

# GDC NAVIGATOR



*The future depends on what you do today*

# Director's Message..



We are deeply grateful for the trust you've placed in our institute, a responsibility we honor. This is a vibrant era for career education, where learning goes beyond exams to prepare students for life itself. At GDC, we emphasize value-based education, guiding individuals to make ethical and meaningful societal contributions.

Our vision is to guide students on their journey, helping them develop skills and build successful careers. GDC Classes are designed to prepare students for entrance exams such as GPAT, NIPER, Drug Inspector, Pharmacist, GATE Life Sciences (XL), Nursing and other pharma competitive exams across India. Our committed team strives to expand your knowledge and support you in achieving your goals. We aim to not only advance your professional career but also enhance your life in numerous ways. Through our GDC Care Programs, we seek to contribute positively not just to individuals, but to society as a whole.

**Dr. Peeyush Jaiswal**

Director

GPAT Discussion Center Pvt. Ltd

# Historic Success by

# GDC Prime

A Revolutionary way to Achieve

students in

# GPAT-2026



1 Shivjiyani Dhruv Rashiklal

2 Anay Prashant Potdar

3 Mohammed Mudassir Nagori

Selection in GPAT-2026 from GDC

# 4000+

8 Students In Top 10 Rank  
78 Students In Top 100 Rank



4 Mayuri Santosh Nikam

5 Pratiksha Harishchandra

6 Nayak Prahee Prashant

8 Manas Prabhu

10 Aniket Kalyan Mane

Top Ranker students in GPAT-2026 are from GDC PRIME Course



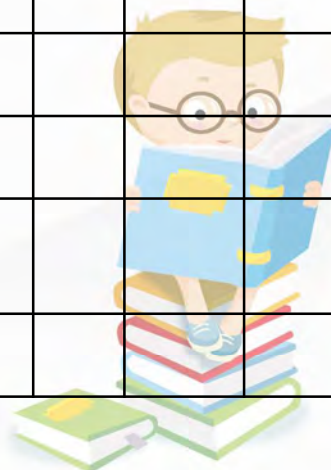
# Chapter Wise Weightage Analysis and Syllabus



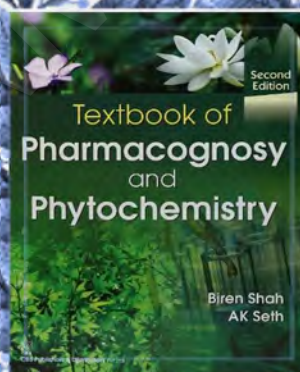
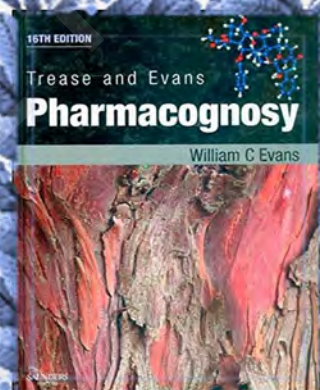
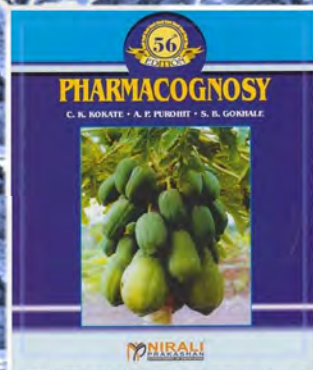
## Pharmacology



S. No.	Chapter name	No. of days to complete	PYQ Analysis						Notes	Revision	Remark
			2026	2025	2024	2023 - I	2023 - II	2022			
1.	General Pharmacology		05	03	06						
2.	Drugs Acting on Autonomic Nervous System		01	03	01						
3.	Autacoids and Related Drugs		03	01	01						
4.	Drugs Acting on Respiratory System		00	03	00						
5.	Hormones and Related Drugs		03	02	01						
6.	Drugs Acting on Peripheral Nervous System		00	01	00						
7.	Drugs Acting on Central Nervous System		05	02	00						
8.	Cardiovascular Drugs		02	02	03						
9.	Drugs Acting on Kidney		01	01	01						
10.	Drugs affecting Blood and Blood Formation		00	03	01						
11.	Gastrointestinal Drugs		00	01	00						
12.	Antimicrobial Drugs		04	05	06						
13.	Chemotherapy of Neoplastic Disease		01	02	00						
14.	Miscellaneous drugs		01	01	01						



# REFERENCE BOOKS FOR Pharmacognosy and Allied Subjects





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# PHARMACOGNOSY

Module-1



**Dr. Peeyush Jaiswal**

**M.Pharm, PhD**

(GATE-2008, 2009, GPAT-2010, 2011)

Director, GPAT Discussion Center Pvt. Ltd.

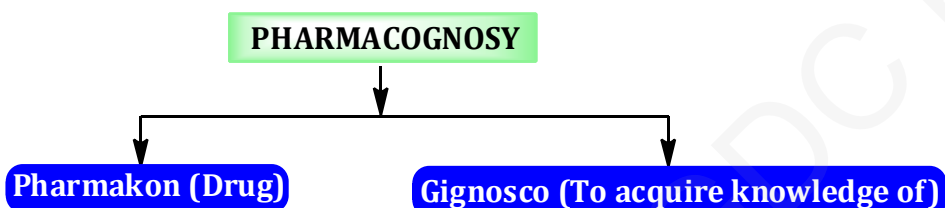
# Introduction to Pharmacognosy

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## DEFINITION, HISTORY OF PHARMACOGNOSY AND TRADITIONAL AND ALTERNATIVE SYSTEMS OF MEDICINE

### INTRODUCTION



- Pharmacognosy is defined as a **branch of bioscience** which treats in detail medicinal and related products of crude or primary type **obtained from plant, animal and mineral origins**.
- It is an objective study of crude drugs from natural sources treated scientifically and it encompasses the knowledge of the **history, distribution, cultivation, collection, processing for market and preservation, the study of sensory, physical, chemical and structural characters** and the uses of crude drugs.
- It was **C. A. Seydler**, a medical student at Germany, in 1815, who created the term Pharmacognosy in his doctoral thesis titled "*Analecta Pharmacognostica*".
- In the nineteenth century, the term '*Materia Medica*' was used for the subject now known as "**Pharmacognosy**".
- **Dioscorides**, known as the "**Father of pharmacognosy**", he wrote "*De Materia Medica*," elaborating on large data about helpful medicinal plants.

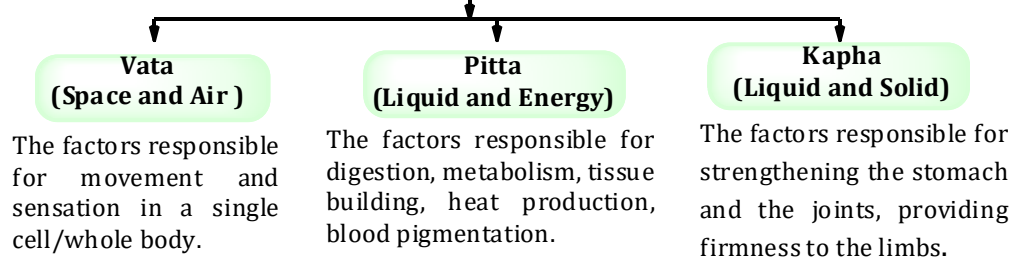
### SOURCES OF THE CRUDE DRUG

Natural product medicine obtained from various sources like plant, animals, minerals, marine sources and plant tissue culture.

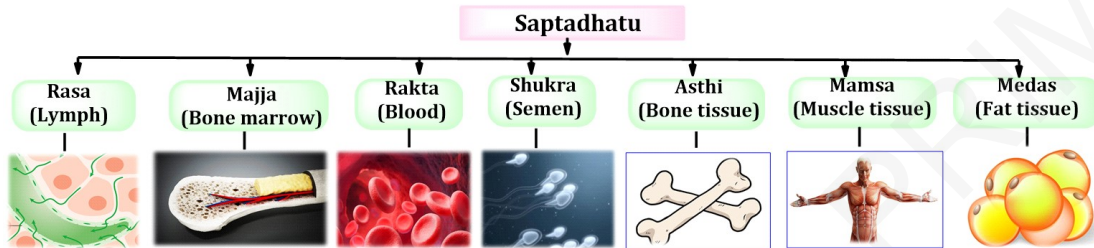
- **Plant** - Nux vomica, Clove, Senna
- **Animal**- Honey, Bees wax, Shellac
- **Microorganism**- Penicillins, Tetracyclines, Acarbose
- **Mineral** - Kaolin, Talc, Bentonite
- **Marine**- Ara-C, Thelphin, Halotoxin



Tridosha is three pillars of life

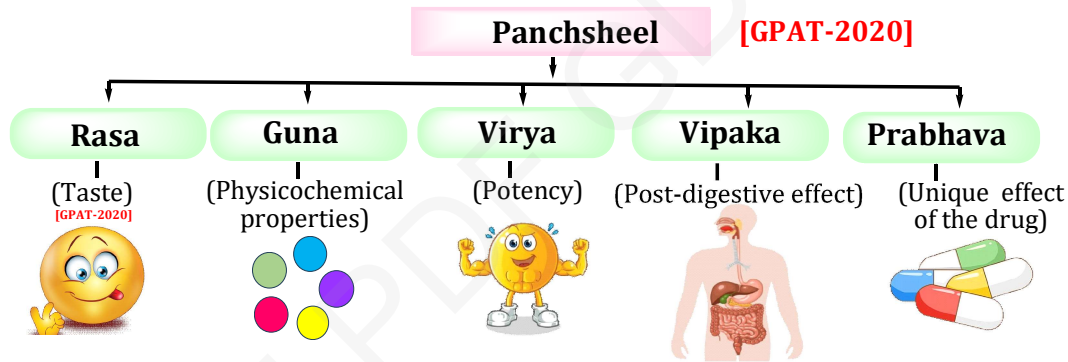


Tridosha exist in human body in seven forms called Saptadhatu.



### 3. Panchseel Theory

Five Important Pharmacological Principles of Drug Substances

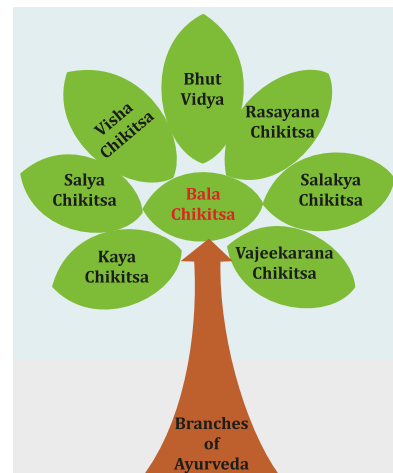


### ➤ BRANCHES OF AYURVEDA

Classified into eight branches

There are a total of eight branches of Ayurveda. These eight branches are also referred to as “the eight limbs of Ayurveda” or “Ashtanga Ayurveda”.

• Kaya chikitsa	• Medicine
• Shalya tantra	• Surgery
• Shalakyta tantra	• ENT treatment
• Bala Chikitsa	• Paediatric
• Rasayana	• Treat with chemicals
• Vajikarana	• Aphrodisiacs therapy
• Aganda tantra	• Toxicology
• Bhut-vidya	• Psychiatry





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# PHARMACOGNOSY

Module-2



**Dr. Peeyush Jaiswal**

**M.Pharm, PhD**

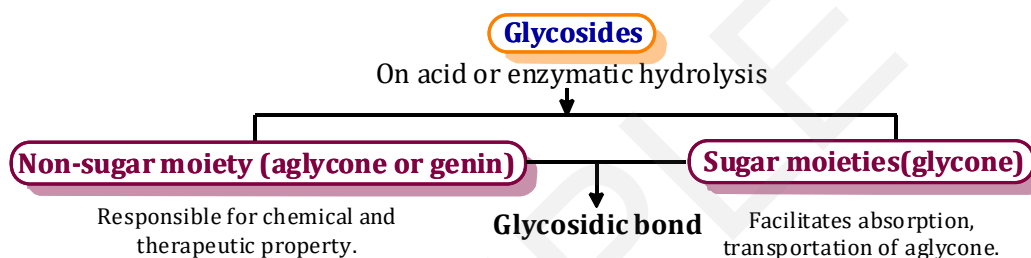
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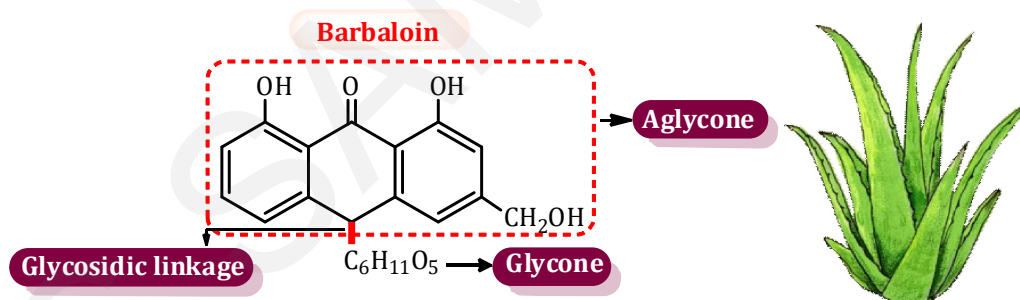
## INTRODUCTION

- Glycosides are organic compound from plant or animal sources.
- On enzymatic or acid hydrolysis yields one or more sugar moieties (Glycone) along with non-sugar moiety (Aglycone). [GPAT-2017]



- On the basis of glycosidic linkage  $\alpha$  and  $\beta$  stereoisomer is assigned.

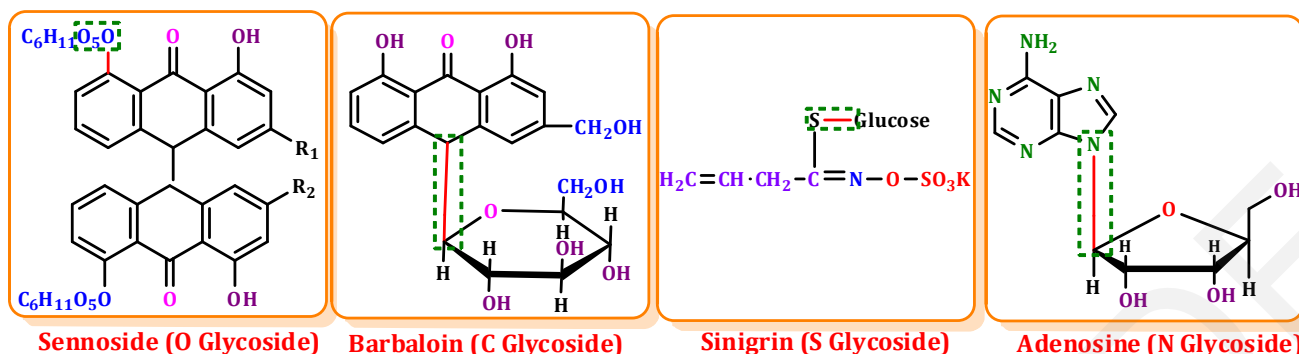
**Example:** Barbaloin is the constituent found in Aloe



- Chemically they are **acetals** or **sugar ethers**, formed by interaction of hydroxyl group each of sugar and non- sugar moiety with loss of water molecule.
- Sugar is mostly  $\beta$  -**D-glucose** others are galactose, mannose, rhamnose, digitoxose, cymarose etc.

## PROPERTIES OF GLYCOSIDES

- Most glycosides are Colourless, Crystalline or amorphous substance  
**Anthraquinone** - Red or Orange in colour  
**Flavone glycoside** - Yellow in colour
- Glycoside are soluble in water, alcohol but insoluble in chloroform and ether.
- Glycoside cannot reduce Fehling's solution until they are hydrolysed.
- Optically active  $\rightarrow$  Laevorotatory (more active form).



**[B] Based on chemical nature [GPAT-2023]:**

TYPE OF GLYCOSIDE		EXAMPLES
<b>Anthraquinone glycosides</b>		Senna, Aloe, Cascara, Rhubarb, Hypericum, Cochineal
<b>Cardiac glycosides</b>		Digitalis, Strophanthus, Ouabain, Thevetia, Squill
<b>Saponin glycosides</b>	<b>Tetracyclic Triterpenoids</b>	Dioscorea, Shatavari [GATE-2002, GPAT-2011]
	<b>Pentacyclic triterpenoids</b>	Brahmi, Ginseng, Liquorice, Senega, Gokhru, Quillaia bark, Jalbrahmi, Safed musali [GPAT-2010, 2014]
<b>Cyanogenetic glycosides</b>		Bitter almond, Wild cherry bark [GATE-2004]
<b>Isothiocyanate glycosides</b>		Black mustard
<b>Flavonoid glycosides</b>		Buck wheat, Gingko, Silymarin
<b>Coumarin glycosides</b>		Ammi, Visnaga, Psoralea, Tonka bean, Mylabris, Cantharides
<b>Aldehyde glycosides</b>		Vanilla, Anantmul
<b>Phenol glycosides</b>		Bearberry
<b>Steroidal glycoalkaloids</b>		Solanum
<b>Bitter glycosides</b>		Gentian, Picrorrhiza, Chirata, Quassia, Gymnema, Henna, Kalmegh, Manjishtha, Stevia

**[C] Based on pharmacological action:**

PHARMACOLOGICAL USES	EXAMPLE
<b>Laxative and Purgative</b>	Aloe, Senna, Cascara
<b>Cardiac glycoside</b>	Digitalis, Strophanthus, Thevetia, Squill
<b>Immunomodulator</b>	Ginseng, Picrorrhiza
<b>Expectorant</b>	Liquorice, Wild cherry bark
<b>Bitter glycoside and Hepatoprotectives</b>	Gentian, Picrorrhiza, Chirata, Quassia
<b>Emetic</b>	Black mustard
<b>Antidiabetic</b>	Gymnema
<b>Leucoderma</b>	Psoralea, Ammi

**[D] Based on the nature of the glycoside:**

- **Primary glycosides:** Originally present in the plant -e.g., Purpurea glycoside A.
- **Secondary glycosides:** Resulted from removal of one sugar from the primary glycosides -e.g., Digitoxin.



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# PHARMACOLOGY

## Module-3

THEORY Module

### Useful for

- GPAT
- NIPER
- Pharmacist
- Drug Inspector



**Dr. Abhishek Tripathi**  
M.Pharm, PhD  
HOD, Pharmacology

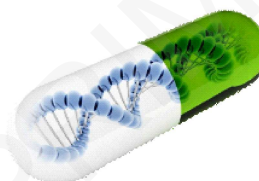
# 01

## CHAPTER

# INTRODUCTION, ROUTES OF DRUGS ADMINISTRATION

## INTRODUCTION OF PHARMACOLOGY

- ❖ **Pharmacology** – Branch of science that is concerned with the **study of a drug and its action** in the body.
- ❖ **Drug** – It is a substance that is used or intended to be used to **modify or explore physiological system or pathological states**, for benefit of the recipient



## HISTORICAL ASPECTS OF PHARMACOLOGY

CONTRIBUTIONS	SCIENTISTS
Father of Pharmacology	Oswald Schmiedeberg
Father of Indian Pharmacology	Ram Nath Chopra
Father of Indian Pharmacy Education	Mahadeva Lal Schroff
Father of Chemotherapy	Paul Ehrlich
Father of Medicine	Hippocrates
Founder of first Pharmacology Institute	Rudolf Buchheim
Discovery of Penicillin	Alexander Fleming
Discovery of Streptomycin	Selman Waksman
Discovery of Insulin	Banting and Best
Discovery of antimicrobial effect of Prontosil	Gerhard Domagk
Discovery of Homeopathy	Samuel Hahnemann
Discovery of Blood types	Karl Landsteiner
Discovery of Vaccination	Edward Jenner
Discovery of Neurotransmitters	Otto Loewi

## BRANCHES OF PHARMACOLOGY

- ❖ **Pharmacokinetics (Greek: Kinesis-movement)** – “What the body does to the drug”. This refers to movement and alteration of drug by the body. It includes:

Absorption (A), Distribution (D), Metabolism (M) & Excretion (E)

- ❖ **Pharmacodynamics (Greek: dynamis-power)** – “What the drug does to the body”. This refers to physiological and biochemical effects of drugs, its **mechanism of action** at organ system/subcellular/macromolecular levels and their adverse effects.
- ❖ **Pharmacotherapeutics** – Application of pharmacological information together with **knowledge of disease for its prevention, mitigation or cure**.
- ❖ **Pharmacoeconomics** – It deals with **economic aspects of drugs** used therapeutically.

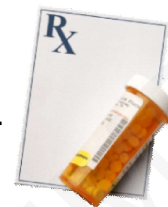
## PRESCRIPTION AND NON-PRESCRIPTION DRUGS

### ❖ Prescription drugs

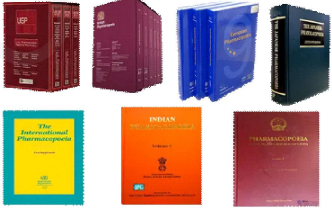
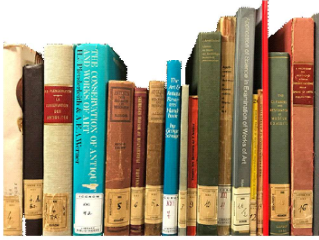
- Pharmaceutical drugs that **require a legal medical prescription** from registered **physicians** for its sales, marketing or dispensing,
- eg. Antidepressant drugs, Opioid and Narcotic drugs.

### ❖ Non-prescription drugs

- Pharmaceutical drugs that can be purchased **without any kind of medical prescription** from physicians.
- It is also called **over-the-counter drugs**.
- eg. Nimesulide, Aspirin, Oral Rehydration Solution (ORS), etc.



## SOURCES OF DRUG INFORMATION

SOURCES	DESCRIPTION	EXAMPLES
<b>Pharmacopoeia (IP, BP, USP, etc.)</b>	It is a book that is produced by a medical or pharmaceutical society and the government, or both that <b>provides instructions for identifying drugs.</b>	
<b>Monographs (WebMD network, RxList, etc.)</b>	Monographs are factual, scientific documents on a drug product that, without promotional material, <b>describe the drug's properties, claims, indications, and conditions of use.</b>	
<b>National Formularies (NF)</b>	Deals with pharmaceutical ingredient and is the usual <b>drug reference in hospital and for physician, druggists and chemists.</b>	
<b>Martindale</b>	It is also called as an <b>extra pharmacopoeia</b> . It contains complete drug reference book published by Pharmaceutical Press listing 6,000 drugs.	
<b>Physician's Desk Reference (PDR)</b>	It is a compilation of <b>visual materials and plain english explanations</b> for the safe and effective use of prescription and non-prescription medication	



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# PHARMACOLOGY

Module-4

THEORY Module



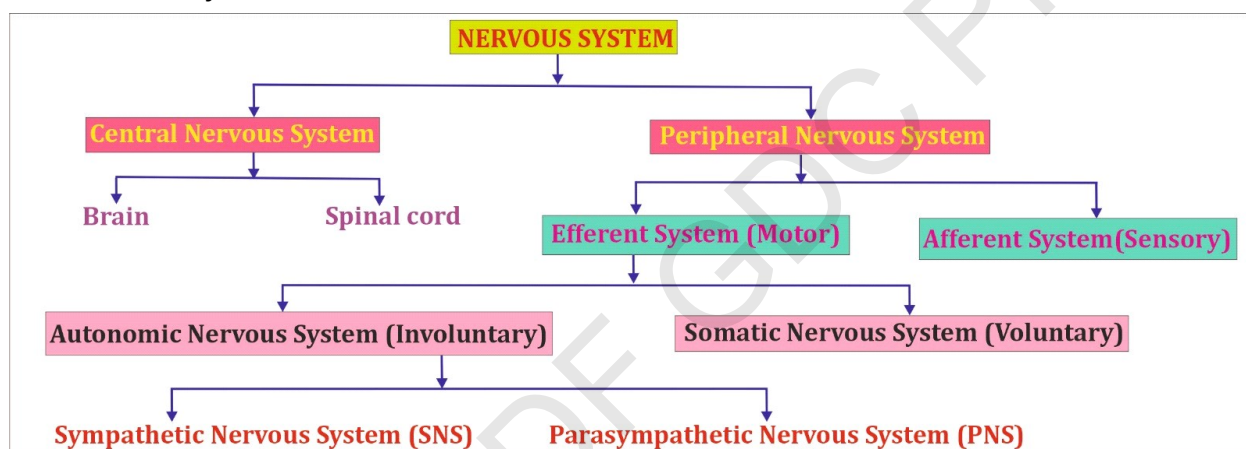
**Dr. Abhishek Tripathi**  
M.Pharm, PhD  
HOD, Pharmacology

# Introduction of Central Nervous System



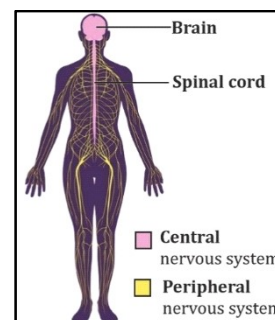
## INTRODUCTION OF NERVOUS SYSTEM

- The **nervous system** is the highly complex part of an animal that coordinates its actions and sensory information by transmitting signals to and from different parts of its body.
- The nervous system is divided into **two** anatomical divisions:



## CENTRAL NERVOUS SYSTEM (CNS)

- The **central nervous system (CNS)**, which is composed of the **brain** and **spinal cord**.
- CNS is the site of information processing and controlling unit.
- BRAIN**
  - It is the central information processing organ of our body.
- SPINAL CORD**
  - It is a complex organization of nerve cells responsible for **movement** and **sensation**.
  - It **carries signals** between brain and rest of the body.



## PERIPHERAL NERVOUS SYSTEM (PNS)

- The **peripheral nervous system (PNS)**, which includes **neurons** located outside the brain and spinal cord.
- The main function of the PNS is to connect the CNS to the limbs and organs, essentially serving as a relay between the brain and spinal cord and the rest of the body.

❖ **Toxicity**

- **Side effect of moderate alcohol intake:** Vomiting, Flushing.
- **Acute alcoholic intoxication:** Hypotension, Respiratory depression, Collapse, Coma and Death.

❖ **Withdrawal syndrome**

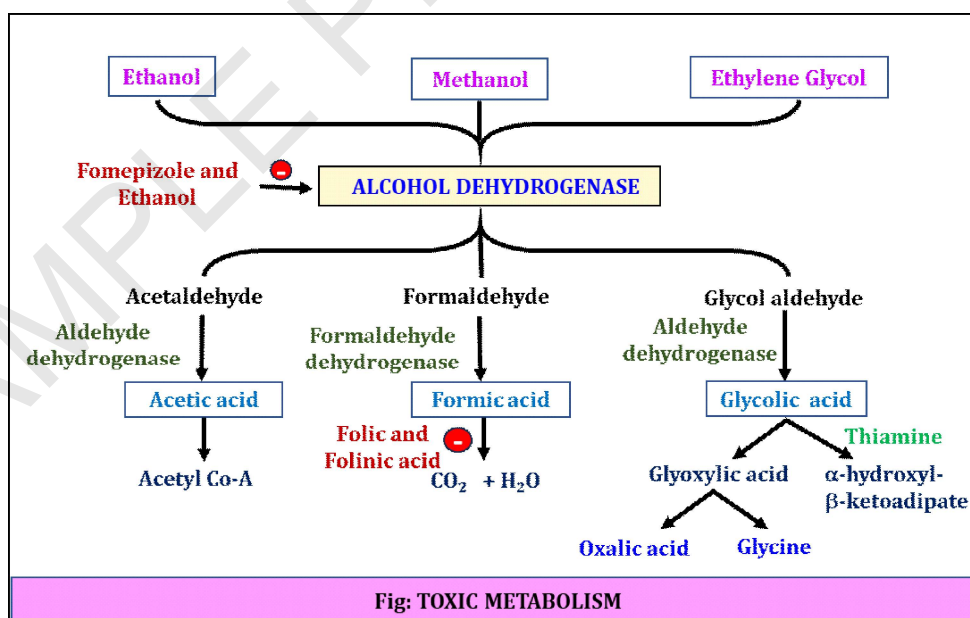
- When an alcohol dependent subject to stop drinking, withdrawal syndrome appears within a day and occur anxiety, sweating, tachycardia, and tremor, impairment of sleep, confusion, hallucinations, and delirium tremors.

**DRUG TREATMENT OF ALCOHOL INTOXICATION**

DRUG	MECHANISM OF ACTION
<b>Benzodiazepam</b>	Prevent withdrawal syndrome.
<b>Naltrexone</b>	Opioid antagonist, prevent relapse of alcoholic form.
<b>Acamprosate</b>	NMDA antagonist, used for maintenance therapy.
<b>Ondansetron</b>	5 HT <sub>3</sub> antagonist, blocks action of alcohol.
<b>Disulfiram</b>	Inhibits aldehyde dehydrogenase

**ALCOHOL METABOLISM**

- Alcohol is metabolized by several processes or pathways.
- The most common of these pathways involves two enzymes—**Alcohol dehydrogenase (ADH)** and **Aldehyde dehydrogenase (ALDH)**.
- These enzymes help break apart the alcohol molecule, making it possible to eliminate it from the body.

**Disulfiram**

- Disulfiram irreversibly inhibits **aldehyde dehydrogenase** and causes acetaldehyde to accumulate following ingestion of alcohol



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# PHARMACOLOGY

Module-5

THEORY Module

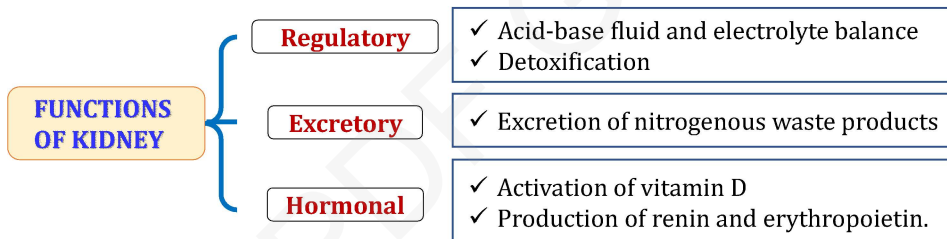
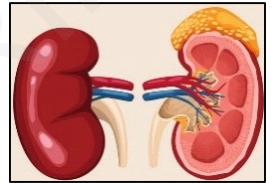


**Dr. Abhishek Tripathi**  
M.Pharm, PhD  
HOD, Pharmacology



## INTRODUCTION

- **Kidney** serves the body as a natural **filter of the blood**, and **removal of waste product**.
- **Nephron** is the **functional unit of kidney**.
- Diuresis is condition where **urine outflow increases**.
- Urine formation begin with **glomerular filtration (120 ml/min.)**  
[GPAT-2016]
- Volume filtered is about **180 L/day**.
- Urine excretion is about – **1.5 L/day**.
- **Diuretics** (natriuretics) are drugs which cause a net **loss of Na<sup>+</sup> and water** in urine.

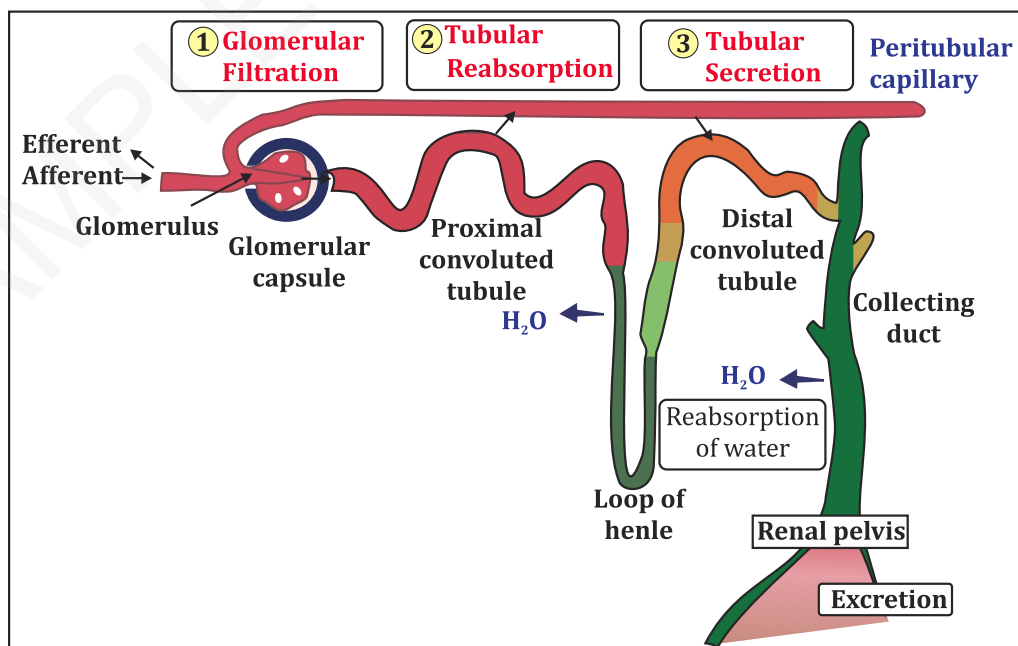


## MECHANISM OF URINE FORMATION

## 1. Glomerular Filtration

## 2. Tubular Reabsorption

## 3. Active Tubular Secretion





## INTRODUCTION

Blood is a body fluid in humans and other animals that delivers necessary substances such as **nutrients and oxygen** to the cells and transports metabolic waste products away from those same cells.

## TYPES OF BLOOD CELLS

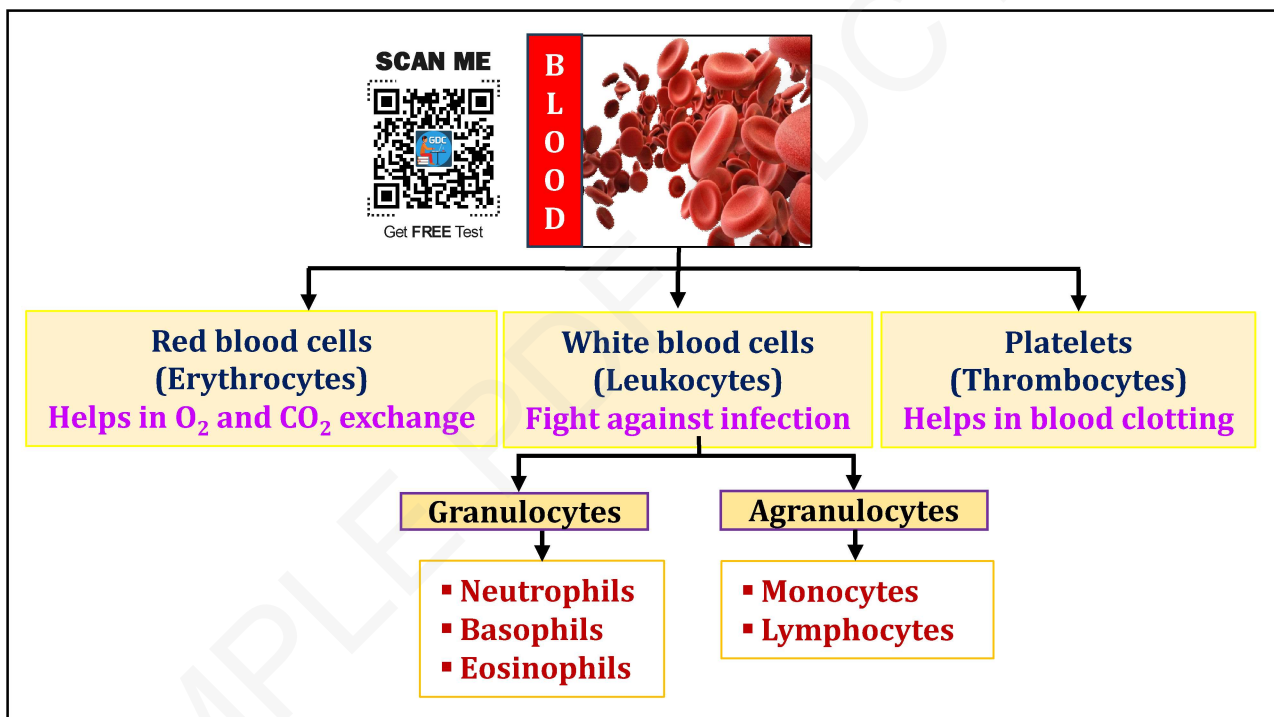


Fig. :- Types of blood cells

## HEMATINICS AND ERYTHROPOIETIN

### □ HEMOPOIESIS

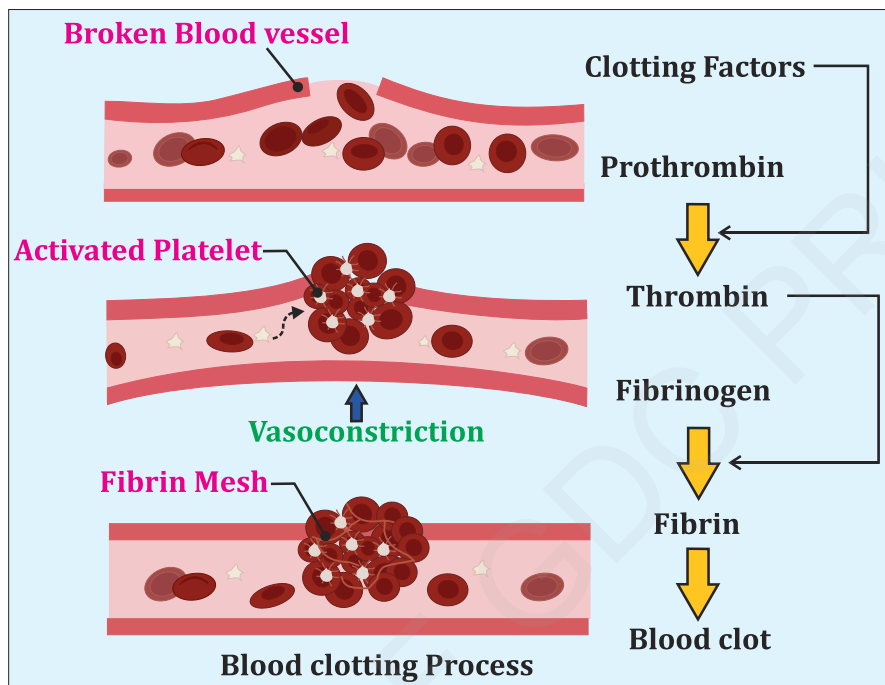
- It is the process of **formation and development** of the various types of blood cells and other formed element.
- Hemopoiesis takes place in the **red bone marrow** found in the epiphyses of long bones (**for example, the humerus and femur**).

### □ ERYTHROPOIETIN

- Erythropoietin (EPO) is a hormone produced primarily by the **kidney**.

### ❖ Stages of blood coagulation (Anticoagulant)

- Formation of prothrombin activator in response to rupture or damage to the blood vessels.
- Conversion of prothrombin activator to thrombin.
- The thrombin act as an enzyme to convert fibrinogen to fibrin thread that mesh platelets, Blood cells and plasma to form the clots.



## CLASSIFICATION OF ANTICOAGULANT DRUGS

CLASS	SUBCLASS	DRUGS
<b>PARENTERAL ANTICOAGULANT</b>	<b>Indirect thrombin inhibitor</b>	<ul style="list-style-type: none"> <li>• Heparin (unfractionated)</li> <li>• Low molecular weight heparins (Enoxaparin, Reviparin, Nadroparin, Dalteparin, Parnaparin),</li> <li>• Fondaparinux, Danaparoid</li> </ul>
	<b>Direct thrombin inhibitor</b>	<ul style="list-style-type: none"> <li>• Bivalirudin</li> <li>• Argatroban</li> </ul>
<b>ORAL ANTICOAGULANT</b>	<b>Vitamin K antagonist</b>	<ul style="list-style-type: none"> <li>• Bishydroxycoumarin (Dicoumarol), Warfarin sod.</li> <li>• Acenocoumarol (Nicoumalone)</li> <li>• Ethyl-biscoumacetate</li> </ul>
	<b>Direct factor Xa inhibitor</b>	<ul style="list-style-type: none"> <li>• Rivaroxaban</li> <li>• Apixaban</li> </ul>
	<b>Oral direct thrombin inhibitor</b>	Dabigatranetexilate



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# PHARMACEUTICAL ANALYSIS

Module-6



**Dr. Peeyush Jaiswal**

**M.Pharm, PhD**

(GATE-2008, 2009, GPAT-2010, 2011)

Director, GPAT Discussion Center Pvt. Ltd.

# Introduction of Analytical Techniques

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## INTRODUCTION

- Pharmaceutical analysis is a **branch of chemistry** which involves the application of **analytical procedures to ensure the purity, quality and safety** of pharmaceutical products.
- It involves qualitative and quantitative analysis that consists of series of procedures for the identification, determination, quantitation and purification.
- ❖ **Importance of Analytical Chemistry:**
  - The **shelf lives of many medicines are determined** with the help of analytical chemistry.
  - It is used to check for the **presence of adulterants in drugs**.
  - Analytical chemists can **test water samples** for any kind of contamination.

## TECHNIQUES INVOLVED IN PHARMACEUTICAL ANALYSIS

### TECHNIQUES IN PHARMACEUTICAL ANALYSIS

#### Qualitative Analysis

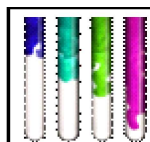
- It **identity atomic and molecular species** or the functional groups in samples.
- eg:**
  - Colour reaction tests
  - Limit tests
  - Melting point and boiling point determination
  - Precipitate formation etc.
  - Spectroscopy



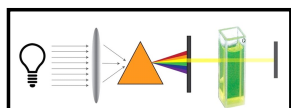
Precipitation



Boiling point



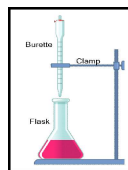
Coloured reaction



Spectroscopy

#### Quantitative Analysis

- It measures the **concentration or amount** of each substance in a sample.
- eg:**
  - Chemical Methods
    - Volumetric
    - Gravimetric
    - Gasometric
  - Physico-chemical Methods or Instrumental Methods



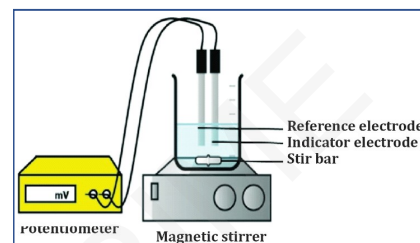
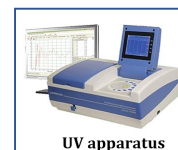
Volumetric analysis



Gasometric method

## 2. Instrumental method

Instrumental method	Instrument used
Absorption of radiation	X-ray, UV, Visible, IR, NMR
Emission of radiation	Fluorimetry, Flame photometry
Rotation of radiation	Polarimetry, Optical rotatory dispersion.
Electric potential	Potentiometry
Electric conductance	Conductometry
Electrical current	Polarography, Amperometry
Thermal properties	DTA, DSC



## 3. Chromatographic method

Where we use affinity or partition coefficient differences between drugs:

eg: Paper chromatography, Column chromatography, Thin layer chromatography, HPLC, HPTLC, Gas chromatography

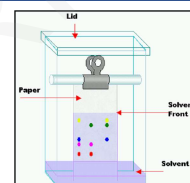
## 4. Microbiological method

Use microorganism for analysis.

eg: Microbiological assay of antibiotics and vitamins

## 5. Radioactive method

eg: RIA



## METHOD OF EXPRESSING CONCENTRATION

- In quantitative analysis the solution required should be expressed in concentration.

$$\text{Concentration} = \frac{\text{Amount of solute}}{\text{Amount of solvent}}$$

### ❖ Parts Per million(ppm)

- It is used to describe the **concentration of dilute solution**.
- For very dilute solution is expressed in parts per billion (ppb).
- It express the concentration of impurities in pharmaceuticals.

$$C_{\text{ppm}} = \frac{\text{Mass of solute (in gm)}}{\text{Mass of solution (in gm)}} \times 10^6 \text{ ppm}$$

Percent concentration	Concentration expressed in terms of percent ( <b>parts per 100</b> ).
	$\% \text{ w/w} = \frac{\text{Mass of solute (gm)}}{\text{Mass of solution (gm)}} \times 100$
	$\% \text{ v/v} = \frac{\text{Volume of solute}}{\text{Volume of solution}} \times 100$
	$\% \text{ w/v} = \frac{\text{Weight of solute}}{\text{Volume of solution}} \times 100$

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# PHARMACEUTICAL ANALYSIS

Module-7



**Dr. Peeyush Jaiswal**

**M.Pharm, PhD**

(GATE-2008, 2009, GPAT-2010, 2011)

Director, GPAT Discussion Center Pvt. Ltd.

# Introduction of Spectroscopy

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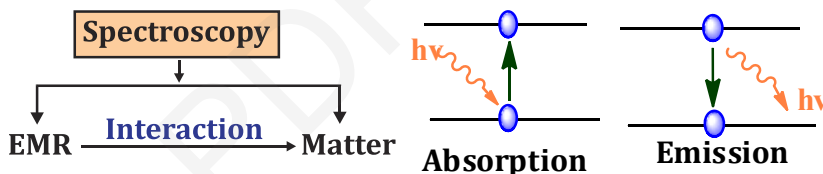


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## SPECTROSCOPY

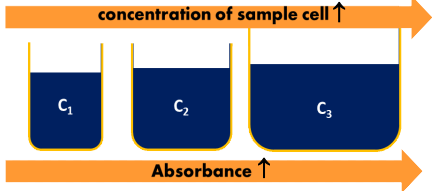
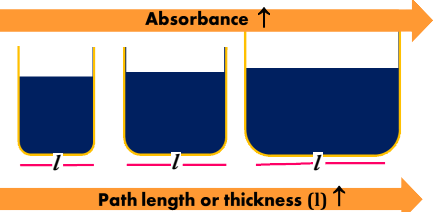
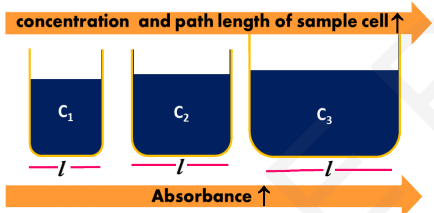
### BASIC OF SPECTROSCOPY

- It is the branch of science that deals with the study of interaction of **Electromagnetic Radiation with matter**.
- Spectroscopy involves the **measurement and interpretation of Electromagnetic Radiation (EMR) absorbed or emitted** when the **molecules or atoms or ions** of a sample move from **one energy state to another energy state**. [GPAT-2021]
- The emission or absorption of radiation is **quantized** and each quantum of radiation is called a **photon**.



### TYPES OF SPECTROSCOPY

TYPES	SUB-TYPES	EXAMPLE
Atomic or molecular level	Atomic spectroscopy	AAS, Flame photometry
	Molecular spectroscopy	UV, IR spectroscopy, Fluorimetry, Colorimetry
Absorption or emission	Absorption spectroscopy	UV, Colorimetry, IR, NMR and Atomic absorption spectroscopy
	Emission spectroscopy	Fluorimetry, Flame photometry
Electronic or magnetic level	Electronic spectroscopy	UV, Colorimetry, Fluorimetry, (study is done using EMR)
	Magnetic spectroscopy	NMR spectroscopy, ESR spectroscopy

IMPORTANT TERMS	FORMULA
<p><b>BEER'S LAW</b> [GATE-1988]</p> <p>Intensity of beam of monochromatic radiation decrease exponentially with increase in the concentration of absorbing species.</p> 	<p><b>Absorption</b> is proportional to <b>concentration</b> of absorbing species.</p> $I = I_0 e^{-kc} \text{ or } A \propto C$ <p><math>k</math> = proportionality constant or absorption coefficient  <math>A</math> = Absorption of medium  <math>c</math> = Concentration of medium</p>
<p><b>LAMBERT'S LAW</b></p> <p>Rate of decrease of intensity (monochromatic light) with thickness of medium is directly proportional to intensity of incident light.</p> 	<p><b>Absorption</b> is proportional to transmittance and <b>thickness</b> of medium.</p> $I = I_0 e^{-kl} \text{ or } A \propto l$ <p><math>A</math> = Absorption of medium  <math>l</math> = Thickness of medium</p>
<p><b>BEER'S LAMBERT'S LAW</b></p> <p>Absorption of solution is directly proportional to <b>thickness/pathlength</b> as well as <b>concentration</b> of the solution.</p> 	$I = I_0 e^{-kc} \text{ or } I = I_0 e^{-kl} = I = I_0 e^{-kc/l}$ $A = \log\left(\frac{I_0}{I_t}\right) = \epsilon c l$ <p>Where,  <math>A</math> = Absorbance  <math>c</math> = Concentration of solution (moles litre<sup>-1</sup>)  <math>l</math> = Path length of the sample (usually 1 cm)  <math>\epsilon</math> = Molar extinction coefficient (molar absorptivity)</p>
<p><b>TRANSMITTANCE (T)</b></p> <p>Ratio of radiant power transmitted by the sample (<math>I_t</math>) to the radiant power incident on the sample (<math>I_0</math>).</p>	$T = \frac{I_t}{I_0} \text{ or } \% T = \frac{I_t}{I_0} \times 100$
<p><b>OPACITY</b></p> <p>It is reciprocal of transmittance.</p>	$\frac{I_0}{I_t}$
<p><b>ABSORBANCE</b></p> <p>It is logarithm to the base 10 of the reciprocal of the transmittance [GATE-1993]</p>	$A = \log\left(\frac{1}{T}\right) \quad A = \log\left(\frac{I_0}{I_t}\right)$ $A = -\log T$
<p><b>MOLAR ABSORPTION COEFFICIENT</b></p> <p><math>\epsilon &lt; 100</math> are weakly absorbed.  <math>\epsilon &gt; 10,000</math> are intensely absorbed.</p>	$\epsilon = \frac{A}{c \cdot l}$

## A. Woodward-fieser rules for dienes, trienes and polyenes [GATE-2008, GPAT-2014, 2023]

## Parent value

- Acyclic conjugated diene - **217 nm**
- Homoannular conjugated diene - **253 nm**
- Heteroannular conjugated diene - **215 nm**

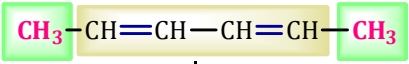
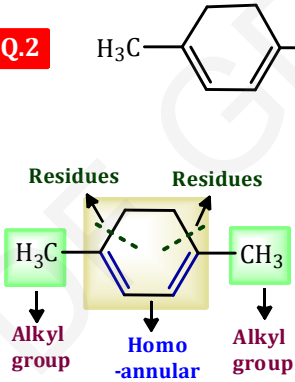
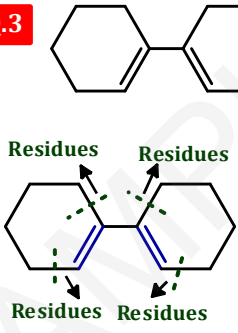
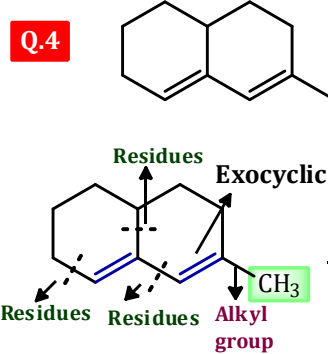
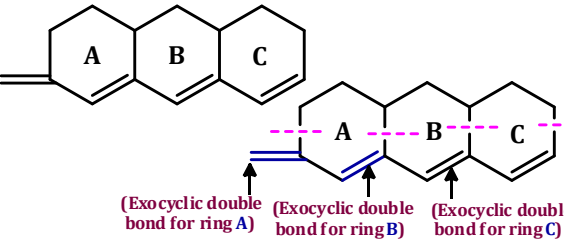
## Increments

- Alkyl substituent or Ring residue - **+ 5 nm**
- Exocyclic double bond - **+ 5 nm**
- Double bond extending conjugation - **+ 30 nm**

## Auxochromes

- -Cl, -Br - **+ 5nm**
- -OH/-OR/-SH - **+ 6nm**
- -SR - **+ 30nm**
- -OCOCH<sub>3</sub> - **+ 0nm**
- -NR<sub>2</sub> - **+ 60nm**

## Q. Calculate the absorption maximum in the ultra-violet spectrum of compounds given below:

Alicyclic diene		Homoannular conjugated diene	
<b>Q.1</b> <chem>CH3-CH=CH-CH=CH-CH3</chem>  Alkyl group      Alicyclic diene      Alkyl group Alicyclic diene (Basic value) = 217nm 2 Alkyl substitution (2 x 5) = 10 nm <hr/> <b>Calculate value</b> = 227nm <b>Observed value*</b> = 227nm	<b>Q.2</b> <chem>Cc1ccc(C)cc1</chem>  Residues      Residues Alkyl group      Homo-annular      Alkyl group Homoannular (Basic value) = 253nm 2 Alkyl substitution (2 x 5) = 10 nm 2 Ring residues (2 x 5) = 10 nm <hr/> <b>Calculate value</b> = 273nm <b>Observed value*</b> = 265nm		
Hetero-annular conjugated double bonds			
<b>Q.3</b> <chem>C1=CCCCC1C2=CCCCC2</chem>  Residues      Residues Residues      Residues (Basic value) = 215nm 4 Ring residues = 20 nm (4 x 5) <hr/> <b>Calculate value</b> = 235nm <b>Observed value*</b> = 234nm	<b>Q.4</b> <chem>C1=CCCCC1C2=CCCCC2C</chem>  Residues      Exocyclic Residues      Alkyl group (Basic value) = 215 nm 1 Exocyclic = 5nm 1 Alkyl subs = 5nm 3 Ring residues = 15 nm <hr/> <b>Calculate value</b> = 240nm <b>Observed value*</b> = 239nm		
Double bond extending conjugation			
<b>Q.5</b> <chem>C=CC1=CC=CC=C1C2=CC=CC=C2C3=CC=CC=C3</chem>  (Exocyclic double bond for ring A)      (Exocyclic double bond for ring B)      (Exocyclic double bond for ring C)	Parent acyclic conjugated diene = 217 nm Double bond exd. conjugation (2 x 30) = 60 nm Exocyclic double bond (3x5) = 15 nm Ring residue (5x4) = 20 nm <hr/> <b>Calculate value</b> = 312 nm		



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# PHARMACEUTICS

Module-8



**Dr. Peeyush Jaiswal**

**M.Pharm, PhD**

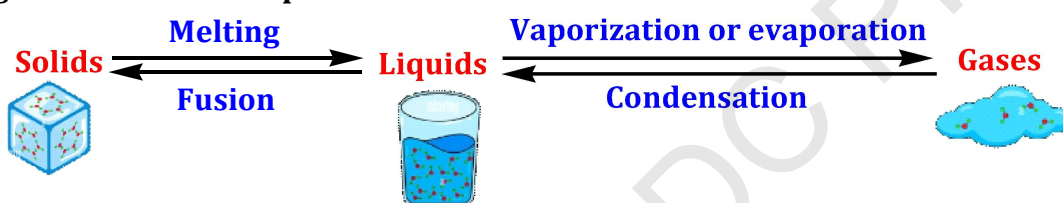
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## INTRODUCTION

- Gases, Liquids, and Crystalline solids are the three primary states of matter or phases.
- ✓ **Sublimation** :- It is a process of transition of a substance directly from a solid state to a gas state  
e.g. - Iodine and Camphor



## THE GASEOUS STATE

- A gas is a substance that has **no fixed size or shape**.
- The physical behaviour of gases is independent of chemical nature of the molecules.
- The **Barometer** is used to pressure measurement.
- Molecules in a gas are always in state of **vigorous & rapid motion**, these travel in random paths.

## □ TEMPERATURE CONVERSION FORMULA

- Refer to changing the value of temperature from one unit to another.
- ✓ **The temperature conversion formula**

$$K = C + 273.15$$

## ❖ Examples

**Que :-** Convert 16°C into Kelvin

**Solution :-** C = 16°C

$$\begin{aligned} K &= C + 273.15 \\ &= 16 + 273.15 \\ &= \mathbf{289.15 \text{ K}} \end{aligned}$$

**Que :-** Convert 225 K to Celsius

**Solution :-** K = 225

$$\begin{aligned} C &= K - 273.15 \\ &= 225 - 273.15 \\ &= \mathbf{-48.15^\circ\text{C}} \end{aligned}$$

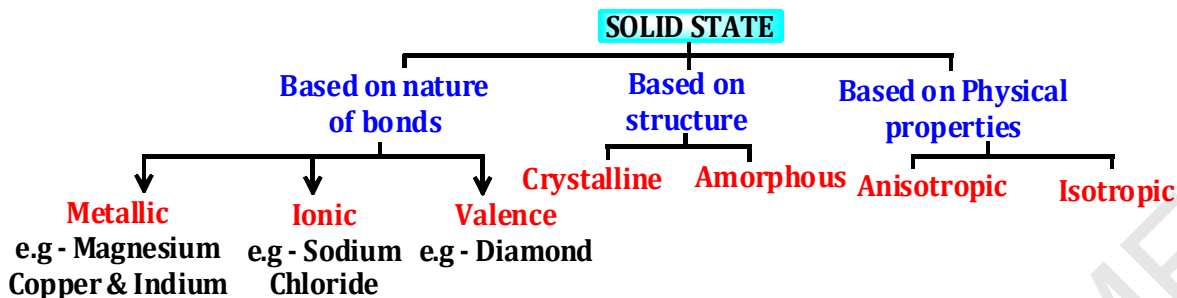
## □ IDEAL GAS LAW

- The laws which deal with ideal gases are naturally called ideal gas laws.

$$PV = nRT$$

- Where, **P** = Pressure  
**V** = Volume  
**R** = Gas constant (**1.98 7 calories/mole**) [GPAT - 2021]  
**T** = Absolute temperature

❑ **CLASSIFICATION OF SOLID STATE**



❑ **CRYSTAL**

- Crystalline solids are arranged in **fixed geometric patterns or lattices**.
- Definite shape and an **orderly arrangement of units**.
- Crystallinity is defined as a coordination of matter resulting from an orderly cohesive **three dimensional arrangement** of its component particles in space.
- The **smallest geometrical** portion of the crystal, which is a repetitive unit to build up the whole crystal, is called a unit cell. [GPAT- 2012]

❖ **Crystal systems**

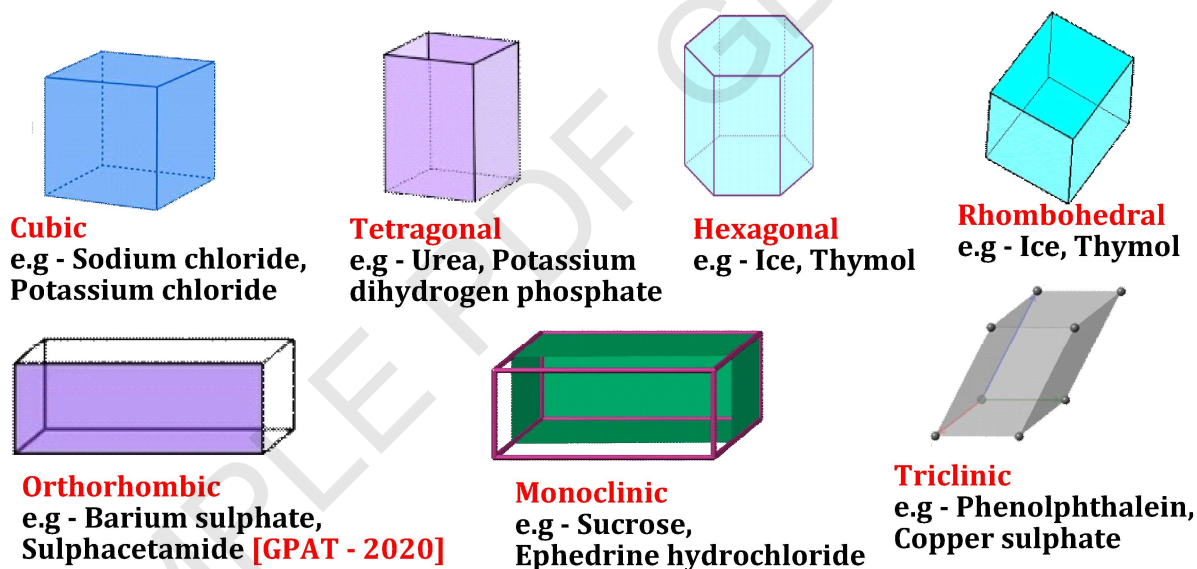


FIG : DIFFERENT CRYSTAL SYSTEMS WITH EXAMPLES

❖ **Lattice**

- When **motifs (commas)** are substitute by points (nodes) the pattern is called a lattice.
- **Three dimensional arrangement** is called as crystal lattice or space lattice.
- Motif is represented by a Commas repeated on the lattice [GPAT- 2018]

❖ **Crystal habit**

- Crystal habit is the description of the **outer appearance of a crystal**. The arrangement of planar faces in the polyhedral solid is termed as a habit [GPAT- 2012]



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# PHARMACEUTICS

Module-9



**Dr. Peeyush Jaiswal**

**M.Pharm, PhD**

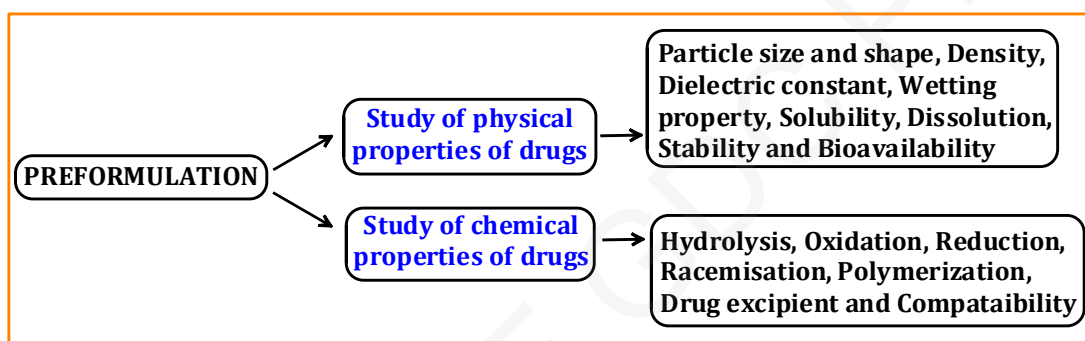
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## INTRODUCTION

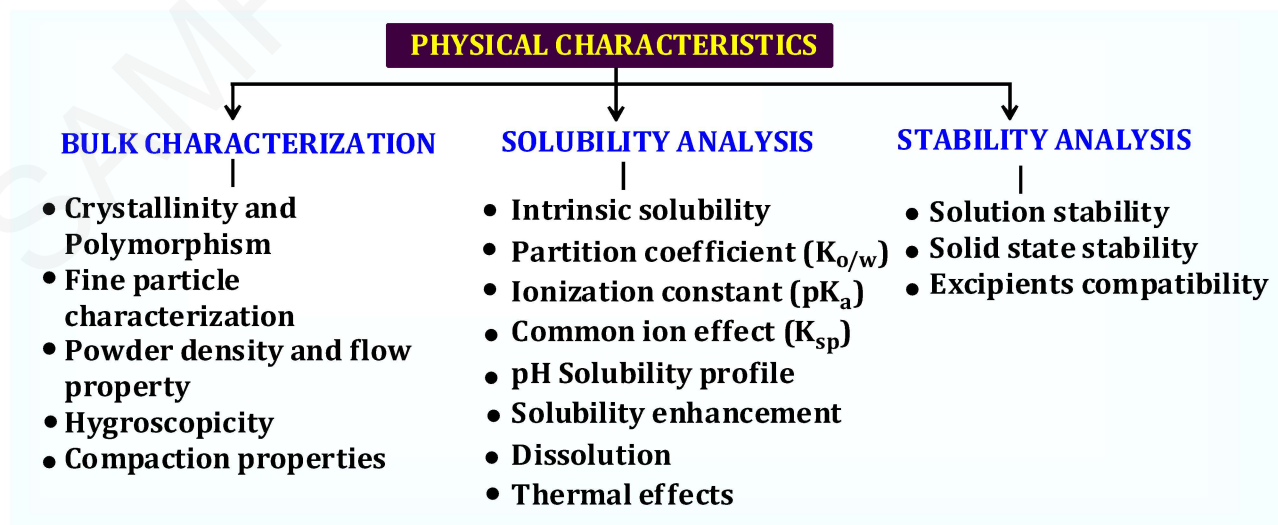
- It is defined as the phase of **research and development** in which preformulation studies characterize **physical and chemical properties** of a drug molecule in order to develop **safe, effective and stable dosage form**.



### ❖ Objective

- Develop the **most safe, stable and efficacious dosage** form with **maximum bioavailability**.
- To determine its **kinetics and stability**.
- Produce necessary and **useful data for development** of analytical methods.
- Determine **most stable polymorph** and salts forms that give **maximum bioavailability**.
- Minimize the time and money required for formulations.

## PHYSICAL CHARACTERISTICS



<b>Packing properties</b> [GPAT-2020]	<ul style="list-style-type: none"> <li>• Molar volume and density</li> <li>• Refractive index</li> <li>• Conductivity electrical and thermal</li> <li>• Hygroscopicity</li> </ul>
<b>Kinetic properties</b>	<ul style="list-style-type: none"> <li>• Dissolution rate</li> <li>• Rates of solid state reactions</li> <li>• Stability</li> </ul>
<b>Surface properties</b>	<ul style="list-style-type: none"> <li>• Surface free energy</li> <li>• Interfacial tensions</li> <li>• Habit (i.e. shape)</li> </ul>
<b>Mechanical properties</b>	<ul style="list-style-type: none"> <li>• Hardness</li> <li>• Tensile strength</li> <li>• Compactibility tableting</li> <li>• Handling flow and blending</li> </ul>

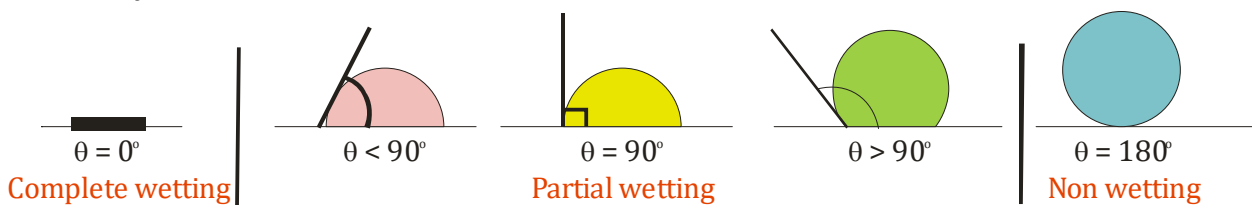
## DETERMINATION OF SURFACE AREA

CHARACTERISTICS	SURFACE AREA MEASURED BY	
	ADSORPTION METHOD	AIR PERMEABILITY METHOD
<b>Definition</b>	Volume of nitrogen absorbed to form a monolayer	Rate at which gas or liquid permeates a bed of powder
<b>Equations</b>	<b>BET Equation</b> $\frac{P}{V(p_o - p)} = \frac{1}{V_m b} + \frac{(b-1)p}{V_m b p_o}$	<b>Poiseuille's Equation</b> $V = \frac{\pi \Delta p r^2 t}{8 \eta L}$ <b>Kozeny - Carman Equation</b> $V = \frac{A}{\eta S^2} + \frac{\Delta P}{KL} \times \frac{\epsilon^2}{(1-\epsilon)^2}$
<b>Instrument</b>	Quantasorb	Fisher subsieve sizer
<b>Detector</b>	Thermal conductivity	Water monometer

## WETTING AGENTS

- The wetting agent molecule has a portion with an affinity for the particle surface and a portion with an affinity for water.
- It facilitates intimate contact of the liquid with particle surfaces.
- Wetting agents for concentrates are usually nonionic surfactants.

CONTACT ANGLE (COS θ)	DEGREE OF WETTING
θ = 0	Perfect wetting
0 < θ < 90°	High wettability
90° ≤ θ < 180°	Low wettability
θ = 180°	Perfectly non-wetting





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# PHARMACEUTICS

Module-10



**Dr. Peeyush Jaiswal**

**M.Pharm, PhD**

(GATE-2008, 2009, GPAT-2010, 2011)

Director, GPAT Discussion Center Pvt. Ltd.

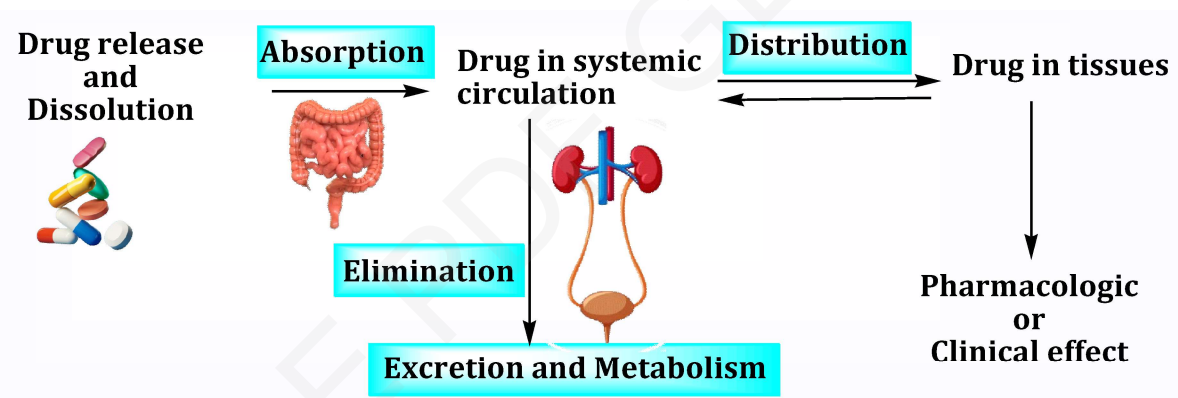
# Introduction of Biopharmaceutics

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## INTRODUCTION

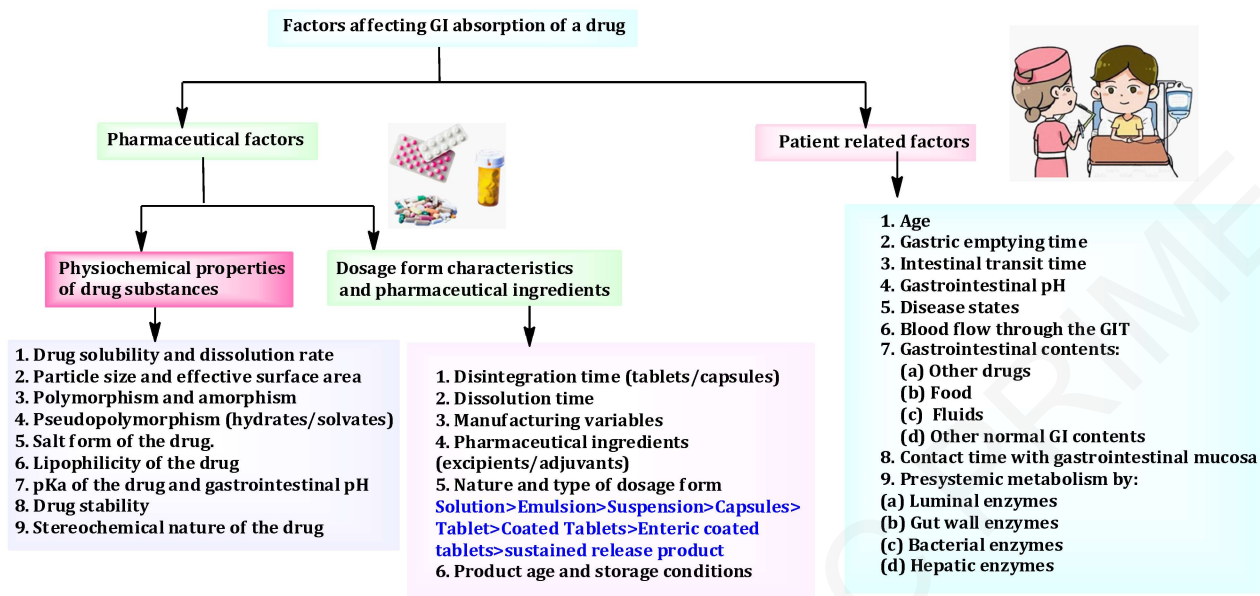
- **Biopharmaceutics** is defined as the **study of factors influencing the rate and amount of drug that reaches the systemic circulation** and the use of this information to optimise the **therapeutic efficacy of drug products**.
- **Bioavailability** is defined as **Rate and extent (amount) of drug absorption**.
- **Pharmacokinetics** is the quantitative study of drug movement in, through and out of the body. Simply speaking, pharmacokinetics is **the kinetics of ADME or KADME**. Pharmacokinetic is a study of **what the body does to the drug**. It relates **changes in concentration of drug within the body with time after its administration**.



**Fig.-Pharmacokinetic Process**

- **Clinical pharmacokinetics** uses of pharmacokinetic principles in optimising the drug dosage to suit individual patient needs and achieving **maximum therapeutic utility**.
- **Absorption**- The **process of movement of drug** from its site of administration to the **Systemic circulation**.
- **Distribution**- Movement of drug between one compartments to another (**Blood and the Extravascular tissue**).
- **Biotransformation**- Usually **inactivates the drug**. Also known as **Metabolism**.
- **Elimination**- Process that tends to **remove the drug from the body** and terminates its action.
- **Excretion**- Responsible for exit of drug/metabolites from the body.
- **Pharmacodynamics** is a study of **what the drug does to the body**. It related **response to Concentration of drug in the body**.
- **Dosage regimen** is the manner in which the drug is to be taken. The schedule of dosing (e.g., four times a day for 10 days) is referred to as the **dosage regimen**.

## FACTORS INFLUENCING GI ABSORPTION OF A DRUG



## BIOPHARMACEUTICS CLASSIFICATION SYSTEM FOR DRUGS [GPAT-2015, 2016]

CLASS	SOLUBILITY	PERMEABILITY	ABSORPTION PATTERN	RATE LIMITING STEP IN ABSORPTION	EXAMPLES
I	High	High	Well absorbed	Gastric emptying	Diltiazem, Metoprolol, Propranolol
II	Low	High	Variable	Dissolution	Nifedipine, Ketoprofen, Carbamazepine
III	High	Low	Variable	Permeability	Insulin, Ranitidine, Atenolol
IV	Low	Low	Poorly absorbed	Case by case	Taxol

## THEORIES OF DRUG DISSOLUTION

- Dissolution is a process in which a solid substance solubilizes in a given solvent Mass transfer from the **solid surface to the liquid phase**.

- Diffusion layer model/Film theory.
- Danckwert's model/Penetration or Surface renewal theory.
- Interfacial barrier model/Double-barrier or Limited solvation theory.



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# ORGANIC CHEMISTRY

## Module-11



**Dr. Peeyush Jaiswal**

M.Pharm, PhD

(GATE-2008, 2009, GPAT-2010, 2011)

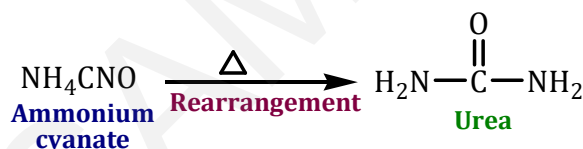
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# Classification and Nomenclature of Organic Compounds



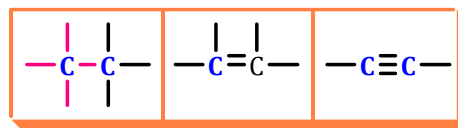
## INTRODUCTION

- Organic chemistry is the major branch of chemistry which deals with the scientific study of preparation, structure, properties, composition and reactions of carbon containing compounds.
- In organic chemistry, not only hydrocarbons are studied but also compounds in which carbon is bonded with any other atoms like oxygen, halogens, nitrogen, phosphorus and sulfur etc.
- Almost all organic compounds contain at least one carbon hydrogen bond (C-H) in it.
- ❖ **VFT (Vital Force Theory): By Berzelius in 1815.**
- Upto 1815, any organic compound could not be synthesized in lab. So Berzelius suggested that there is a mysterious force in living organisms which was named as **Vital Force** and said that organic compounds cannot be synthesized in lab. This theory was called as VFT.
- But in 1828 a German scientist Wohler synthesized an organic compound in lab.** Which was 'urea'. So VFT was failed. Urea was synthesized in lab by heating of Ammonium cyanate ( $\text{NH}_4\text{CNO}$ ).

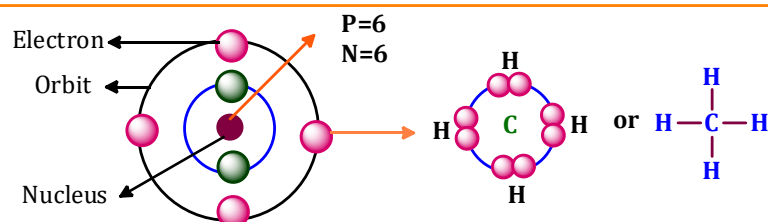


## CHARACTERISTICS OF CARBON ATOMS

- Atomic number of Carbon - 6
- Electronic configuration is 2,4 [ $1s^2, 2s^2, 2p^2$ ]
- Valence of electrons - 4
- Tendency to form multiple bonds
- Due to tetravalency of carbon it has a **tetrahedron shape**.



Mass number. [Protons (P) + Neutrons (N)] ← 12  
 Atomic number (Protons) ← 6  
 C → Symbol of element



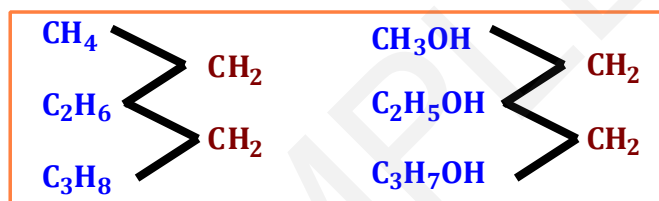
- Catenation:** The self-linking property of carbon atoms through covalent bonds to form long, straight or branched chains and rings of different sizes is called catenation.

Alcohols	R-OH	Amide	R-CONH <sub>2</sub>
Ethers	R-O-R'	Nitro	R-NO <sub>2</sub>
Aldehydes (Aldehydic)	R-CHO	Isocyanide	R-NC
Ketones (Ketonic)	R-CO-R'	Cyanide/Nitriles/Cyno	R-CN
Acid halides	R-CO-X	Thiol	R-SH

- Certain compounds contain more than one functional groups. Such compounds are called polyfunctional compounds.
- The properties of each functional group may be modified by the presence of the others.

### □ HOMOLOGOUS SERIES

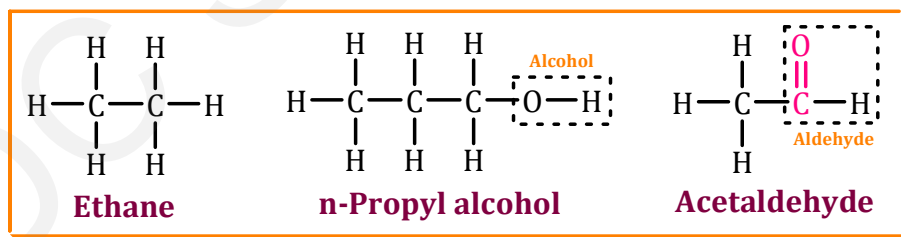
- A homologous series can be defined as a group of compounds in which the various members **have similar structural features and similar chemical properties and the successive members differ in their molecular formula by CH<sub>2</sub>**.
- The two adjacent members are differing by a **-CH<sub>2</sub> - group or (CH<sub>2</sub>=12+2 × 1=14) 14 atomic mass unit**.



### □ SATURATED AND UNSATURATED COMPOUNDS

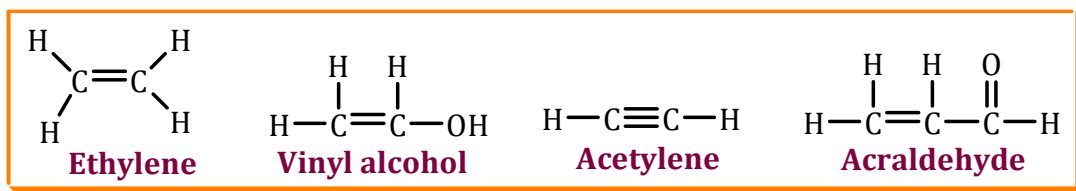
#### ➤ Saturated Compounds

- If, in an organic compound containing **two or more carbon atoms, there are only single bonds** between carbon atoms, then the compound is said to be saturated, **e.g., ethane, n-propyl alcohol, acetaldehyde, etc.**



#### ➤ Unsaturated Compounds

- On the other hand, if the compound contains **at least one pair of adjacent carbon atoms linked by a multiple bond**, then that compound is said to be unsaturated, **e.g., ethylene, acetylene, vinyl alcohol, acraldehyde, etc.**





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**PHYSICAL AND  
INORGANIC CHEMISTRY**

**Module-12**



**Dr. Peeyush Jaiswal**

**M.Pharm, PhD**

(GATE-2008, 2009, GPAT-2010, 2011)

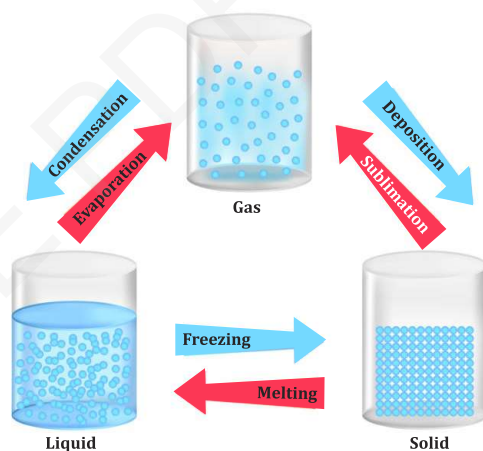
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## PHYSICAL PROPERTIES OF MATTER

PARAMETER	SOLID	LIQUID	GAS
<b>Shape</b>	Definite shape	Indefinite shape	No definite shape
<b>Volume</b>	Definite Volume	Indefinite Volume	Indefinite Volume
<b>Inter particular Forces</b>	Strong	Comparatively weaker	Negligible
<b>Inter particular Space</b>	Negligible	Comparatively large	Very large
<b>Packing of Particles</b>	Particles are very Closely packed	Particles are loosely packed	Particles are loosely packed
<b>Density</b>	Very High Density	Low Density	Very low density

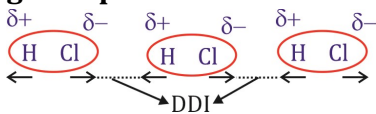
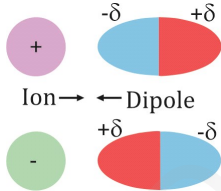
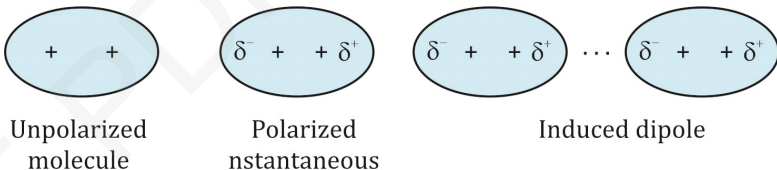
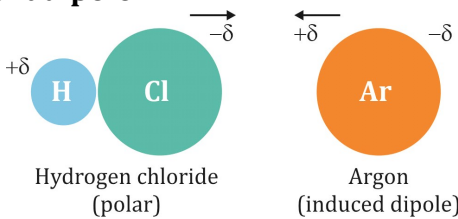
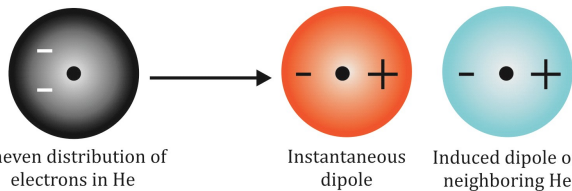
## CHANGING STATES OF MATTER



## GASEOUS STATE

## IMPORTANT MEASURABLE PROPERTIES OF GASES

<b>Mass</b>	It is expressed in gram or kg.
<b>Volume</b>	It is equal to the volume of the container and is expressed in terms of liter (L), Milliliter (mL), Cubic centimeter (cm <sup>3</sup> ), Cubic meter (m <sup>3</sup> ) or Cubic decimeter (dm <sup>3</sup> ). 1 L = 1000 mL = 1000 cm <sup>3</sup> = 1 dm <sup>3</sup> 1 m <sup>3</sup> = 10 <sup>3</sup> dm <sup>3</sup> = 10 <sup>6</sup> cm <sup>3</sup> = 10 <sup>6</sup> mL = 10 <sup>3</sup> L

FORCE	DESCRIPTION
<b>Dipole dipole interactions</b>	<ul style="list-style-type: none"> <li>Dipole-dipole interactions are attractive forces among <b>polar molecules</b>.</li> <li>Polar molecules have <b>permanent dipoles</b> that are formed due to <b>differences in the electronegativities of the atoms</b> that are associated with a covalent bond.</li> <li>The <b>partially positive portion</b> of one molecule is attracted to the <b>partially negative portion</b> of another molecule</li> </ul> 
<b>Ion-Dipole Interactions</b>	<ul style="list-style-type: none"> <li>This is the interaction between an ion and a polar molecule.</li> <li>When NaCl dissolved in water, the polar water molecules are attracted towards Na<sup>+</sup> as well as towards Cl<sup>-</sup>.</li> </ul> 
<b>Ion Induced Dipole Interactions</b>	<ul style="list-style-type: none"> <li>In this type of interaction, a <b>non-polar molecule is polarized</b> by an ion placed near it.</li> <li>The <b>non-polar molecules, upon obtaining a charge</b>, behave as induced dipoles.</li> <li>This interaction between <b>an ion and an induced dipole</b> is known as ion-induced dipole interaction.</li> </ul> 
<b>Dipole-induced dipole forces</b>	<ul style="list-style-type: none"> <li>Dipole-induced dipole forces act between the <b>polar molecules having permanent dipole</b> and the <b>molecules lacking permanent dipole</b>.</li> </ul> 
<b>Dispersion forces or London forces</b>	<ul style="list-style-type: none"> <li>It operates for a <b>short distance and it is the weakest force</b>.</li> <li>This kind of force arises due to the movement of electrons thus creating <b>temporary positive and negative charged regions</b>.</li> </ul> 



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# MEDICINAL CHEMISTRY

## Module-13



**Dr. Peeyush Jaiswal**

**M.Pharm, PhD**

(GATE-2008, 2009, GPAT-2010, 2011)

Director, GPAT Discussion Center Pvt. Ltd.

# Basic Rings of Medicinal Compounds (Important Heterocyclic Atoms)

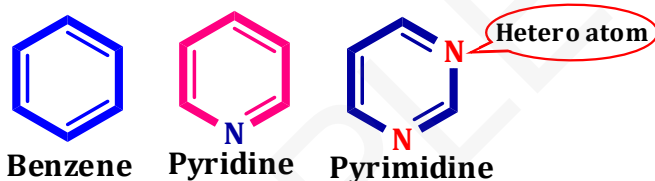


## INTRODUCTION

### What Is Hetero Atom?

Heterocyclic compounds are cyclic organic compounds containing **at least one heteroatom (other than carbon)** in the ring system, such as **nitrogen (N), oxygen (O), or sulfur (S)**.

**Hetero Atom**  $\Rightarrow$  Other than Carbon and Hydrogen



## NOMENCLATURE OF HETEROCYCLIC NUCLEUS




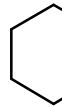

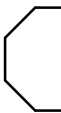


The **Hantzsch-Widman nomenclature** is based on the **type** of the heteroatom; the **ring size** and **nature** of the ring, whether it is saturated or unsaturated. This system of nomenclature applies to monocyclic **three-to-ten-membered ring heterocycles**.

### Type of heteroatom:

The type of Heteroatom is indicated by a prefix as shown below for common heteroatoms.

Elements	Oxygen	Sulfur	Nitrogen	Phosphorus
Prefix	Oxa	Thia	Aza	Phospha

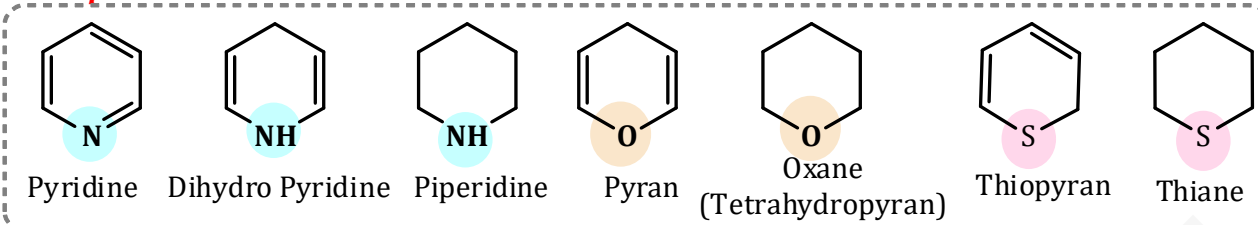
The **ring size** is indicated by a suffix according to table below

Ring								
Ring size	3	4	5	6	7	8	9	10
Suffix	ir	et	ol	in	ep	oc	on	ec

## PREFIX AND SUFFIX FOR SATURATED AND UNSATURATED RINGS

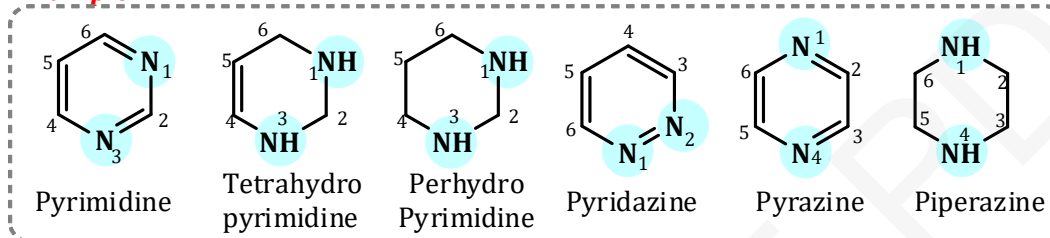
Ring size	Saturated	Unsaturated	Saturated (with Nitrogen)
3	-irane	-irene	-iridine
4	-etane	-ete	-etidine

**Example**



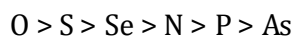
❖ **6-Membered Rings with Two Hetero Atoms**

**Example**

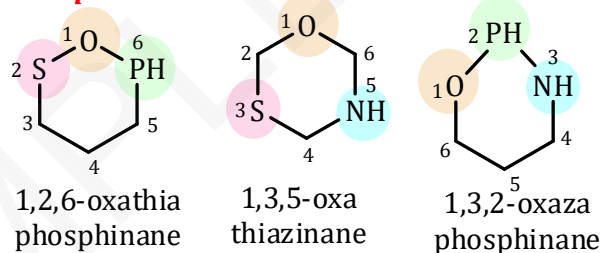


❖ **6-Membered Rings with Three Hetero Atoms**

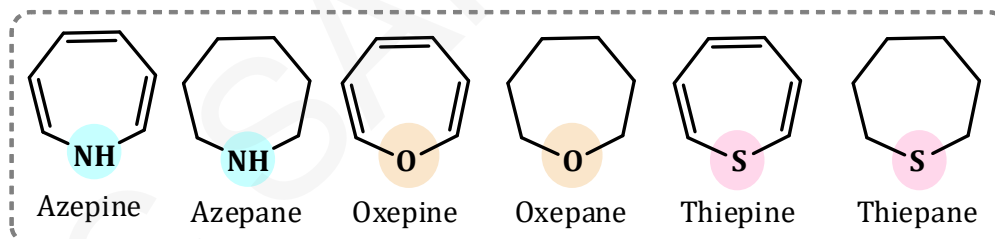
When more than two different heteroatoms are present in a heterocyclic compound, they should be named in the following order:



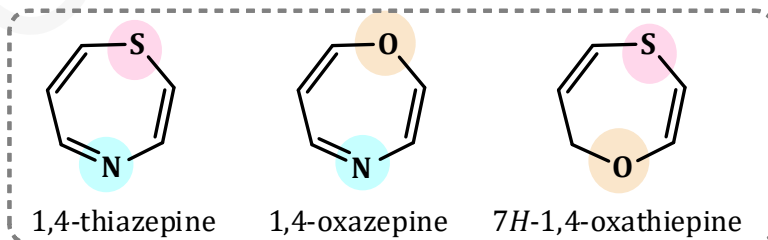
**Example**



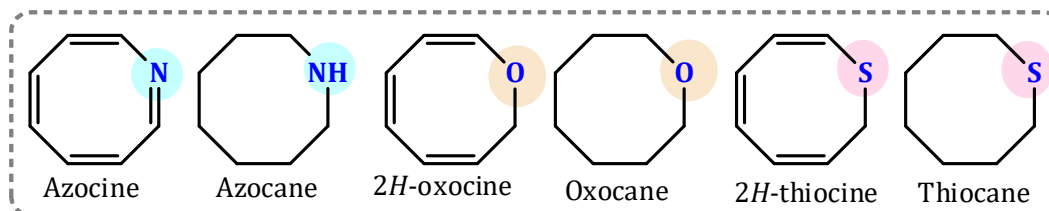
❖ **7 Membered Rings with One Heteroatom**



❖ **7 Membered Rings with Two Heteroatoms**



❖ **8 Membered Rings with One Heteroatom**





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**BIOCHEMISTRY,  
BIOTECHNOLOGY,  
MICROBIOLOGY**

**Module-14**



**Dr. Peeyush Jaiswal**

**M.Pharm, PhD**

(GATE-2008, 2009, GPAT-2010, 2011)

Director, GPAT Discussion Center Pvt. Ltd.



## INTRODUCTION OF BIOCHEMISTRY

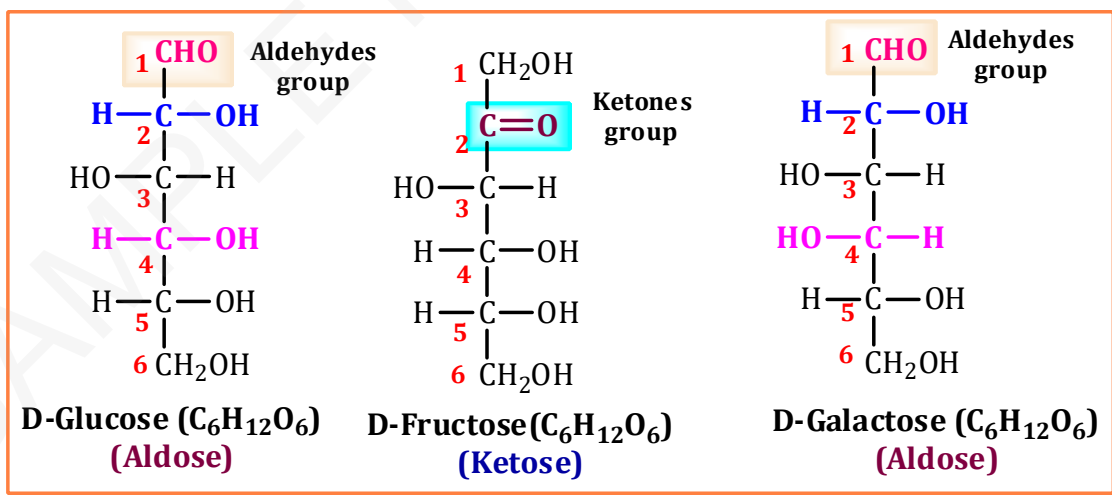
- **Biochemistry** can be simply defined as, “**chemistry of the living cell**”.
- The term Biochemistry was introduced by **Carl Neuberg in 1903**.
- The living matter is composed of mainly six elements—carbon, hydrogen, oxygen, nitrogen, phosphorus and sulfur.



Carl Neuberg

## INTRODUCTION OF CARBOHYDRATE

- Carbohydrates are the most abundant organic molecules in nature.
- Carbohydrates are the main **sources of energy in the body**.
- **Brain cells and RBCs are** almost wholly dependent on carbohydrates as the energy source.
- The general molecular formula of **carbohydrates** is  $C_n(H_2O)_n$ . For example, glucose has the molecular formula  $C_6H_{12}O_6$ .
- Ratio of hydrogen and oxygen is 2:1. **[GPAT-2023]**
- Carbohydrates may be defined as polyhydroxy alcohols with aldehydes or ketones and their derivatives.



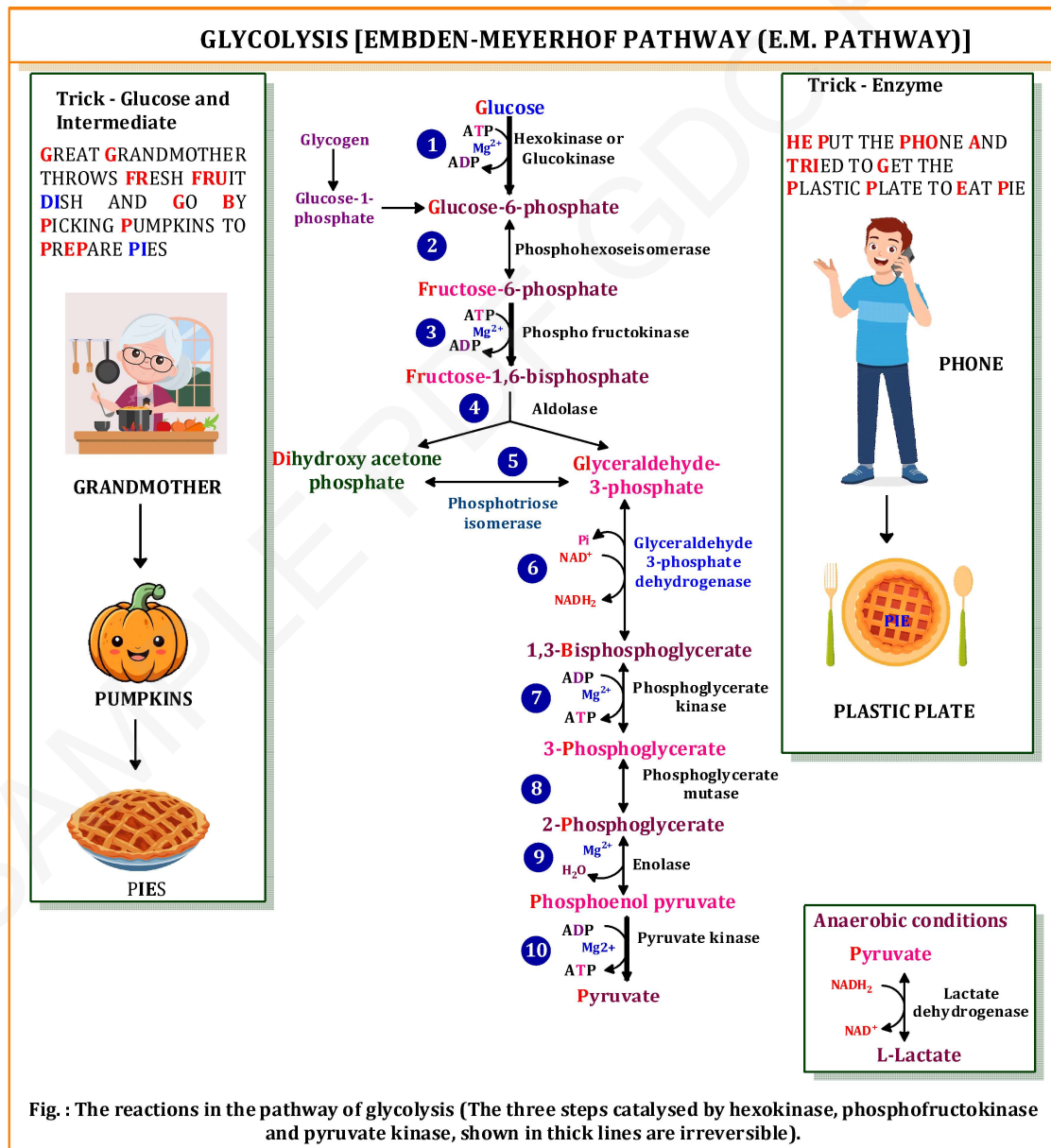
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## GLYCOLYSIS [EMBDEN-MEYERHOF PATHWAY (E.M. PATHWAY)]

- Glycolysis is defined as the sequence of reactions **converting glucose (or glycogen) to pyruvate or lactate**, with the production of ATP. [GATE-2000, 2001, 2004, GPAT-2016, 2022]
- Glycolysis is very essential for **brain** which is dependent on glucose for energy.
- **Glucose 6-phosphate is impermeable** to the cell membrane. It is a central molecule with a variety of metabolic fates—**glycolysis, glycogenesis, gluconeogenesis and pentose phosphate pathway**.
- The three enzymes namely **hexokinase (glucokinase), phosphofructokinase and pyruvate kinase, catalyzing the irreversible reactions regulate glycolysis**.
- In anaerobic conditions of glycolysis are 2 ATP synthesized.





# Easy to Learn

## HUMAN ANATOMY AND PHYSIOLOGY, PATHOPHYSIOLOGY AND HOSPITAL AND CLINICAL PHARMACY

### Module-15



**Dr. Peeyush Jaiswal**

**M.Pharm, PhD**

(GATE-2008, 2009, GPAT-2010, 2011)





Director, GPAT Discussion Center Pvt. Ltd.





## INTRODUCTION

- Tissue is a group of cells that have **similar structure and that function together as a unit.**
- A **non-living material**, called the **intercellular matrix**, fills the spaces between the cells.

## TYPES OF TISSUE

			
Epithelial Tissue	Muscle Tissue	Connective Tissue	Nervous Tissue
<b>Origin</b> Ectoderm, Endoderm Mesoderm	<b>Origin</b> Mesoderm	<b>Origin</b> Mesoderm	<b>Origin</b> Ectoderm

## ORIGIN AND MAIN ROLE OF MAJOR TISSUES [GPAT-2013, 2015, 2016, 2024]

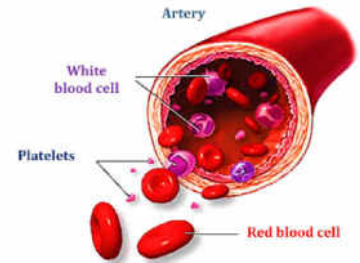
NAME	SUB TYPE	MAIN FUNCTION
<b>Epithelial tissue</b> (Covering Lining) 	<b>Simple Epithelial</b> i. Simple squamous (Pavement) ii. Simple cuboidal iii. Simple columnar iv. Pseudostratified epithelium	<ul style="list-style-type: none"> <li>• Protection, secretion, absorption, excretion reproduction</li> <li>• <b>Protect tissues</b> from friction and injury</li> <li>• <b>Regulate and exchange of chemicals</b> between the underlying tissues and a body cavity</li> </ul>
	<b>Compound Epithelial</b> i. <b>Stratified epithelium</b> ✓ Stratified squamous <ul style="list-style-type: none"> <li>• <b>Keratinised Stratified epithelium</b>- Found on dry surface e.g.- Nails skin, hair [GPAT-2016]</li> <li>• <b>Non -Keratinized stratified</b>- Conjunctiva of the eye (Pink eye) [GPAT-2015]</li> </ul> ✓ Stratified cuboidal ✓ Stratified columnar ii. <b>Transitional epithelium</b> (Urothelium)	
<b>Muscular tissue</b> (Contraction) 	<b>Skeletal muscle, Cardiac muscle, Smooth muscle</b> (a) Striped muscle -Thigh (b) Unstriped muscles -Urinary bladder (c) Cardiac muscles -Heart	<ul style="list-style-type: none"> <li>• Movement of parts, and locomotion</li> <li>• <b>Provide protection</b> against chemical and mechanical stresses</li> </ul>



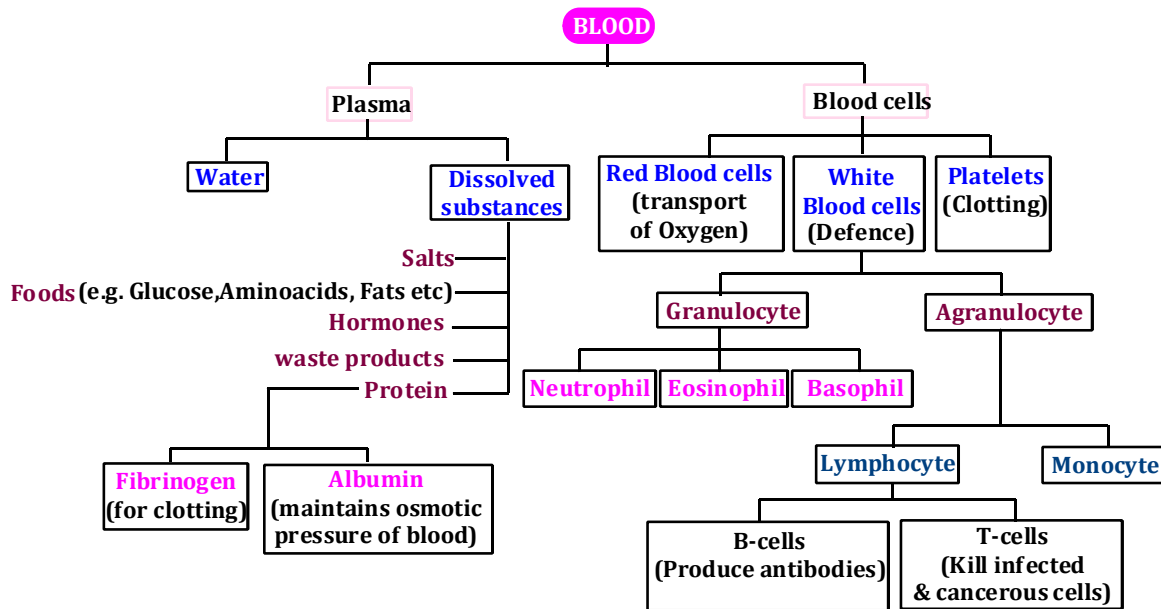
## INTRODUCTION

- The study of blood is also known **Haematology**.
- Blood is a living, **fluid connective tissue and its cells** are known as **Corpuscles**. Total volume of blood 5 liters.
- Human blood pH is 7.35-7.45

**Blood = Plasma + RBC + WBC + Blood platelets** [GPAT-2016]



## TYPES OF BLOOD



## COMPOSITION OF BLOOD

- Blood contains the cells which are called formed **element and liquid portion** known as **Plasma**.

## BLOOD CELLS

- ❖ Three types of cells are present in the blood
  - Red blood cells or Erythrocytes
  - White blood cells or Leucocytes
  - Platelets or Thrombocytes

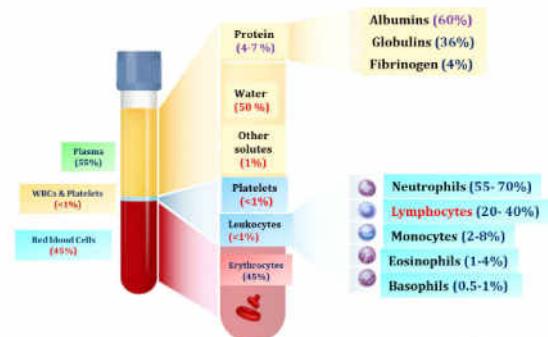


Fig.- Composition of Blood