N}_3^-</math>, <math>\text{RO}^-</math>, <math>\text{R}^-</math>, <math>\text{RS}^-</math>, <math>\text{SH}^-</math>, <math>\text{HSO}_3^-</math>, <math>\text{NO}_2^-</math>, <math>\text{NH}_2^-</math>, <math>\text{RCOO}^-</math>, <math>\text{HC}\equiv\text{C}^-</math>.</p> <p>Neutral : <math>\ddot{\text{N}}\text{H}_3</math>, <math>\text{H}_2\ddot{\text{O}}</math>, <math>\text{R}\ddot{\text{O}}\text{H}</math>, <math>\text{R}\ddot{\text{O}}\text{R}</math>, <math>\text{R}\ddot{\text{S}}\text{H}</math>, <math>\text{RMgX}</math>, <math>\text{Ph}_3\ddot{\text{P}}</math>, <math>\text{RLi}</math>, <math>\text{LiAlH}_4</math>, etc.</p>	<p>They behave both like electrophiles and nucleophiles hence, have dual nature.</p> <p><math>\text{R}\ddot{\text{O}}\text{H}</math>, <math>\text{H}\ddot{\text{O}}\text{H}</math> and <math>\text{R}\ddot{\text{P}}\text{H}_2</math></p>

## ELECTRON DISPLACEMENT EFFECTS IN COVALENT BONDS



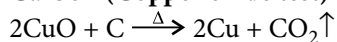
## METHODS OF PURIFICATION OF ORGANIC COMPOUNDS



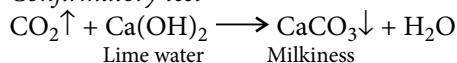
## QUALITATIVE ANALYSIS

### Detection of Elements and their Confirmatory Tests

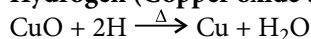
#### Carbon (Copper oxide test)



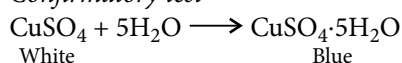
Confirmatory test



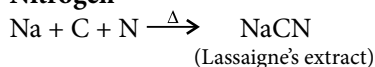
#### Hydrogen (Copper oxide test)



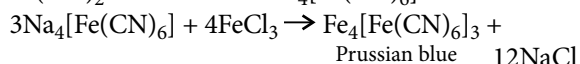
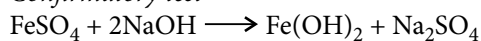
Confirmatory test



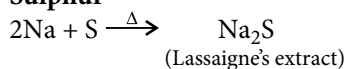
#### Nitrogen



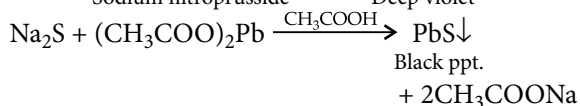
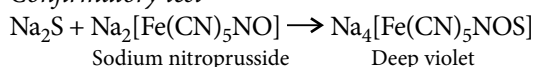
Confirmatory test



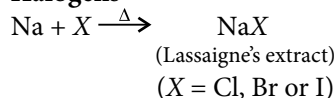
#### Sulphur



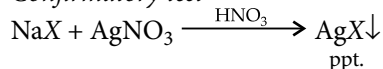
Confirmatory test



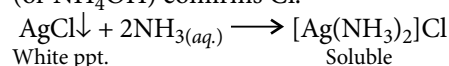
#### Halogens



Confirmatory test



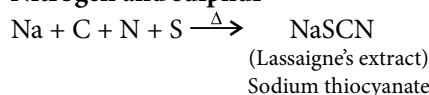
— White ppt. soluble in aqueous  $\text{NH}_3$   
(or  $\text{NH}_4\text{OH}$ ) confirms Cl.



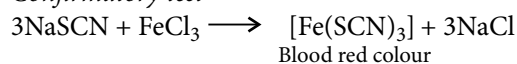
— Yellow ppt. partially soluble in aqueous  $\text{NH}_3$   
(or  $\text{NH}_4\text{OH}$ ) confirms Br.

— Yellow ppt. insoluble in aqueous  $\text{NH}_3$   
(or  $\text{NH}_4\text{OH}$ ) confirms I.

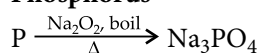
#### Nitrogen and sulphur



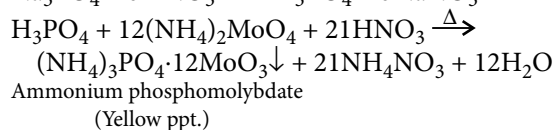
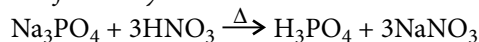
Confirmatory test



#### Phosphorus



Confirmatory test



### Gas Chromatography(GC) – Sensor Can ‘Smell’ Prostate Cancer!

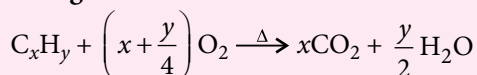
**A** Research team from the University of Liverpool has reached an important milestone towards creating a urine diagnostic test for prostate cancer. The use of a gas chromatography (GC) – sensor system combined with advanced statistical methods towards the diagnosis of urological malignancies, which describes a diagnostic test using a special tool to ‘smell’ the cancer in men’s urine. The GC sensor system is able to successfully identify different patterns of volatile compounds that allow classification of urine samples from patients with urological cancers. The research team used a gas chromatography sensor system called Odoreader that was developed by a team led by Professor Probert and Professor Norman Ratcliffe at UWE Bristol. The test involves inserting urine samples into the Odoreader that are then measured using algorithms developed by the research team at the University of Liverpool and UWE Bristol. “The Odoreader has a 30 metre column that enables the compounds in the urine to travel through at different rates thus breaking the sample into a readable format. This is then translated into an algorithm enabling detection of cancer by reading the patterns presented. The positioning of the prostate gland which is very close to the bladder gives the urine profile a different algorithm if the man has cancer.”

## QUANTITATIVE ANALYSIS

### Methods of Analysis

#### Estimation of carbon and hydrogen

##### Liebig's combustion method :

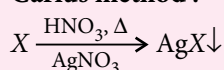


$$\% \text{ of C} = \frac{12}{44} \times \frac{\text{Mass of } CO_2 \text{ formed}}{\text{Mass of compound taken}} \times 100,$$

$$\% \text{ of H} = \frac{2}{18} \times \frac{\text{Mass of } H_2O \text{ formed}}{\text{Mass of compound taken}} \times 100$$

#### Estimation of halogen

##### Carius method :



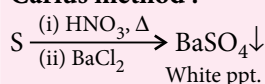
$$\% \text{ of Cl} = \frac{35.5}{143.5} \times \frac{\text{Mass of AgCl formed}}{\text{Mass of compound taken}} \times 100$$

$$\% \text{ of Br} = \frac{80}{188} \times \frac{\text{Mass of AgBr formed}}{\text{Mass of compound taken}} \times 100$$

$$\% \text{ of I} = \frac{127}{235} \times \frac{\text{Mass of AgI formed}}{\text{Mass of compound taken}} \times 100$$

#### Estimation of sulphur

##### Carius method :



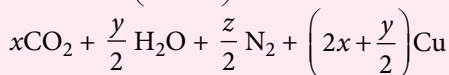
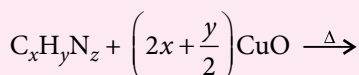
$$\% \text{ of S} = \frac{32}{233} \times \frac{\text{Mass of } BaSO_4 \text{ formed}}{\text{Mass of compound taken}} \times 100$$

#### Estimation of carbon, hydrogen and nitrogen

The elements carbon, hydrogen and nitrogen present in a compound can be determined by an apparatus known as CHN elemental analyser. It requires only 1-3 mg of the compound and displays the values of the element on the screen. The results are accurate within  $\pm 0.03\%$  error.

#### Estimation of nitrogen

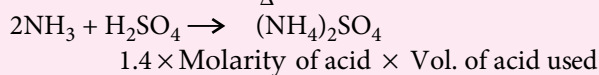
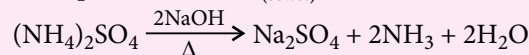
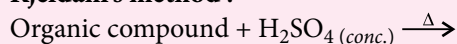
##### Dumas method :



$$\% \text{ of N} = \frac{28}{22400} \times \frac{\text{Vol. of } N_2 \text{ at STP}}{\text{Mass of compound taken}} \times 100,$$

$$\text{Vol. of } N_2 \text{ at STP} = \frac{P_1 V_1 \times 273}{760 \times T_1}$$

##### Kjeldahl's method :



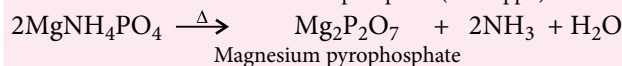
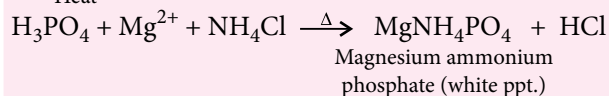
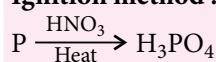
$$\% \text{ of N} = \frac{\text{Vol. of acid used} \times \text{Basicity of acid}}{\text{Mass of compound taken}}$$

$$\% \text{ of N} = \frac{1.4 \times \text{Normality of acid} \times \text{Vol. of acid used}}{\text{Mass of compound taken}}$$

(for monobasic acid)

#### Estimation of phosphorus

##### Ignition method :



$$\% \text{ of P} = \frac{62}{222} \times \frac{\text{Mass of } Mg_2P_2O_7 \text{ formed}}{\text{Mass of compound taken}} \times 100$$

#### Estimation of oxygen

$\% \text{ of oxygen in a compound} = 100 - (\text{Sum of the } \% \text{ of all other elements present in the compound}).$