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by

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PHARMACEUTICS

PHARMACEUTICAL TECHNOLOGY

History of Profession and Pharmacopoeia

❑ PHARMACY

- Pharmacy is the art, science and economics of preparing and dispensing medications and providing drug-related information to the public.
- The word "pharmacy" was coined from the Greek word "**pharmakon**" meaning "**medicine**" or "**drug**".
- **Pharmaceutics** is the branch of science which deals with the **formulation of drug into dosages form**. It is the science of **compounding/manufacturing and dispensing drugs**.

❑ HISTORY OF PHARMACY PROFESSION IN INDIA IN RELATION TO INDUSTRY

YEAR	NAME OF FOUNDER	NAME OF SHOP/ INDUSTRY
1811	Mr. Bathgate (East India Company)	1st Chemist Shop in Kolkata
1821	Mr. Smith Stanistreet and Co.	Another Apothecary Shop opened
1901	Acharya Praffula Chandra Ray	Establishment of Bengal Chemicals and Pharmaceutical Works at Calcutta
1903/1907	Prof. T.K Gajjar	1903- Laid a Factory at Parel (Bombay)
		1907- Laid Alembic Chemical works, Baroda

❑ HISTORY OF PHARMACY PROFESSION IN INDIA IN RELATION TO EDUCATION

YEAR	COLLEGE
1842	• First pharmacy college in Asia was started in Goa by the Portuguese at the old Portuguese medical school known as "Escolar Medica de Goa" • Currently this school is known as 'Goa College of Pharmacy".
1912	The International Pharmaceutical Federation founded, head office in the Netherlands.
1932	Banaras Hindu University under the leadership of Professor Mahadev Lal Schroff.
1937	BHU became the first university in India to start 3-year B. Pharm course.
1939	• The United Provinces Pharmaceutical Association (UPPA) was renamed as Indian Pharmaceutical Association (IPA)
December 1948	The First Indian Pharmaceutical Congress was organized at Calcutta with Prof. M.L. SCHROFF as its First President.

Every year on 6th March	National Pharmacy Education Day- in honour of the birth anniversary of Professor Mahadeva Lal Schroff

Pharmacopoeia

❑ DEFINITION

- Pharmacopoeia is a book describing drugs, chemicals, and medicinal preparations especially one issued by an officially recognized authority and serving as a standard.
- **Pharmacopoeia is an official book** published by the **Ministry of Family and Health Welfare**
- **The head office of Indian Pharmacopoeia Commission** is situated at **Ghaziabad.**

YEAR	PHARMACOPOEIA	PLACE
1601	Pharmacopoeia Angustana (First pharmacopoeia)	Augsburg in Bavaria
1618	Pharmacopoeia Londinensis	---------
1699	Edinburgh Pharmacopoeia	Edinburgh
1807	Dublin- Pharmacopoeia	Dublin
1864	British Pharmacopoeia	U.K
1820	United State Pharmacopoeia	U.S.P
1955	Indian Pharmacopoeia 1st edition	India

❑ DIFFERENT PHARMACOPOEIA

❖ Indian pharmacopoeia

- The Indian Pharmacopoeial list **1946** was prepared by the department of **Health, Government of India.**
- The government of India constituted a permanent Indian Pharmacopoeia committee in **1948.**
- The actual process of publishing the first Indian Pharmacopoeia started under the **chairmanship of Col. R. N. Chopra.**

- After independence, in year 1948 Indian Pharmacopoeia was made official in India

❑ DIFFERENT EDITIONS OF INDIAN PHARMACOPOEIA

EDITION	SUPPLEMENT	FEATURES	CHAIRMANSHIP
1st - 1955	1960	• Covers 986 monographs • Titles of monograph in Latin language • Weight and measure in metric system	Dr. B. N. Ghosh
2nd - 1966	1975	• Titles of monograph in Latin language to English • Name of drugs first came • New analytical technique was added	Dr. B. Mukherji

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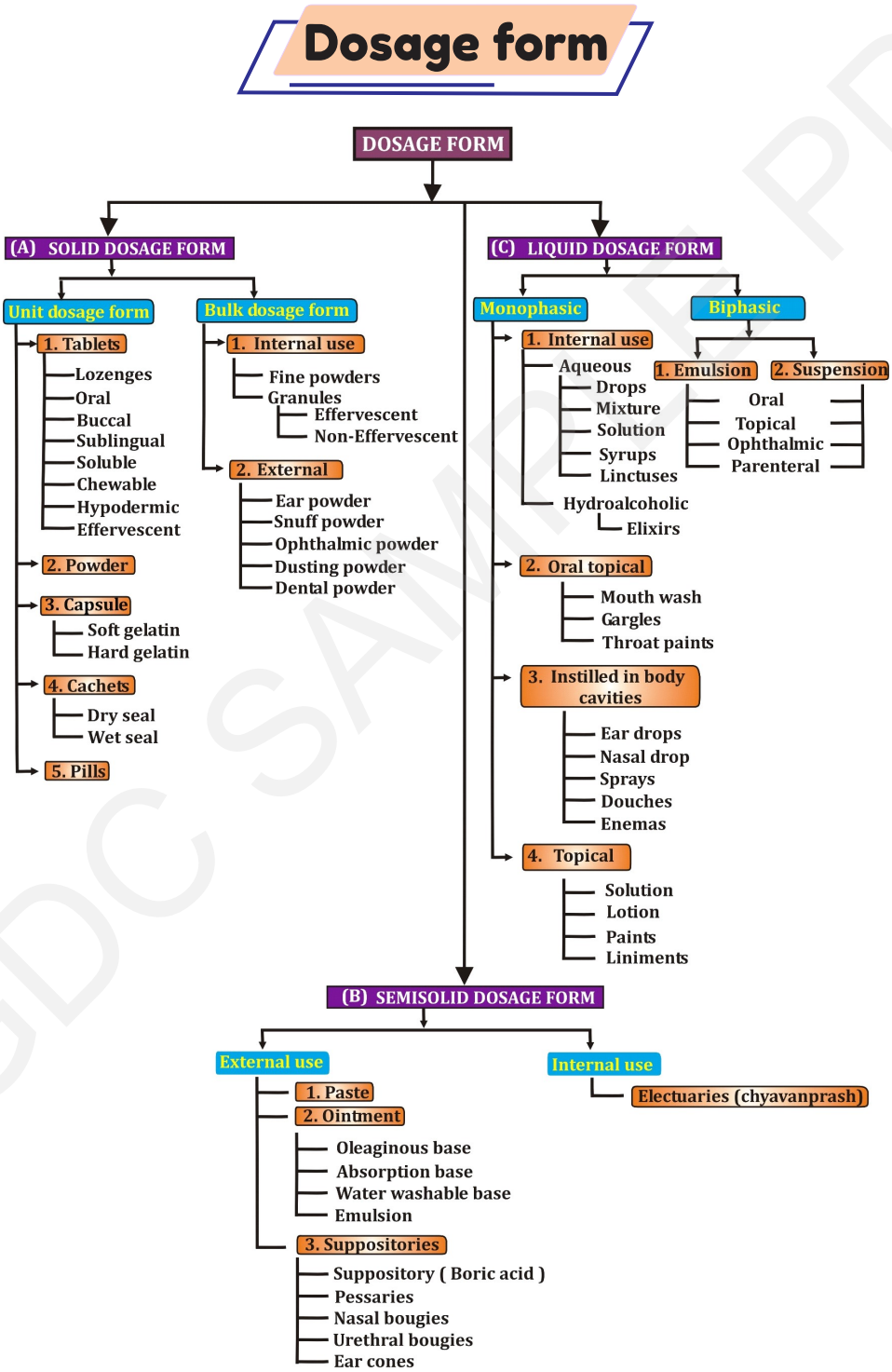
3rd. – 1985 (2 Volume)	**1989 and 1991**	• **Dissolution has been added** • **Microbial limit test** prescribed for liquid preparation. • **Flame photometry electrophoresis, fluorometry was added**	**Dr. Nityanand**
4th - 1996 (2 Volume) (Blue)	**2000, 2002 and 2005**	• **Computer generated formulae was used.** • **IR and UV spectrophotometry test was added** • **Contain 1149 monographs and 123 appendices**	**Dr. Nityanand**
5th - 2007 (3 Volume) (Blue)	**2008**	• Volume one contain general notice, structure of IPC • **Volume three contain general monographs**	**Dr. Nityanand**
6th – 2010 (3 Volume) (Blue)	**2012**	• **Products of biotechnology, herbal products was added.** • **Antiretroviral drug was added**	**Dr. Gulab Nabi Azad**
7th – 2014 (4 Volume) (Red)	**2015 and 2016**	**Contain 2548 monographs** 19 new Radiopharmaceutical monographs was added among this 577 are new	**Dr. Gulab Nabi Azad**
8th – 2018 (4 Volume) (Orange)	**2019 and 2021**	• **General chemical test and TLC eliminated** • More specific test like IR, UV Spectrophotometer was added • **Pyrogen test replaced by Bacterial Endotoxin Test**	**Dr. PK Pradhan**
9th - 2022 (Orange)		• Launched in **1st July 2022** at **Vigyan Bhawan, New Delhi** • **92 new monographs including 60 Chemical, 21 Vitamins, Minerals, Amino acids, Fatty acids etc.** • This has led to the **total number of 3152 monographs** in the current edition of IP.	**Dr. Mansukh Mandaviya**

❑ BRITISH PHARMACOPOEIA

- According to latest edition (2023) of British pharmacopoeia there are total **six volumes** defined.
- British pharmacopoeia contain nearly **3,000 monograph**

❑ STORAGE CONDITION

STORAGE CONDITION	MEANING
Cold storage or under refrigeration	Usually 2 to 8°C
Cool storage	Between 8 to 25°C
Room temperature	20 to 25°C
Warm	Between 30 to 40°C
Freezer	Store between -5 to -20°C



Sodium alginate	Manucol
SLS	Empicol
SUPER DISINTEGRANTS	
Croscarmellose sodium	Ac-di-Sol, Solutab
Crospovidone	Kollidon CL, Polyplasdone XL
Sodium starch glycolate	Explotab, Primojel
Polacrilin potassium	Amberlite
LUBRICANTS	
Glyceryl palmitostearate	Precirol
Hydrogenated vegetable oil	Lubritab, Sterotex
PEG 4000 or 6000	Macrogols, Carbowax
GLIDANT	
Cellulose, powdered	Elcema, Solka, Floc
Silicon dioxide, colloidal	Aerosil, Cab-o-Sil

❑ STEPS INVOLVED IN MANUFACTURING OF TABLET

1. **Preparation of granules for compression- Sphere for good flow**
2. Compression of granules into tablets
3. Evaluation of tablet granules

a) Measurement of surface area

- Gas adsorption method
- Air permeability method

b) Determination of granule density

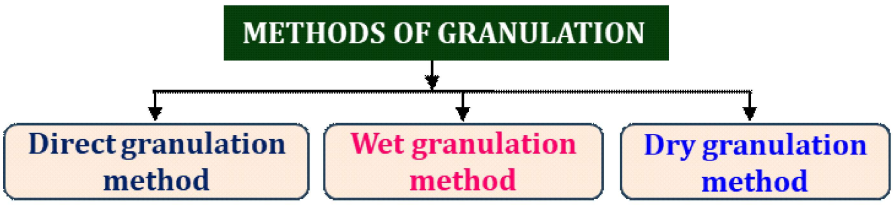
- Mercury displacement method
- Pycnometer

c) Strength of granules

d) Flow property of powder

- Angle of repose
- Compressibility index
- Carr's index
- Hausner's ratio

❑ METHODS OF GRANULATION

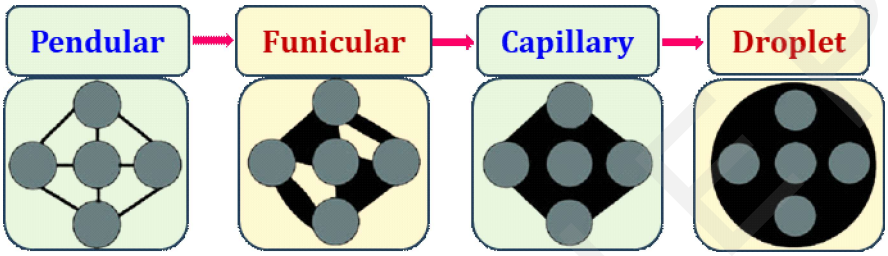


❖ Wet granulation

➢ Equipments used in Wet granulation

EQUIPMENT	FUNCTION
Littleford Lodige Mixer	Capable of both wet mass and blending
Diosna Mixer	Mainly works for Mixing, granulating, coating and drying
Sigma Blade mixer, Topo Mixer, Fluidized bed dryer	Used for mixing high viscosity liquids
Gral-Mixer	Modification of planetary mixer
Oscillating granulator	Shifting of granules

➢ Stages in the development of moist granules



❖ Dry granulation

- **Slug –** Described as **compact mass of powder**, done by
  (a) High capacity heavy duty tab press
  (b) Chilsonator roller compactor

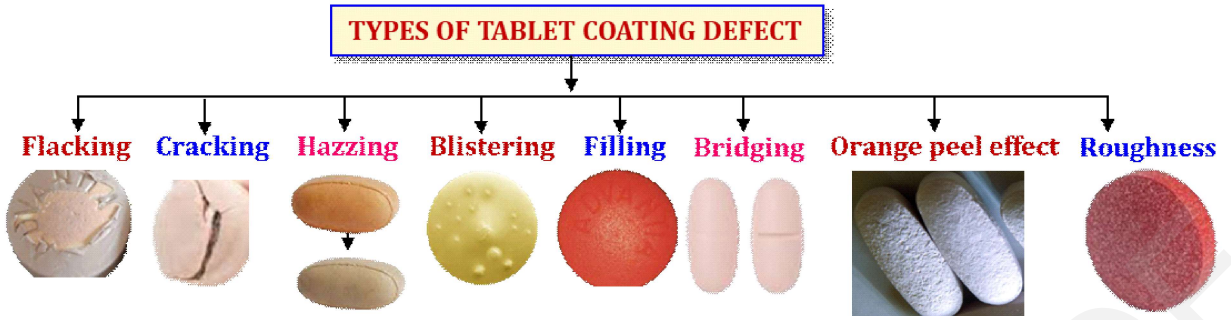
❖ Direct compression

- E.g. :- **NaCl, KCl** can be directly compressed

❑ PARTS OF TABLET COMPRESSION MACHINES AND THEIR FUNCTION

PARTS	FUNCTIONS
Hopper	For holding & feeding granulation to be compressed
Dies	Define the size and shape of the tablet
Punches	Used for compression of granulation within the die
Cam tracks	Guide the movement of the punches
Turrets	Hold upper and lower punches
Feeding Machine	Used for moving granulation from the hopper into the dies
Die table	Portion holding the dies

❑ TABLET COATING DEFECTS



❑ TYPES OF TABLET COATING DEFECTS

DEFECTS	DESCRIPTION	CAUSES	REMEDIES
Roughness 	Rough or gritty surface	Droplets may dry too rapidly	Moving the nozzle closer to the tablet bed
Orange peel effect 	Film being rough and non-glossy	• Inadequate spreading of the coating solution. • Too rapid drying • High solution viscosity	• Use of mild drying condition • Thinning the solution
Bridging 	Shrinking of film and pulling away from sharp corners	• Improver atomization pressure • High viscosity of coating solution	• Increase the plasticizer content • Reduce the viscosity of solution
Blistering 	Local detachment of film	• Too rapid evaporation of the solvent from the core • Effect of high temperature	Uses the mild drying condition
Hazing/ Dull film/Blooming 	Coating becomes dull immediately or after prolonged storage	• High temperature • High humidity	• Decrease the plasticizer • Increase molecular weight
Cracking 	Film cracks across the crown of the tablet	Internal stress in film exceeds then tensile strength	Adjusting the plasticizer type and concentration, and the pigment type and concentration
Twinning 	Two or more of the tablet cores are stuck together.	Cause due to over wetting	• Reducing spray rate • Increased pan speed
Pitting 	Holes appear on tablet surface	Melting of lubricant on tablet surface. Most common with stearic acid.	Decrease coating temperature to below melting point of lubricant. Substitute lubricant

❖ Valve & Actuators

➢ Valve

- **Easy to open and close, deliver the content in desired form.**
- **Metering valve**
  - ✓ Used to disperse potent medication.
  - ✓ Usually dispense **50-150 mg ±10% of liquid** at one time.
  - ✓ Mainly used to delivery aerosol product into **nasal & respiratory airway**.

COMPONENTS OF VALVE	
Components	**Material of construction**
Ferrule or mount cap	Aluminum or Brass
Valve body or housing	Nylon or Delrin
Stem	Nylon or Delrin
Gasket	Buna-N and Neoprene
Spring	Stainless steel
Dip tube	Polypropylene and polyethylene

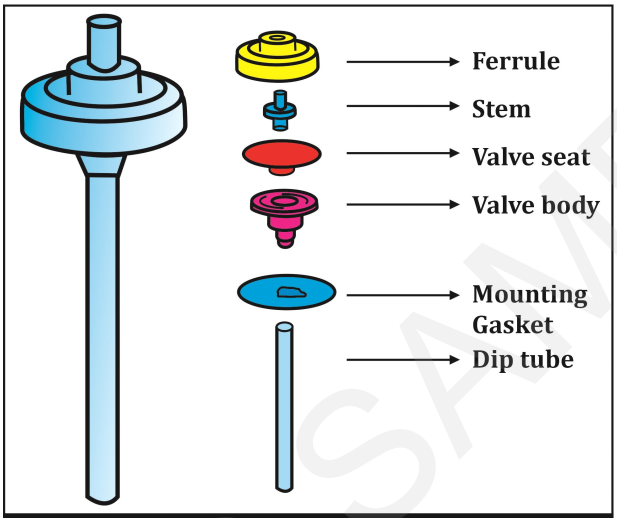


Fig: Aerosol bottle valve assembly

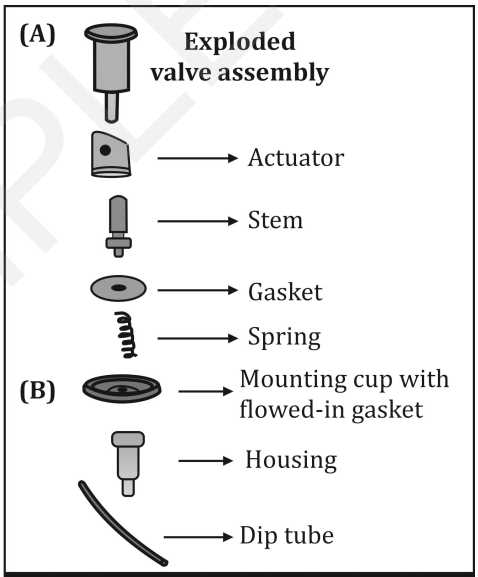


Fig: (A) Vapour tap body
(B) Aerosol can valve assembly

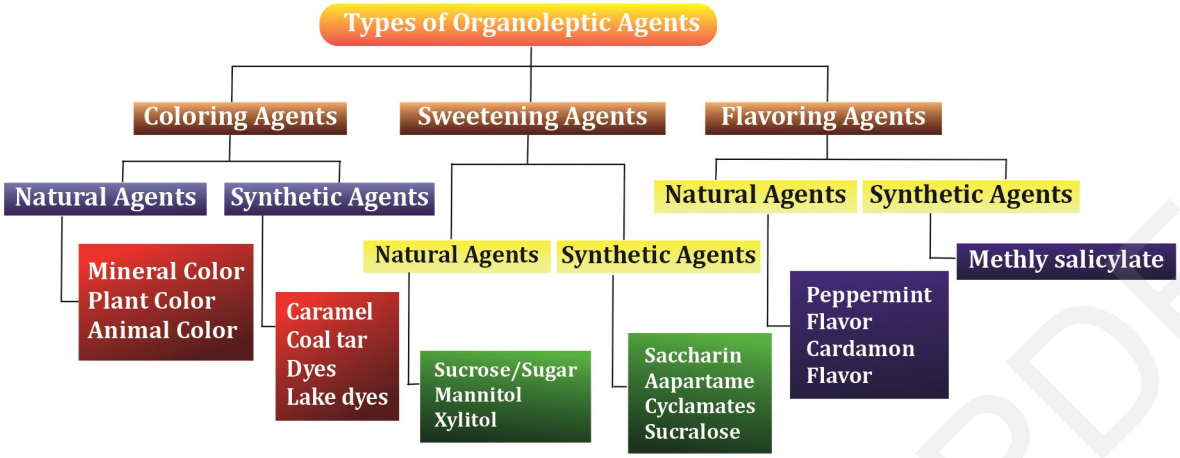
➢ Actuators

- Allow easy opening & closing of valve.
- Deliver the product in the proper and desired form.

✓ Types

TYPES	DESCRIPTION
Spray actuators	Topical use like antiseptic, local anesthetic
Solid stream actuators	Used to disperse, semisolid product –Ointments
Special actuators	Designated to deliver medication to throat, nose, eye, vaginal tract
Foam actuators	Large orifice, semisolid products

❖ Types of organoleptic agents



❖ Colouring agent

- These agents are used to **provide distinctive color with pleasing appearance** of elegance to the dosage form.
- It serves as a means of **identification to the user.**

➢ Natural Color

✓ Mineral Color

- The mineral color was **composed of materials such as ferric oxides red and yellow, lead chromate, Prussian blue, Titanium Dioxide, Carbon Black.**
- Titanium oxides: As the thickness of oxides varies produce color and used in sunscreen with a physical blocker because of its **high refractive index**, **its strong UV light absorbing capabilities** and its **resistance to discoloration in UV light**.

✓ Plant color

- The coloring principles from plants are **obtained by extraction**. Plant was most important source of colors in ancient times.
- Notable color of plant world was **alizarin, anthocyanin, carotenoids, chlorophyll, flavones.**

✓ Animal Color

- Animal Color are obtained from animal source.
- Some animals from which the color is obtained are snails, coccus cactus etc.
- E.g - **Tyrine Blue** – It is obtained from oxidizing of a colorless secretion from the gland of snails.

➢ Synthetic Color –

Synthetic Colors are mostly **obtained from coal tar dyes** and also used in food & beverages to **enhance their appearance without toxicity. E.g Caramel, Coal tar dyes, Lake dyes.**

❑ THEORY OF SIZE REDUCTION

THEORY	EQUATION
✓ **RITTINGER'S THEORY** • **Energy, E** required for size reduction is **directly proportional** to the **new surface area**	$E = K_R(S_n - S_i)$ ✓ E = Amount of energy, kW.h ✓ S_i = Initial specific surface area, $\mu m^2/\mu m^3$ ✓ S_n = New specific surface area, $\mu m^2/\mu m^3$ ✓ K_R = Rittinger's constant, energy per unit area, kW.h./μm^3
✓ **BOND'S THEORY** • The energy used for **deforming or fracturing** a set of particles of **equivalent shape** is **proportional** to the change in **particles dimensions**	$E = 2K_B\left(\frac{1}{\sqrt{d_n}}\right) - \left(\frac{1}{\sqrt{d_i}}\right)$ ✓ K_B = Bond's work index, energy per unit mass, Kw.h.$\sqrt{\mu m}$ ✓ d_i = Initial diameter of particles,μm ✓ d_n = New diameter of particles, μm
✓ **KICK'S THEORY** • The energy used in deforming or fracturing a set of particles of **equivalent shape** is **proportional** to the ratio of the **size changes**	$E = k_k \, In \, \frac{d_i}{d_n}$ ✓ K_k = Kick's constant, energy per unit mass, kW. h ✓ d_i = Diameter of the particle in the initial stage, μm ✓ d_n = Diameter of the new particle, μm

Size Separation

❑ INTRODUCTION

- It is a unit operation that involves the **separation of a mixture** of various sizes of particles into **two or more portions** by means of screening surfaces.
- Size separation is also known as **Sieving, Sifting, Classifying or Screening.**
- As per the sieving method, the powder is passed through a set of sieves which are arranged in **Descending order.**

❑ GRADES OF POWDERS AND SIEVE NUMBER ALONGWITH NOMINAL APERTURE SIZE AS PER IP

Grade of powder	Sieve through which all particle must pass	Sieve through < 40% particle pass	Nominal mesh aperture size
Coarse	10	44	355 µm
Moderately coarse	22	60	250 µm
Moderately fine	44	85	180 µm
Fine	85	120	-
Very fine	120	-	-
Microfine	350(90% pass)	-	-
Superfine	90% pass through 10 micron	-	-

Extraction

❑ INTRODUCTION

- Extraction is a unit operation in which **separation of active constituents** is achieved from a **solid or liquid** preferably by solvent action.
- The **active constituents** are soluble in solvents. The solvent used for this purpose is **known as menstruum.**
- Infusions, Decoctions, Tincture extract and other extract forms are together called galenicals.

❑ EXTRACTION PROCESS – LEACHING

Leaching	A process in which **active constituents** are selectively **removed** from the crude, by the action of solvent
Maceration	A process in which the solvent and the **crude material** are allowed to be in contact with each **other for longer time**
Percolation	A leaching process in which the **crude material** is packed into a column and the **solvent** is allowed to pass through the material
Expression	The removal of **small quantity of liquid** from a relatively large amount of **solid material** by applying force

❑ SOLVENTS AND THEIR UTILITY IN THE EXTRACTION

SOLVENT	GALENICALS
Water	Proteins, Colouring Matter, Gums, Anthraquinone Derivatives, Alkaloidal Salts, **Glycosides**, Sugars, Tannins
Ethyl alcohol	**Alkaloids**, Alkaloidal salts, Glycosides, Volatile Oils, Resins
Ether	Oils, Fats, Waxes, Resins, Alkaloids
Solvent ether	Extract of **male fern**
Glycerin	Tannins, syrup of Wild Cherry
Light petroleum	Tincture of **Strophanthus**
Acids	Tartaric acid to prepare **Ergot extract**
Alkalis	Potassium hydroxide solution for the **extraction of eugenol** from cloves

❑ NOTE

- The maceration process in which gentle heat is used during process of extraction is **Digestion**
- An extraction process in which water is poured over drugs, allowing close contact for stated period and finally liquid is filtered off is called **Infusion.**
- Extractors is used for continuous dispersed solids leaching is **Podbielniak.**
- Crude is kept in contact with menstruum is called **Maceration.**

Evaporation

❑ INTRODUCTION

- A process of **vaporizing large quantities** of volatile liquid to get a concentrated product.
- A device used for the evaporation or concentration of thermolabile substances is Vacuum pan.
- Aqueous thermolabile solution is concentrated by a process **evaporation under reduced pressure.**

❑ FACTORS INFLUENCING EVAPORATION

FACTORS	EFFECT IN EVAPORATION
Temperature	Higher the temperature, higher will be evaporation.
Vapour pressure	Rate of evaporation is **directly proportional** to the vapour pressure of the liquid.
Surface area	The **greater the surface area** of the liquid, the greater will be the evaporation.
Agitation	It breaks scum or layer and **increase rate of evaporation.**

❑ EQUIPMENT FOR EVAPORATION

EQUIPMENT	CHARACTERISTICS AND USES
Evaporating pan (Steam jacketed kettle)	• **Steam** gives out heat to the kettle. • Suitable for concentrating aqueous and **thermolabile liquors**, Eg:- **Liquorice extract**
Horizontal tube evaporator	• The best suited for **non-viscous solutions** that do not deposit scales or crystals on evaporation Eg:- **Cascara extract**
Vertical tube evaporator (Short tube evaporator)	Used in the manufacture of **cascara extract, sugar, salt, caustic** soda
Climbing film evaporator (Rising film evaporator)	Thermolabile substances such as **insulin, liver extracts** and **vitamins** can be concentrated.
Falling film evaporator	• Used to **separate volatile and nonvolatile materials.** • Useful for concentrating the **heat sensitive materials** such as fruit juices.
Forced circulation evaporator	• Suitable for thermolabile substances • Used for the concentration of **insulin and liver extracts**

Distillation

❑ INTRODUCTION

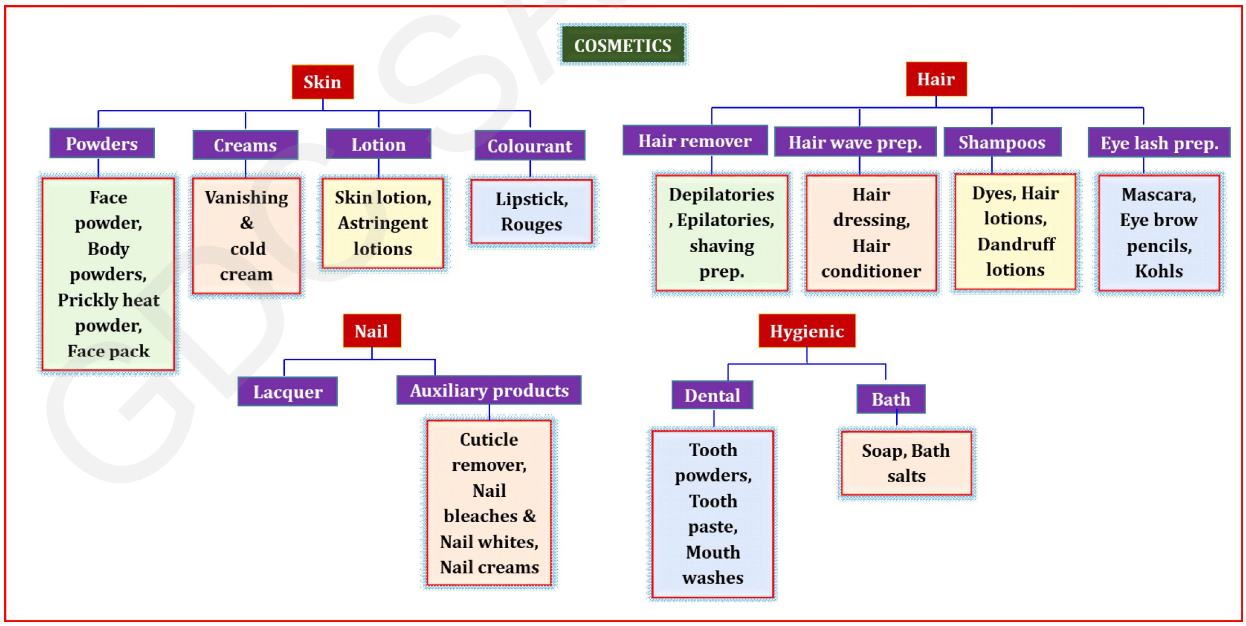
- The separation of the components of a **liquid mixture** by a process involving vaporization and subsequent condensation at another place.
- Liquids which decompose at or below their boiling point are purified by **distillation under reduced pressure.**

Krystal crystallizer	**Evaporation**	• It is used for crystallization of **Sodium Chloride and magnesium sulphate.**
Vacuum crystallizer	**Adiabatic evaporative cooling**	• It is used for thermolabile substances. • Adiabatic evaporative cooling is used to create supersaturation in a **Vacuum crystallizer.**
Magma crytallizer	**Evaporation**	• Not used for salt which has that which has flat solubility curve.
Krystal evaporator/OLSO crystallizer	**Evaporation**	• Oldest design developed for production of large & coarse crystal. • Low maintenance.
Tank Crystallizer	**Evaporation**	• Globar salts, synthetic sponge Batch process.

COSMETIC TECHNOLOGY

❑ INTRODUCTION

- Products that have a **gentle effect on the human body,** used for **cleansing, beautifying, enhancing beauty, changing look,** or supporting healthy **skin** or **hair.**
- **There are four major groups into which the cosmetics can be divided-**



Cosmetics For Hair

❑ HAIR CARE & COSMETIC PREPARATIONS

❖ Shampoo

Characterized as a **surfactant preparation** in an appropriate form, such as a **liquid, solid, or powder,** that, when used as directed and in a manner that **protects the user's hair health,** effectively **removes surface grease, filth,** and **skin debris** from the scalp and hair shaft.

➢ Formulation of shampoo

✓ Detergents

TYPES	EXAMPLE
Anionic	**Superior to other class** • **Sodium lauryl sulfate** • Alkyl benzene sulphonates • Sulphated monoglycerides, Sarcosinates • Sulphosuccinates 
Cationic	**Poor detergency** • Distearyl dimethyl ammonium chloride • Dilauryl dimethyl ammonium chloride • N-cetylpyridinum bromide • Benzethonium chloride 
Amphoteric	• N-alkyl β–iminodipropionates, Ammonium compounds
Nonionic	• Low foaming capacity, but have excellent resistance to hard water

✓ Additives

PERFORMANCE ENHANCER	
Conditioning agent 	Secondary detergents fatty material **(Lanolin, mineral oil)** • **Natural product**: - Amino Acid, **Egg, Lecithin.** • **Polymer** :- Polyvinyl pyrrolidone
Opacifying agent	Higher alcohol such as Stearyl & Cetyl alcohols Higher acids such as Behenic acid, Calcium stearate, Glaubers salts

DISPENSING PHARMACY

Prescription

❑ INTRODUCTION

- The word "prescription" is derived from the Latin term praescriptus. (Prae - 'before' and scribere- meaning 'to write').
- It is an order **given to a pharmacist** to **prepare and dispense** a certain drug for the patient by a **doctor, dentist, veterinarian** or **registered medical practitioner (RMP).**

❑ PARTS OF PRESCRIPTION

1. **Date**
2. **Patient Information**
3. **Superscription (R_x)**
4. **Inscription (Prescription's main body**
5. **Subscription (Direction to Pharmacist)**
6. **Signatura (Direction to Patient)**
7. **Renewal Instruction**
8. **Prescriber information**

❑ FORMAT OF PRESCRIPTION

TIWARI NURSING HOME
M-72, Block D-4 Janajkpuri, Mumbai
Ph : 745621
2576598741

① **Date** :-

② **Name** :- **Age** :- **Sex** :-
Address :-

③ Rx **(Superscription)**
65 mg PCM
20 mg Diclofenac
12.1 mg Lactose
8 mg Starch
④ **Inscription**

⑤ **Subscription** :- fiat, mistura — It means to prepare mixture

⑥ **Signatura** :- Cochleare amplum (One tablespoon) bis in die (twice a day) past cibos (after meals) sumendus (to be taken)

⑦ **Refill** :- _____

⑧ **Name, Address, Registration no. of the prescriber**

PARTS	DESCRIPTION
Superscription (Symbol R_x)	• It is represented by **R_X (Latin term) "recipe"** which means **"take thou"** or **"you take"** • In olden days, this symbol was considered to be originated from the **sign of Jupiter (God of Healing)** • Symbol (R_x) is considered as requesting god for the quick recovery of the patient.
Inscription (Medication prescribed)	• It is the **main part of the prescription**. • It contains the **names and quantities** of the **prescribed medicaments.**
Subscription (Direction to Pharmacist)	• In this part **the prescriber gives direction** to the **pharmacist** regarding the dosage form to be prepared.
Signatura (Direction for Patient)	• It is usually written as **"Sig"** • To be placed **on the label.** • This consists of direction to be given to the patient regarding the administration of medicine. • The signatura written in **English and use some Latin** abbreviations like t.i.d (thrice a day), b.i.d (twice a day) and o.d (once a day).

❑ LATIN TERMS FOR DIFFERENT DOSAGE FORM

LATIN TERM	ABBREVIATION	ENGLISH MEANING
Auristillae	auristill.	Ear drops
Capsula amylacea	caps amylac.	Cachets
Capsula	caps.	Capsule
Cataplasma	cataplasm.	Poultice
Charta	chart	Powder
Collutorium	collut.	Mouth wash
Collyrium	collyr.	Eye lotion
Cremor	crem.	Cream
Dentrificium	dentif	Dentrifrice
Emulsio	emul	Emulsion
Gargarisma	garg.	Gargle
Guttae	gtt.	Drops
Infusum	inf	Infusion
Inhalatio	inhal.	Inhalation
Injectio	inj	Injection
Insufflatio	insuff	Insufflation
Linimentum	lin.	Liniment
Liquor	liq	Solution
Lotio	lot	Lotion
Mistura	mist	Mixture
Nebula	neb	Spray solution

Oleum	ol	Oil
Pasta	past	Paste
Pessus	pess	Pessary
Pilula	pil	Pill
Pulvis	pulv	Powder
Tabella	tab	Tablet
Unguentum	ung.	Ointment

❑ LATIN TERMS FOR METHOD OF ADMINISTRATION OR APPLICATION

S.NO.	LATIN TERM	ABBREVIATION	MEANING
1.	Addendus	addend	To be added
2.	Applicandus	applicand	To be applied
3.	Ad. usum externum	ad us enter.	For external use
4.	Agita ante usum	agit. a. us	Shake before use
5.	Capiendus	capiend	To be taken
	Sumendus	s. OR sum.	To be taken
6.	Consperge	consper	Dust, Sprinkle
7.	Dandus	dand	To be given
8.	Dolentiparti	dolent part	To the affected area
9.	Dolore urgente	dol. urg.	When pain is severe
10.	Deglutiendus	deglut	To be swallowed
11.	Guttatim	guttatim	Drop by drop
12.	Instillandus	instilland	To be dropped in
13.	Infricandus	infricand	To be rubbed
14.	Lente	-	Slowly
15.	Miscendus	miscend	To be mixed
16.	Quantum sufficiat	Q.S.	As much as if sufficient
17.	Secundum	-	According to
18.	Sine (S)	-	Without
19.	Statim	stat	Immediately
20.	Utendus	utend	To be used

❑ LATIN TERMS FOR TIME OF ADMINISTRATION

❖ Times per day

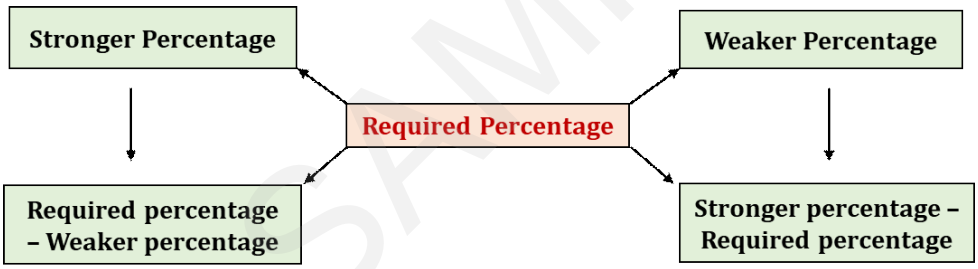
S.NO.	LATIN TERM	ABBREVIATION	MEANING
1.	Semel in die	sem in die	Once a day
2.	Bis in die	b.i.d	Twice a day
3.	Ter in die	t.i.d	Three time a day
4.	Quater in die	q.i.d. , q.d.	Four times a day
5.	Sexies in die	Sex i.d.	Six times a day
6.	Bis terve in die	b.t.i.d	Two or three times a day
7.	Quaque hora	q.q.h	Every hour
8.	Singulis hora	sing. hor	Every one hour
9.	Hora decubitus	h.d.	At bed time
10.	Quoties opus sit	quot .o.s	As after as necessary
11.	Quotidie	quot.	Daily

Synergistic and antagonistic drugs	There is a combination of two **sympathomimetic drugs** with **additive effect.** So there is a need to reduce the dose of each drug.	**Rx** • **Amphetamine sulphate 20mg** • **Ephedrine sulphate 100mg** • **Syrup upto 100ml**
Drug interaction	**Acetophenetidin depresses the CNS** and this side effect is undesirable. **Caffeine is a CNS stimulant** to neutralise the side effect of Acetophenetidin.	**Rx** • **Acetophenetidin 150mg** • **Acetyl salicylic acid 200mg** • **Caffeine 30mg**
	Calcium, which is found in milk, **inactivates tetracycline.** As a result, milk should **not be consumed** with tetracycline capsules.	**Rx** **Tetracycline hydrochloride 250mg**

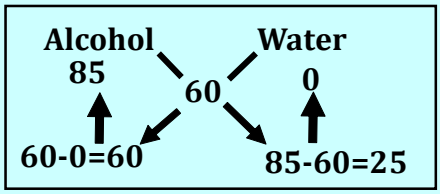
Pharmaceutical Calculation

❑ ALLIGATION METHOD

It is needed when we have to mix **two similar preparations of different strength,** to **produce a preparation of intermediate strength.**



✓ **Question:** Calculate the **volume of 85% of alcohol** required to produce **600 mL of 60% alcohol. Solution:**



- Volume required = **600 mL**
- % of alcohol required = **60**
- % of alcohol used = **85**
- By alligation method,
- 60 parts of 85% alcohol and 25 parts of water will produce required % alcohol
- Quantity of 85% alcohol required = $\frac{600 \times 25}{85}$ = **423.52ml**
- Quantity of water required = $\frac{600 \times 60}{85}$ = **176.47 ml**
- **Hence,** By dissolving 423.52 ml of 80% alcohol in 176.47 ml of water will produce 600 ml of 60% alcohol.

Posology

The word **posology** is derived from the Greek words **'posos'** meaning **how much** and **'logos' meaning science**.

Dose calculation based on Age

Young's formula

$$\text{Child Dose} = \left[\frac{\text{Age of child in years}}{\text{Age of child in years} + 12}\right] \times \text{Adult dose}$$

Question: Calculate a dose for a child of 4 years old cimetidine by young formula when adult dose of the drug is 100 mg.

Solution: Age of child = 4
Adult dose = 100 mg
Calculation = $\left[\frac{4}{4+12}\right] \times 100$
Child dose = 25 mg

Dilling' formula

$$\text{Child Dose} = \left[\frac{\text{Age of child in years}}{20}\right] \times \text{Adult dose}$$

Question: Calculate a dose for a child of 7 years old cimetidine by Dilling's formula when adult dose of the drug is 2 mg.

Solution: Age of child = 7
Adult dose = 2 mg
Calculation = $\left[\frac{7}{20}\right] \times 2$
Child dose = 0.7 mg

Fried's formula

$$\text{Child Dose} = \left[\frac{\text{Age of child in months}}{150}\right] \times \text{Adult dose}$$

Question: Calculate a dose for child of 09 months old by Fried's formula. Adult dose is 250 mg.

Solution:
Child dose = 15mg
Calculation = $\left[\frac{09}{150}\right] \times 250$
Child dose = 15 mg

Cowling's formula

$$\text{Child Dose} = \left[\frac{\text{Age of child} + 1}{24}\right] \times \text{Adult dose}$$

Question: Calculate a dose for a child of 5 years old cimetidine by Cowling's formula when adult dose of the drug is 100 mg.

Solution: Age of child = 5
Adult dose = 100 mg
Calculation = $\left[\frac{5+1}{24}\right] \times 100$
Child dose = 25 mg

Dose calculation based on Body weight

Clark's formula

$$\text{Child Dose} = \left[\frac{\text{Weight of child in pound}}{150}\right] \times \text{Adult dose}$$

$$\text{Child Dose} = \left[\frac{\text{Weight of child in kg}}{70}\right] \times \text{Adult dose}$$

Question: Calculate a dose for child of 6 year old by Clark's formula whose weight is 25 pounds, Adult dose is 500 mg.

Calculation = $\left[\frac{25}{150}\right] \times 500$ **Solution: Child dose = 83.3 mg**

Dose calculation based on Body surface area

Catzel's formula

$$\text{Child Dose} = \left[\frac{\text{Surface area of child in } m^2}{\text{Surface area of adult (1.73)}}\right] \times \text{Adult dose}$$

Question: Calculate a dose for a child of 7 years old by Catzel's formula whose surface area is 1.9 m2. Adult dose is 150 mg.

Solution: Age of child = 7
Adult dose = 150 mg
Surface area = 1.9 m2
Calculation = $\left[\frac{1.9}{1.73}\right] \times 150$
Child dose = 164.73 mg

Fermentation Technology

❑ INTRODUCTION

Fermentation technology - Fermentation technology is a field which involves the use of **microorganisms and enzymes for production of compounds** which have application in the **energy, material, pharmaceutical, chemical and the food industry**.

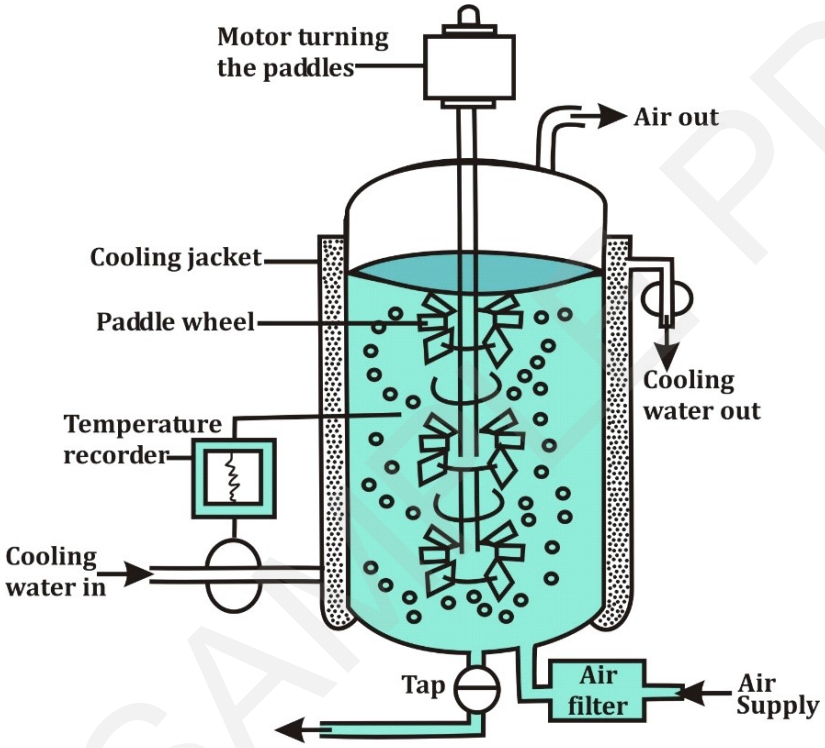
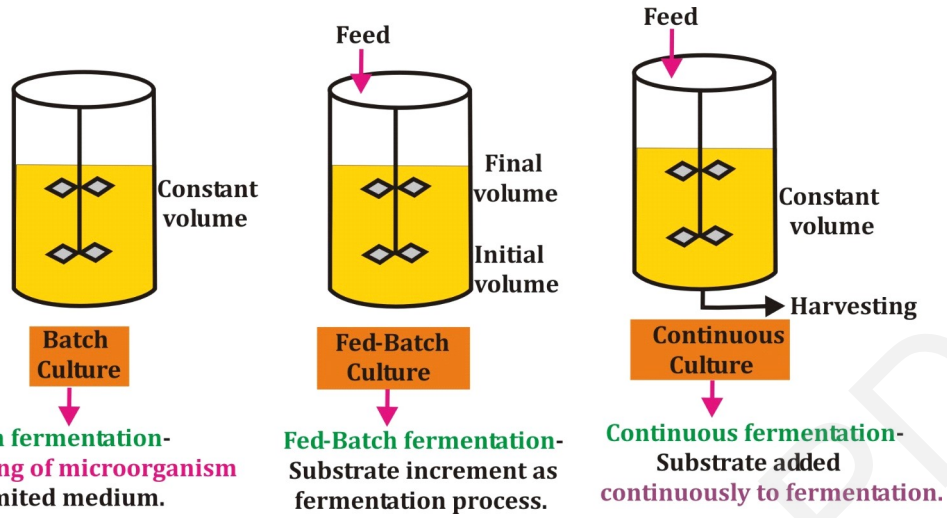


Fig- FERMENTER

❑ PARTS OF FERMENTER

S.NO.	PARTS	USED
1	Bafflers	Prevent sedimentation on sides & proper mixing
2	PT 100	Temperature sensor (platinum resistance electrode)
3	Foam probe	Keep above the medium level to sense foam formation
4	O_2 Pump	Monitor O_2 dissolve oxygen
5	Heater pad	Directly heats the medium
6	Cold finger	After direct heating, used to cool vessel content
7	Rotameter	Variable air flow meter
8	Air pump	Supply for air
9	Peristaltic pump	To pump acid base, antifoam & medium

❑ TYPES OF INDUSTRIAL FERMENTATION



❑ FERMENTATION PRODUCT

GROUP	PRODUCT	ORGANISM
Chemical	Ethanol	*Saccharomyces cerevisiae*
	Lactic acid	*Lactobacillus bulgaricus*
Enzyme	α- amylase	*Bacillus subtilis*
Antibiotics	Penicillin	*Penicillium chrysogenum*
	Streptomycin	*Streptomyces griseus*
	Chloramphenicol	*Streptomyces venezuelae*
Vitamin	Riboflavin	*Ashbya gossypii*
	Vit. B_{12}	*Pseudomonas denitrificans*
Foods	Mushroom product	*Agaricus bisporus*
	Cheese	*Penicillium roqueforti*
	Bakery, beer, wine	*Saccharomyces cerevisiae*

Recombinant DNA Technology

❑ INRTODUCTION

S. NO.	TERMINOLOGY	DEFINITION
1	Recombinant DNA technology	Recombinant DNA technology is the techniques involved in the **construction, and use of recombinant DNA molecule**
2	Genetic Engineering	Genetic engineering primarily involves the **manipulation of genetic material (DNA)** to achieve the desired goal in a pre-determined way. Some other terms are also in common use to describe genetic engineering
3	Genomic Library	Genomic library is **collection of the total Genomic DNA** fragments from a particular species represents gene libraries
4	Gene Therapy	Gene therapy is the process of **inserting genes into cells to treat diseases**

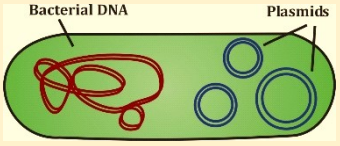
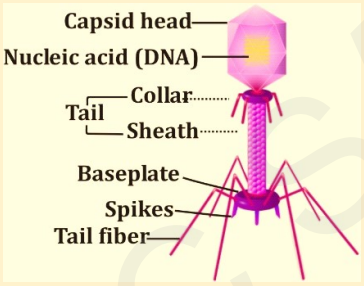
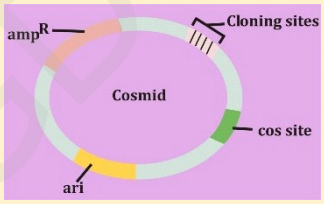
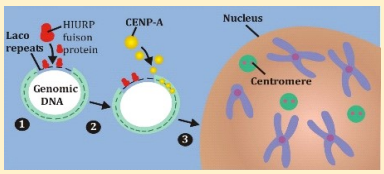
❑ HOST CELL USED IN GENETIC ENGINEERING

The hosts are the living systems or cells in which the carrier of recombinant DNA molecule or vector can be propagated.

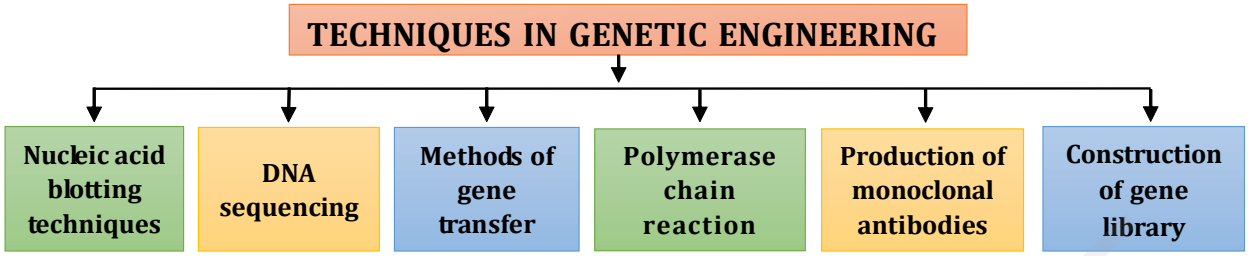
GROUP	CATEGORY	EXAMPLES
Prokaryotic	Bacteria	*Escherichia coli, Bacillus subtilis, Streptomyces SP*
Eukaryotic	Fungi	*Saccharomyces cerevisiae, Aspergillus nidulans*
	Animals	Insect cells, Oocytes, Mammalian cells, Whole organisms
	Plant	Protoplasts Intact cells Whole plants

❑ VECTORS

- **Vector are the DNA molecules**, which can carry a foreign DNA fragment to be cloned. The most important **vectors are plasmids, bacteriophages, cosmids and artificial chromosome vectors.**

S.NO.	TYPES	FEATURES
1	**Plasmids** 	• A plasmid is a **small, extrachromosomal double- circular, self-replicating DNA molecules** • Plasmids are the most-commonly used **bacterial cloning vectors**
2	**Bacteriophage** 	• Bacteriophages or simply phages are the **viruses that replicate within the bacteria** • In case of certain phages, their DNA gets incorporated into the bacterial chromosome and remains there permanently • Phage vectors can accept short fragments of foreign DNA into their genomes • T_4 and T_7 bacteriophage prophase generation in DNA ligase
3	**Cosmids** 	• Cosmids are the vectors possessing characteristics of both **plasmid and bacteriophage λ** • Cosmids can be constructed by adding a fragment of phage λ DNA including cos site, to plasmids
4	**Artificial chromosomes** 	• Developed in 1997 (H. Willard), human artificial chromosome is a **synthetically produced vector DNA**, possessing the characteristics of human chromosome • eg - BACs - Bacterial artificial chromosome YACs - Yeast artificial chromosomes

❑ TECHNIQUES IN GENETIC ENGINEERING



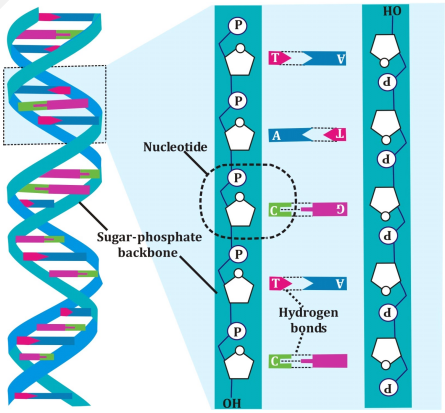
1. Nucleic acid blotting Techniques

- These are analytical tool for identification of desired DNA or RNA fragments from thousands of molecules and it is process of immobilization of sample nucleic acid or solid support.

CHARACTERISTIC	SOUTHERN	NORTHERN	WESTERN
Molecule detect	DNA	mRNA	Protein
Gel electrophoresis	Agarose gel/Polyacrylamide gel	Formaldehyde Agarose gel	Polyacrylamide gel
Blotting method	Capillary transfer	Capillary transfer	Electric transfer
Probes	cDNA, Radioactive or non-radioactive	cDNA rRNA radioactive or non-radioactive	Primary antibody

2. DNA sequencing

DNA sequencing is method for determination of **nucleotide sequence in DNA molecules.**



➢ **Types of method**

1. Maxam & Gilbert techniques
2. Dideoxy nucleotide method
3. Automated DNA sequencing
4. DNA chips (microarray)

3. Methods of gene transfer

S. NO.	METHOD	FEATURES
1	Transformation	Transformation is the method of **introducing foreign DNA** into bacterial cells (eg - *E.coli*), the transformation frequency, which refers to the fraction of **cell population** that can be transferred
2	Conjugation	Conjugation is a **natural microbial recombination process**. During conjugation, two live bacteria (a donor and a recipient) come together, join by **cytoplasmic bridges** and transfer single-stranded DNA (from donor to recipient)
3	Transduction	The foreign DNA can be packed inside animal viruses, these viruses can naturally infect the cells and **introduce the DNA into host cells.** The transfer of DNA by this approach is referred to as transduction

❑ EDUCATION REGULATION (ER)

- Education regulation for D. Pharm Course have been framed by PCI.
- PCI also makes regulation called education regulation with approval of **Central government.**
- **Minimum Qualification** a person who has attain the **age 18 year.**

❖ Periods of study and of practical training

- **Not less than 500 hours** spread over a period of not less than three months
- **Not less than 250 hours** are devoted to actual dispensing of prescriptions in a recognised hospital/dispensary or Pharmacy/ Chemist and Druggist or licensed drug manufacturing unit)

❑ CENTRAL REGISTER OF PHARMACISTS

- **Central Council (PCI) is to maintain a register of pharmacists** known as the **Central Register.**
- **Register contains the names of all persons** for the time being entered in the **registers of different states.**
- Each State Council is required to supply five copies of its register to the Central Council as soon as after the **1st April every year.**
- Central Register is a compilation of all State registers.

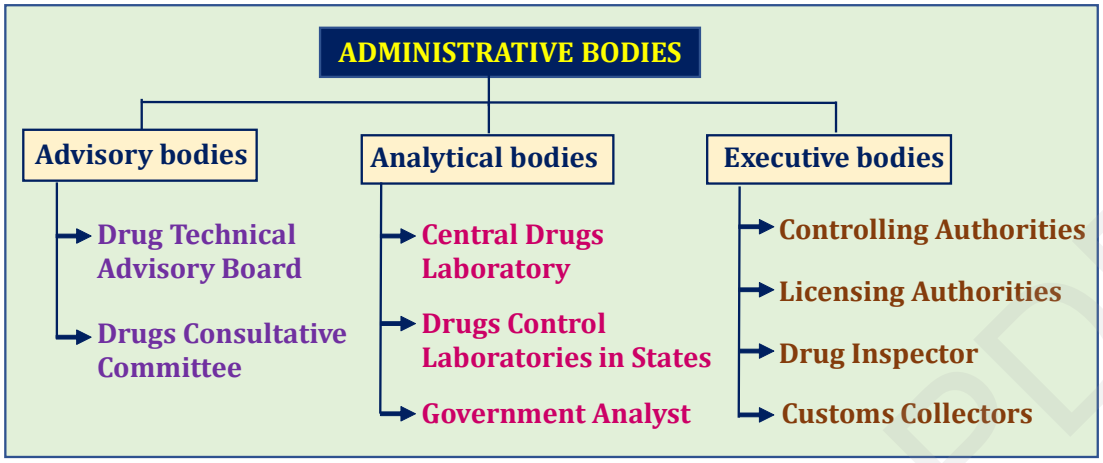
❑ STATE PHARMACY COUNCIL

- **State Pharmacy Council and Joint State Council** are also constituted **by the State Government.**
- **Two or more states** may also agree that the state council
- **Duration of each council – 5 years**
- The state council may appoint a registrar - **Secretary** and also as **Treasurer.**

STATE COUNCIL	JOINT STATE COUNCIL
Elected member	
• **6** Registered pharmacists amongst themselves. • **1** member elected by MCI of the state.	• **3-5** → Registered pharmacist • **1** member elected by the MCI of each state from amongst its members.
Nominated members	
• **5** members at least 3 are possessing a degree and diploma in Pharmacy/ Pharmaceutical Chemistry / Registered pharmacist, nominated by state government.	• **2-4** members nominated by each state of whom more than half shall possessing a degree and diploma in Pharmacy/ Pharmaceutical Chemistry / Registered pharmacist.
Ex-officio members	
• Chief Administrative Medical Officer of the State. • Officer-in-charge of D and C Act,1940. • Govt. Analyst under the drug and cosmetic Act as state govt. may appoint in this behalf.	• Chief administrative medical officer of each of the participating state. • Officer in charge of drug control organization of each participating state. • Govt. analyst of each participating state.

❑ ADMINISTRATION OF THE ACT AND RULES

- **Three administrative bodies**



❖ Drug Technical Advisory Board (DTAB)

- Constituted by the **Central Government**

Ex-officio members (Total = 8)	1. Director General of Health services –**Chairman** 2. Drug controller of India 3. Director of Central Drug Laboratory, Kolkata 4. Director of Central Research Institute, Kasauli 5. Director Indian Veterinary Research Institute, Izzatnagar 6. Director of Central Drug Research Institute, Lucknow 7. President – Medical Council of India (MCI) 8. President – Pharmacy Council of India (PCI)
Nominated members (Total = 5)	1. **Two Person** nominated by the central govt. amongst person who are incharge of drug control in States. 2. **One person** from pharmaceutical industry, nominated by central govt. 3. **Two govt. analyst** nominated by central govt.
Elected members (Total = 5)	1. **A teacher** in pharmacy or pharmaceutical chemistry or pharmacognosy, elected by executive committee of PCI 2. **A teacher** in medicine or therapeutics, elected by executive committee of MCI 3. **One pharmacologist** elected by Governing body of Indian Council of Medical Research 4. **One person** elected by the council of Central Medical Association 5. **One person** to be elected by the council of the Indian Pharmaceutical Association

❖ Drug Consultative Committee (DCC)

- Constituted by the **Central Government**
- Function is **to advise the Central Government, or State Government** and **DTAB**

✓ Constitution

- **Two persons** are nominated by the Central Govt.
- **One person** from each State is nominated by that concerned State Govt.

3. Daily and weekly hours:

WORKING HOURS

ADULT	CHILD	WOMAN
• **NMT 48 hours in a week** • NMT 9 hours in a day (Per day maximum 10 ½ hours) • **For more than 5 hours (Need interval of ½ hour)**	No child should be employed or allowed to work in any factory are following :- • **More than 4.5 hour in a day** • **During night between 10 PM – 6 AM**	**6 A.M- 7.P.M** (Time varies in between depend upon state)

- No female child allowable to work in any factory **except between 8 AM and 7 PM.**

❑ HEALTH AND SAFETY

- ✓ **Cleanliness:**
  - **Painted or varnished:** Atleast once in every 5 years.
  - **White/ Color washed and white/color washing:** atleast once in 14 months
  - **Smooth impervious surface:** Be cleaned at least once in 14 months
- ✓ **Disposal of waste and effluents**
- ✓ **Dust and fume**
- ✓ **Artificial humidification**
- ✓ **Fencing of machinery**
- ✓ **Pressure plant**
- ✓ **Work on or near machinery in motion**
- ✓ **Employment of young person on dangerous machinery**
- ✓ **Safety officer: 1000 or more** worker are employed
- ✓ **Welfare officer: 500 or more** worker are employed
  - **Canteen – No. of worker is more than 250**
  - **Creches – Children under 6 years if no. of female worker is more than 250**

❑ ANNUAL LEAVES WITH WAGES

1. Every worker who has worked for **a period of 240 days or more** in a calendar year shall be allowed during subsequent calendar year, leaves with wages for a number of days calculated as follow:
   - **Adult: 1 day for every 24 days of work.**
   - **Child: 1 day for every 15 days of week.**
2. In calculating the **period of 240 days** of lay-off, maternity leaves to females **not exceed 12 weeks** and leaves are earned in previous year are **included in this period.**

❑ OFFENCES AND PENALTIES

OFFENCES	PENALTIES
General penalties for offences	2-3 months / Rs. 2,000/-
Enhanced penalty after previous conviction	6 months / extend Rs. 1,000/-
Penalty for obstructing inspector	3 months / Rs. 5,000/-
Offence by worker	Rs. 20/-
Penalty for using false certificate of fitness	1 month /Rs. 50/-
Penalty for permitting double employment of child	Rs. 50 /-

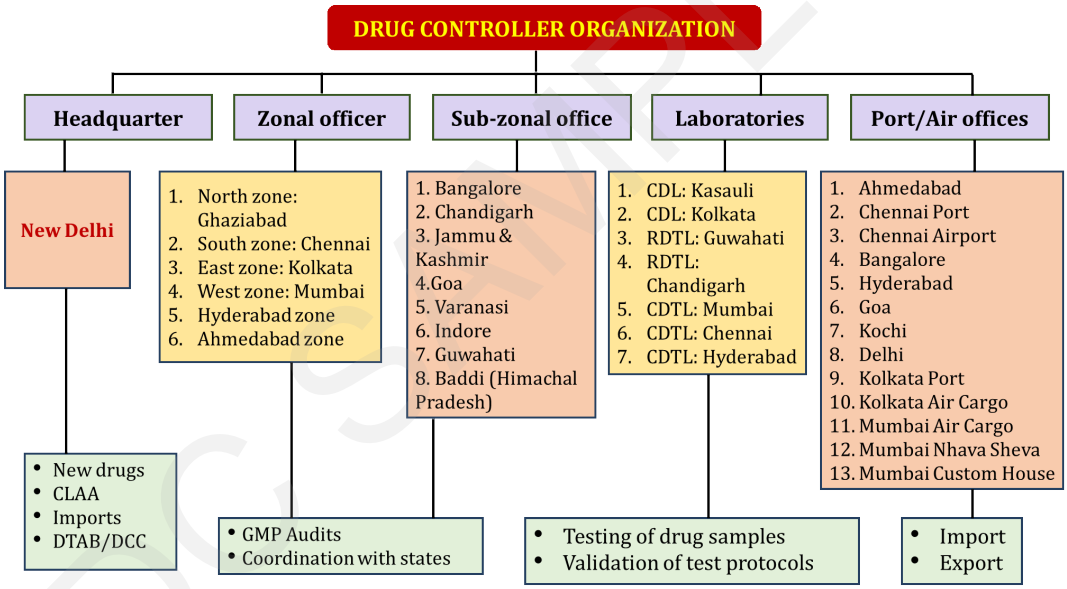
Central Drug Standard Control Organization (CDSCO)

❑ INTRODUCTION

- **The CDSCO of India** is **main regulatory body** for regulation of pharmaceutical, medical **devices and Clinical Trials.**
- Head office - **New Delhi**
- Functioning under the **control of Directorate General of Health Services, Ministry of Health and Family Welfare Government of India.**
- **Drugs Controller General of India [DCGI],** He/she is a responsible for approval of New Drugs, **Medical devices and Clinical Trials** to be conducted in India.
- **Minister of Health and Family Welfare – Dr. Mansukh Mandaviya**
- **Drugs Controller General of India - Dr. Rajeev Singh Raghuvanshi**

NOTE: - Minister of Health and Family Welfare and Drugs Controller General of India will change in future. So, go through Google.

❑ ORGANIZATION OF CDSCO



International Organization for Standardization (ISO)

- It is an independent, **non-governmental organization,** whose membership consists of different national standards bodies
- As of 2022, there are **167 members** representing ISO in their country, with each country having only one member.
- ISO was founded on **23 February 1947**
- It is headquartered in **Geneva, Switzerland**

PHARMACOLOGY

General Pharmacology

❑ IMPORTANT TERMS AND THEIR DEFINITIONS

TERMS	DEFINITIONS
Affinity of drug	The ability of the drug to **occupy and activate the receptors**.
Efficacy of drug	The ability of a drug to produce the **desired beneficial effect**.
Potency of drug	The **amount of drug required** to produce a desired response.
Placebo drug	A **dummy medicine** that is inert in nature and given in the grab of original medicine.
Nocebo effect	Converse of placebo refers to the **negative psychodynamic effect** evoked by loss of faith in medicine or physician.
Agonist	Activate a receptor to produce a response**.**
Antagonist	Prevent actions of agonist but does not have any effect on its own.
Partial agonist	Produce **submaximal effect** but antagonize action of full agonist.
Inverse agonist	Produces effect in opposite direction to agonist.
Anaphylaxis	It is a **serious allergic reaction** that involves more than one organ system (for example, skin, respiratory tract, and/or gastrointestinal tract).
Tolerance	Requirement of higher dose of a drug to produce a given response.
Tachyphylaxis	A rapid development of tolerance producing **an acute, sudden decrease in response** to a drug after its administration.
ED_{50}	It is a median effective dose of a medication that **produces a desired effect in 50% of the population** that takes that dose.
LD_{50}	It is a median lethal dose of a medication. It is the amount of **drug lethal to 50% of the population** exposed to it.
Therapeutic Index	The ratio of LD_{50} to ED_{50}. The more the ED_{50} value, more the drug will be safe.
Therapeutic Drug Monitoring (TDM)	Monitoring of drug therapy by **measuring plasma concentration** of drug is known as TDM.

❑ ROUTES OF DRUG ADMINISTRATION

[I] LOCAL ROUTE

1. **Topical –** Applied to surface at Skin. Eg. Antiseptic & ointments
2. **Deeper tissue**
   - i. **Intra articular –** Injection into knee joints. (Eg. – Hydrocortisone) Large joint – Upto 40mg. Small joints – 5-10mg.
   - ii. **Intra thecal –** Injection into CSF. Dose – ≤20ml. Eg. - Lidocaine
   - iii. **Retro bulbar –** Injection into behind eyeball. Eg. Anaesthesia
   - iv. **Intra arterial –** Drugs injected into artery via needle. Eg. Anticancer drug.

[II] SYSTEMIC ROUTES (ENTERAL ROUTE)

1. **Oral route –** Administered via oral route Eg. Paracetamol
2. **Sublingual –** Drug placed below tongue. Eg. Nitroglycerin, Clonidine
3. **Rectal –** Drug inserted in rectum as suppository. Eg. Diazepam
4. **Inhalational –** Absorption from alveoli. Eg. General anaesthetic
5. **Intranasal –** Mucous membrane of nose absorb drug. Eg. Calcitonin

[III] SYSTEMIC ROUTES (PARENTERAL ROUTE)

1. **Intramuscular –** Injected into skeletal muscles at 90^0 angle (deltoid, gluteus maximus). Dose – 2-4ml Eg. Adrenaline
2. **Intravenous –** Injected as bolus or infusion in veins at 25^0 angle . Dose – Upto 500ml or more. Eg. Furosemide.
3. **Intradermal/Cutaneous –** Drug injected into the skin raising a bleb at $10 – 15^0$ angle. Dose – 0.1-0.2ml. Eg. Diazepam.
4. **Subcutaneous –** Drug deposited in loose subcutaneous tissue via Dermojet, Implants, Pellet, Silastic at 45^0 angle. Eg. Insulin, Testosterone.

PHARMACOKINETICS

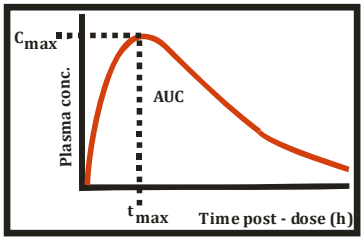
Refers to – **"What the body does to the drug".**

It consists of **(ADME) Absorption (A), Distribution (D), Metabolism (M), Excretion (E).**

❑ ABSORPTION

- Absorption is **movement of drug** from site of **administration to blood circulation.**
- Only **lipid soluble drugs** can cross the biological membrane.
- Drugs are absorbed only in **free or unionized form**.
- **Bioavailability** refers to **fraction of drug that reaches to systemic circulation.**
- **Bioavailability is** determined by area under curve **(AUC)** & calculated by: -

$$\text{Bioavailability (F)} = \frac{\text{AUC(oral)} \times 100}{\text{AUC(IV)}}$$



- **First pass metabolism** known as **first pass effect** or **Presystemic metabolism**.

❑ DISTRIBUTION

- Distribution is **reversible transfer of drugs** between body fluid compartments.
- The apparent volume of drug, distributed in the body to provide same concentration as in blood plasma.

$$V_d = \frac{\text{Total amount of drug in the body}}{\text{Concentration of the drug in plasma}}$$

- **Acidic drug** primarily **binds to plasma Albumin.**
- **Basic drugs** primarily **bind to α_1 acid Glycoprotein.**

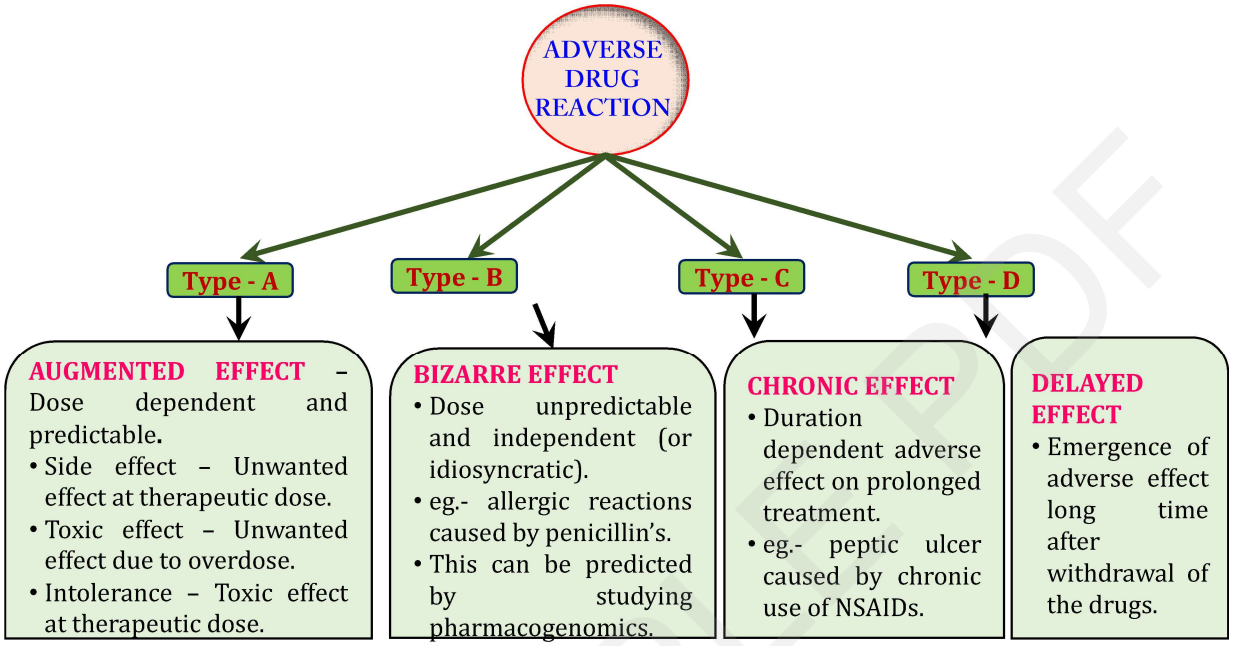
❑ METABOLISM

- Most common synthetic **Phase I** conjugation reaction is **Oxidation**.
- Most common synthetic **Phase II** conjugation reaction is **Glucuronide conjugation.**
- Most important (overall) drug metabolizing reaction → **Oxidation.**
- **Prodrug** medications that **converted into an active form** once they enter the body.
- **Hofmann elimination –** Drugs inactivated via spontaneous molecular rearrangement without any enzyme. E.g. – Atracurium, Skeletal muscle relaxant.

INACTIVE DRUG (PRODRUG)	ACTIVE FORM
Proguanil	**Cycloguanil**
Levodopa	**Dopamine**
Enalapril	**Enalaprilat**
Dipivefrine	**Epinephrine**
Sulindac	**Sulphide metabolite**
Prednisone	**Prednisolone**
Bacampicillin	**Ampicillin**
Sulfasalazine	**5-Amino salicylic acid**
Acyclovir	**Acyclovir triphosphate**
Cyclophosphamide	**Aldo phosphamide, Acrolein**
α- methyldopa	**α – Methyl norepinephrine**
Clopidogrel	**Thiol metabolites**
Fluorouracil	**Fluorouridine**
Mercaptopurine	**Methylmercaptopurine ribonucleotide**

ACTIVE DRUG	ACTIVE METABOLITE
Amitriptyline	**Nortriptyline**
Codeine	**Morphine**
Diazepam	**Oxazepam**
Digitoxin	**Digoxin**
Imipramine	**Desipramine**
Phenacetin	**Paracetamol**
Primidone	**Phenobarbitone**
Spironolactone	**Canrenone**
Allopurinol	**Alloxanthine**
Morphine	**Morphine-6-glucouronide**
Cefotaxime	**Desacetyl cefotaxime**
Procainamide	**N-acetyl procainamide**

ADVERSE DRUG REACTION



❑ TYPES OF ALLERGIC REACTION

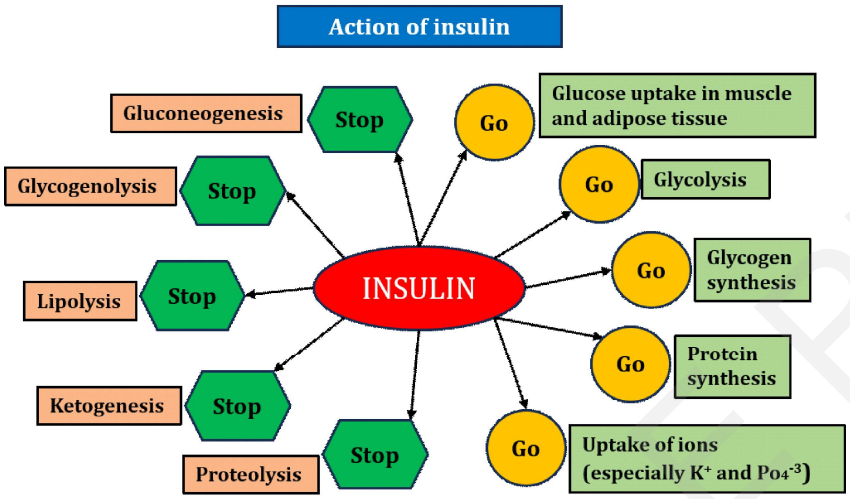
CLASS	TYPES OF HYPERSENSITIVITY REACTION	ANTIBODIES
HUMORAL	**Type I** - Anaphylactic reaction	IgE
	Type II - Blood Cytolytic reaction	IgG, IgM
	Type III - Complex AG:AB mediated reaction (Arthus reaction)	IgG
CELL MEDIATED	**Type IV** - Delayed hypersensitivity reaction or Cell mediated	Production of T-lymphocyte

❑ TERATOGENICITY

ABNORMALITIES	DRUGS
Phocomelia (seal like limbs)	**Thalidomide**
Discoloration of teeth, retard bone growth	**Tetracycline**
Socket like nose, eye	**Warfarin**
Pre closure of ductus arteriosus	**Indomethacin/Aspirin**
Vaginal carcinoma in teenage female	**Stilbestrol**
Virilization of female fetus	**Progestin**
Hypoplastic phalanges	**Phenytoin**
Spina bifida and neural tube defects	**Valproate sodium**
Low IQ baby, Growth retardation	**Alcohol**
Hypoplasia of organs, Dry cough	**ACE inhibitor**
Fetal goiter	**Lithium**

Preproinsulin (110 AA) —- 24 AA → **Proinsulin** (86 AA) —- 35 AA → **Insulin** (51 AA)

❑ ACTIONS OF INSULIN



❑ CLASSIFICATION OF INSULIN (Preparation and Analogue)

CLASS	INSULIN
Rapid acting	Insulin lispro, Insulin aspart, Insulin glulisine
Short acting	Regular (soluble) insulin
Intermediate acting	Insulin zinc suspension or Lente Natural Protamine Hagedorn (NPH) or isophane insulin
Long acting	Insulin glargine, Insulin detemir

❑ MECHANISM OF ACTION OF INSULIN

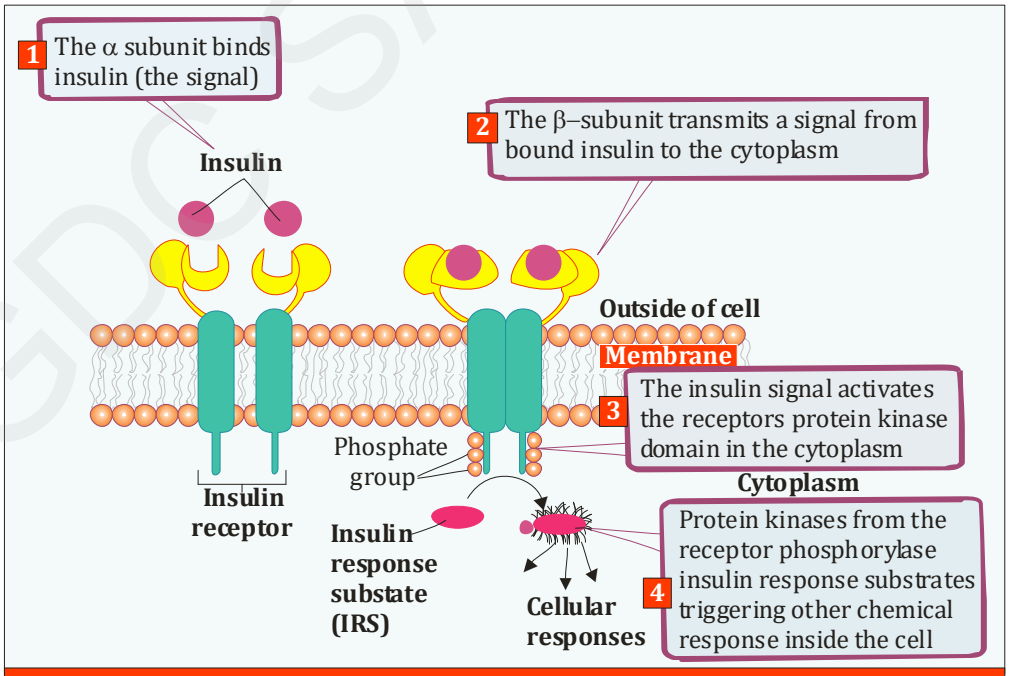
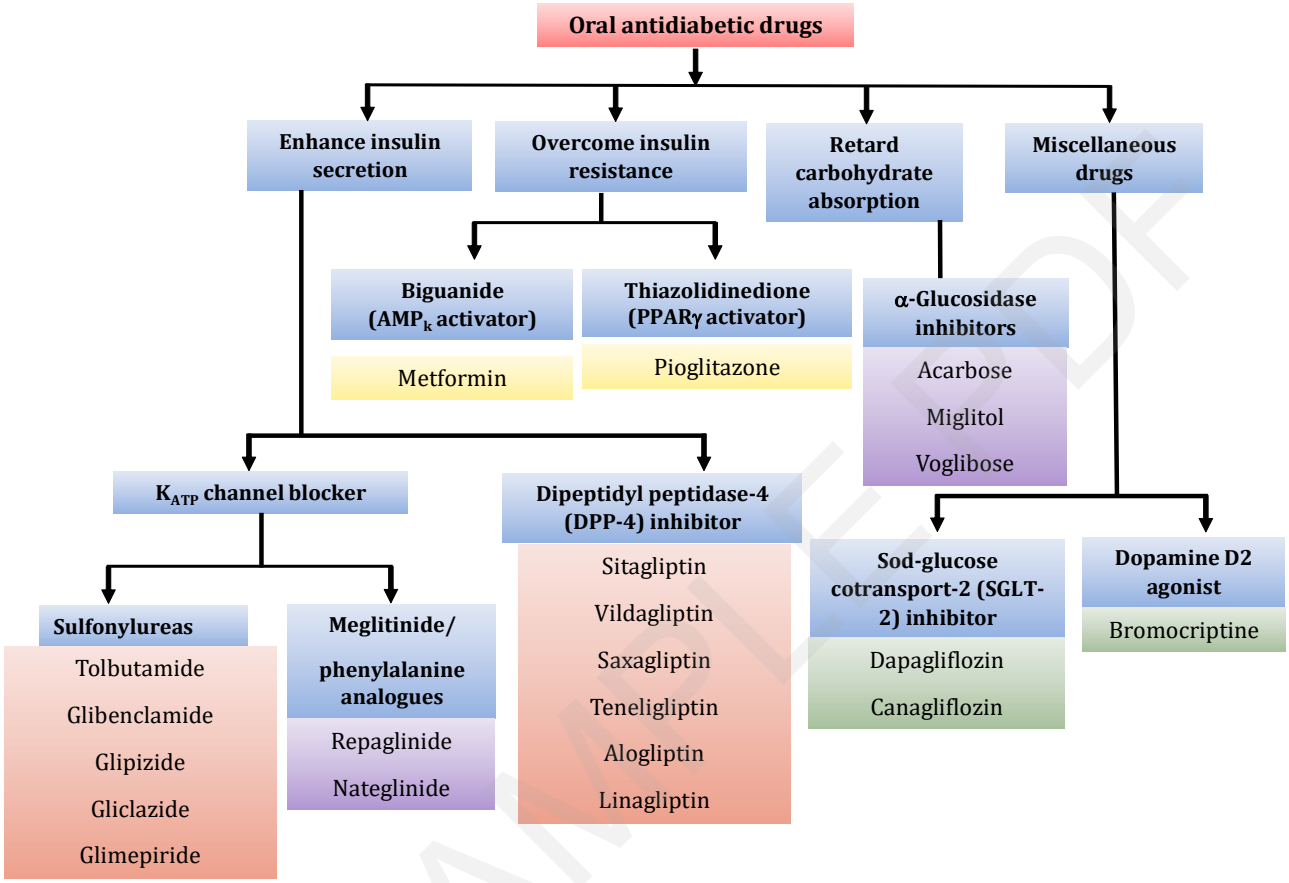


FIG.- MECHANISM OF ACTION OF INSULIN

❑ ORAL HYPOGLYCEMIC DRUGS/ ANTIDIABETIC DRUGS

❖ Classification of oral hypoglycaemic drug



❖ Adverse effect of oral hypoglycaemic drugs

DRUG	ADVERSE EFFECTS
Sulfonylureas	Hypoglycaemia, Teratogenic
Meglitinides Analogues	Weight gain
Metformin	Megaloblastic anaemia
Phenformin	Lactic acidosis
Thiazolidinediones	Hepatic dysfunction, CVS defects

CORTICOSTEROIDS

- Adrenal gland has two-part **cortex and medulla**.
- Adrenal cortex secretes – **Glucocorticoid, Mineralocorticoid and Sex hormones**
- Adrenal medulla secretes – **Adrenaline and Noradrenaline**

❑ TRICK FOR SULFONAMIDES

TRICK - SULFA

S	- **S**teven Johnson Syndrome
U	- **U**rine Precipitate/useful for UTI
L	- **L**arge spectrum
F	- **F**olic acid synthesis blocker
A	- **A**nalogues of PABA

❑ POINTS TO BE REMEMBER

- **Cotrimazine -** Trimethoprim + Sulfadiazine.
- First sulfa drug: **Prontosil** (**invented by G. Domagk**)
- **Other DHFRase inhibitors are –** Pyrimethamine, Methotrexate, Proguanil, Pentamidine
- **All DHF Rase inhibitors cause –** Megaloblastic anaemia
- **Cotrimoxazole is the DOC for –** Toxoplasmosis, Pneumocystis carinii pneumonia.
- Cotrimoxazole is **contraindicated during pregnancy.**

❑ IMPORTANT DRUG AND THEIR DESCRIPTIONS FOR FLUOROQUINOLONES

Ciprofloxacin	• It is **(Prototype)** Most potent first -generation Fluroquinolones. • **Absorbed orally,** but in present of food its absorption is slow. • **Ciprofloxacin** and **Levofloxacin** are the only Fluoroquinolones which are effective **against pseudomonas**
Sparfloxacin	It is maximum plasma protein binding and longest acting Fluoroquinolones.
Pefloxacin	It is the **methyl derivative** of Norfloxacin which is more lipid soluble and completely absorbed orally. It has **highest first pass metabolism.**
Norfloxacin	It has least oral bioavailability.

❑ ADVERSE EFFECT OF QUINOLONES

- They are **contraindicated in pregnancy** because of concern of teratogenicity.
- **Cartilage damage** in weight bearing joints (Contraindicated in children).
- Drug which prolongs QTc interval are major side effect in patients of **cardiac arrythmias & hypokalaemia.**

β - LACTAM ANTIBIOTICS

❑ INTRODUCTION

- β -lactam antibiotics are those drug that **contain β-lactam** in their ring structure.
- **All β -lactam** antibiotics are **bactericidal** in nature.
- All drugs in this class are acting by **inhibiting the cell wall synthesis** in bacteria.
- These drug **bind** to **penicillin binding protein** on cell membrane and **inhibit transpeptidation.**
- Composition of Bacterial cell wall → **N-acetylglucosamine (NAG) & N-acetylmuramic acid (NAM).**

PHARMACOGNOSY

Introduction of Pharmacognosy

- Pharmacognosy, defined as the **scientific study of crude drugs** obtained from **plants, animals and mineral** kingdom and their constituents. Known initially as ***materia medica.*** Derived from **two Greek words**-

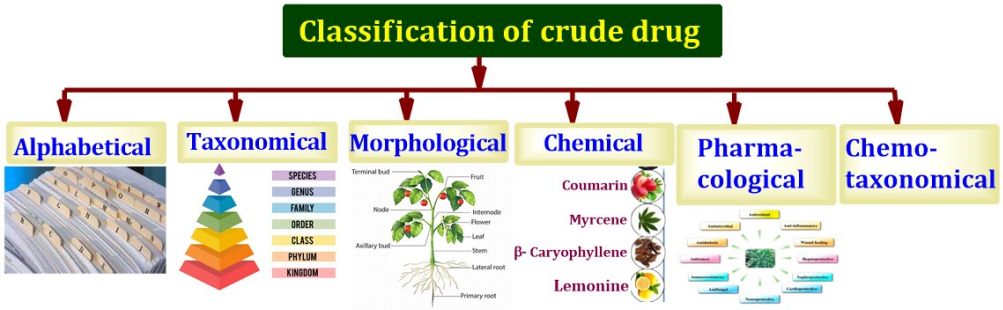
Pharmacognosy → **Pharmakon (drug)** + **Gignosco (to acquire knowledge of)**

❑ HISTORY OF PHARMACOGNOSY

SCIENTIST	CONTRIBUTION
Dioscorides	• **Father of Pharmacognosy** (***Materia Medica***)
Seydler	• Coined the term "**Pharmacognosy**" 1815 (***Analecta Pharmacognostica***)
Theophrastus	• **Father of Botany**
Aristotle	• **Father of Zoology,** Father of Natural History (**Animal kingdom**)
Hippocrates	• **Father of Medicine**
Galen	• **First pharmacist**, Pioneer of Experimental Physiology
Bentham & Hooker	• **Plant classification** was further developed by them
Shen Nung	• **Pen-t Sao** (The oldest known herbal, Contain 365 drugs).
Charaka	• **Charaka Samhita** - Arranged 50 group of 10 Herbs.
Sushrutha	• **Father of Cosmetic Surgery** • Arranged 760 herbs in 7 distinct set
Haberlandt	• **Father of Plant Tissue Culture**
Stass and Otto	• **Develop a new extraction process for Alkaloid.**
Mahadeva Lal schroff	• **Father of Indian Pharmacy** • The birth of his (06 march) celebrated as National Pharmacy Education Day onwards 2023.
William withering	• Carry out detailed study of **digitalis.**

AYURVEDIC PREPARATION	DESCRIPTION
Asava and Arista 	• Asavas and Aristas are medicinal preparations made by soaking the drugs, either in **powder form or in the form of decoction** (kasaya) in a solution of **sugar or jaggery,** as the case may be for a **specified period of time,** during which it undergoes a **process of fermentation generating alcohol.** • **Asavas and Aristas can be kept indefinitely.**
Arka 	• Arka is a liquid preparation obtained by **distillation** of certain liquids or of **drugs soaked in water.**
Avaleha or leha 	• Avaleha or lehya is a semisolid preparation of drugs, prepared with **addition of jaggery, sugar or sugar candy** and **boiled with prescribed drug juice or decoction**. • Normally, lehyas should be used within **one year.**
Churna 	• Churna is a fine powder of drug or drugs. They retain potency for **one year.**
Parpati- kalpas 	• The mineral or herbal drugs are processed by **special techniques of roasting** and are converted into flattened scales or thin layers. • Parpati-Kalpas are claimed to **have a long shelf life.**
Bhasma 	• The powdered form of the substance, obtained by **calcination of metals, minerals or animal products.**
Vatika and Gutika 	• Medicaments in the form of **tablets or pills** are known vatika and gutika respectively. **These preparations can be used upto two years.**

CLASSIFICATION OF CRUDE DRUG



Sutures and Surgical Catgut

Sutures are medical devices used to hold together the edges of a wound or incision to promote healing. They are typically made of sterile **thread** or filament and are commonly used in **surgeries** and other procedures to close incisions or repair tissue.

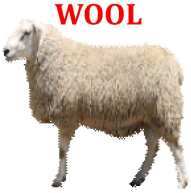
❑ TYPES OF SUTURES

ABSORBABLE SUTURES	NON - ABSORBABLE SUTURES	METALLIC SUTURES
They will break down and be absorbed by the body over time.	They will need to be removed manually after the wound has healed.	They are the wires or metals.
Example: • **Surgical catgut** • **Sterile reconstituted collagen suture**	**Example**: • **Silk** • **Nylon** • **Polyamide**	**Example**: • **Silver** • **Stainless steel**

❑ SUTURES AND SURGICAL CATGUT CONTAINING CRUDE DRUGS

Surgical catgut is a type of suture material that is made from the **intestines** of **sheep**. They are commonly used in various surgical procedures to close wounds or hold tissues together.

NAME OF DRUGS	BIOLOGICAL SOURCE	CHEMICAL CONSTITUENTS	USES
PLANT FIBRES			
COTTON (Purified cotton, Absorbent cotton) 	Obtained from epidermal trichomes or hairs of seeds of ***Gossypium herbaceurre*** **Family:-** Malvaceae	• Cellulose • Wax • Protoplasm	Filtering media Surgical dressing
FLAX 	Obtained from pericyclic fibres of stem of ***Linum usitatissimum.*** **Family:-** Linaceae	• Pecto-cellulose • **Lignans**	• Straining and filtering media • Preparations of bags
JUTE (Gunny-bag fibres) 	Obtained from phloem fibres of ***Corchorus sp.*** **Family:-** Tiliaceae	• Cellulose • Lignin • Hemicellulose	• Manufacture of tows and Gunny-bag • Straining Filtration media
ANIMAL FIBRES			
SILK 	Obtained from silk worm cocoons of ***Bombyx mori*** **Family:-** Bombycidae	• Protein known as **Fibroin**	• Sutures • Ligatures

WOOL 	Obtained from fleece of sheep ***Ovis aries*** **Family:-** **Bovidae**	• Keratin • Wool fiber (31%) • Wool sweat or 'suint' (K salts of fatty acids, 32%) • Wool grease	• Manufacturing of surgical dressings like domette, crepe bandage
REGENERATED FIBRES			
RAYON (viscose rayon, regenerated cellulose) 	It is an artificial fibre, composed of **regenerated cellulose.**	• Cellulose • Hemicellulose • Moisture	• Preparation of gauze and other surgical dressing making fabrics

❑ CHEMICAL TEST FOR SUTURES AND SURGICAL CATGUT

IDENTIFICATION TEST	OBSERVATION	INFERENCE
Cotton Ammonical copper oxide solution (cuoxam-regent) dissolves raw cotton	• **Formation of balloons** • **Absorbent cotton dissolves**	Presence of cotton
Jute Phloroglucinol + Hydrochloric acid.	**Red colour**	Presence of lignin
Silk Extract + Lead acetate solution	**Negative**	Presence of silk
Wool Caustic soda + Lead acetate	**Black precipitate**	Presence of wool

Natural Pesticides

NAME OF DRUGS	BIOLOGICAL SOURCE	CHEMICAL CONSTITUENTS	USES
NEEM (Margosa)  	Obtained from aerial part of ***Azadirachta indica*** **Family:-** **Meliaceae**	**Leaves-** Azadirachtin **(Insect repellant)** Salanin, Meliantriol **(Antifeedant)** **Seeds-** Nimbin, Nimbidin **(Antiviral)** **Bark -** Margolone, Margolo - none **(Antibacterial)** **Flowers -** Myricitin, Kaempferol **(Insecticidal)**	• Insect repellent • Insecticide • Antifeedant • Antimicrobial
PYRETHRUM (Insect flower) 	Obtained from flower head of ***Chrysanthemum cinerariaefolium*** **Family:-** **Compositae**	• Pyrethrum (Insecticidal) • Pyrethrin I and Pyrethrin II	• Insecticide • Contact poison • **Kill flies & mosquitoes.**
RYANIA 	Obtained from root and stem of ***Ryania speriost*** **Family:-** **Flacourtriaceae**	• Ryanodine	• Insecticide to control cabbage, cauliflower worms.

PHARMACEUTICAL CHEMISTRY

PHYSICAL CHEMISTRY

❑ INTRODUCTION

- Physical chemistry deals with the principles of physics involved in chemical interactions. It examines: How matter behaves on a molecular and atomic level.

Chemical Bonding and Molecular Structure

❑ ATOMIC STRUCTURE

Atomic Number	• The number of **protons present** in the nucleus is called atomic number of an element.
Mass Number	• The sum of **number of neutrons and protons** is called the mass number of the element. • It is also known as **number of nucleons** because neutrons & protons are present in nucleus. • **Mass number = Number of protons + Number of neutrons**
Mole Concept	• A mole is defined as the amount of substance which contains same number of elementary particles (atoms, molecules or ions) as the number of atoms present in 12 g of carbon (C-12). • 1 mol = 6.023×10^{23} atoms = one gram atom = gram atomic mass

❑ CHARGE AND MASS OF ELECTRON, PROTON AND NEUTRON

PARTICLE	UNIT	MASS (GRAMS)	CHARGE (COULOMBS)
Electron (e^-)	-1	9.1×10^{-28}	-1.60×10^{-19}
Proton (p^+)	+1	1.672×10^{-24}	$+1.60 \times 10^{-19}$
Neutron (n^0)	0	1.675×10^{-24}	0

❑ DIFFERENT TYPES OF ATOMIC SPECIES

TERM	DISCRIPTION	EXAMPLE
Isotopes	Same **atomic number** but **different mass number**	$_6C^{12}$, $_6C^{13}$, $_6C^{14}$
Isobars	Same **mass number** but **different atomic number**	$_1H^3$, $_2He^3$
Isodiaphers	Same **difference of number** of **Neutrons & Protons**	$_5B^{11}$, $_6C^{13}$
Isotones	Having **same number of Neutron**	$_1H^3$, $_2He^4$
Isosters	They are the molecules which have the **same number of atoms & electrons**	CO_2, N_2O
Isoelectronic	Species having **same no. of Electron**	Cl^-, Ar

❑ HENDERSON- HASSEL BACH EQUATION

- The Henderson-Hasselbalch equation provides a relationship between the pH of acids (in aqueous solutions) and their pKa (acid dissociation constant).

$$pH = pKa + \log \frac{[\text{conjugated base}]}{[\text{weak acid}]} \quad \text{(For weak acid)}$$

$$pOH = pKb + \log \frac{[\text{conjugated base}]}{[\text{weak acid}]} \quad \text{(For weak base)}$$

❖ APPLICATION OF HENDERSON- HASSEL BACH EQUATION

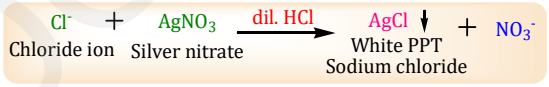
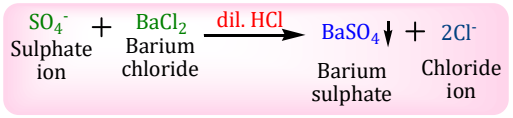
- To calculate the pH of the **buffer solution** made by mixing salt and weak acid/base.
- It is used to calculate the **pK_a value and used to prepare buffer solution** of needed **pH.**

Limit Test

❑ INTRODUCTION

- **Limit test** is defined as quantitative or semi quantitative test designed **to identify and control small quantities of impurities** which are likely to be **present in the substances.**
- Identified by simple comparison of **Opalescence, turbidity, or colour** is compared with the **fixed standards** as prescribed in the pharmacopoeias. Usually the limits are pre scribed in **parts per million (PPM).**

❑ DIFFERENT SUBSTANCE AND THEIR LIMIT TEST

SUBSTANCE	PRINCIPLE/ REACTION	RESULT
CHLORIDE	Limit test of chloride based on reaction between **chloride ion** and **silver nitrate** in the presence of **dilute nitric acid.** 	• Reaction produces silver chloride **as white precipitate.** • Opalescence produce in sample solution should not be greater than standard solution
SULPHATE	Limit test of sulphate based on reaction between **sulphate ion** and **barium chloride** in the presence of **dilute hydrochloric acid.** 	• Reaction **produces barium sulphate.** • **Alcohol prevent super saturation.** • Turbidity of test solution is less than that of standard solution the compound will pass the limit test of sulphate.

❑ EXPECTORANT, EMETICS AND REPIRATORY STIMULANTS COMPOUNDS

INORGANIC COMPOUND	SYNONYMS	MOLECULAR FORMULA	PROPERTIES	USES
Ammonium acetate	Ammonium salt	CH_3COONH_4	Colourless	Expectorant, diuretic
Ammonium carbonate	Sal volatile, Preston salt, Baker's ammonia	$(NH_4)_2CO_3$	White translucent crystal.	Respiratory stimulant
Potassium iodide	Potassium Iodine Oxide, Iodic Acid, Potassium Salt	KI	White granular powder	Expectorant, diuretic,
Antimony potassium tartrate	Potassium Antimontarterate, Or Tartar Emetic	$K_2Sb_2C_8H_4O_{12}\cdot 3H_2O$	Colourless crystal	Emetic, used to Schistosmiosis
Copper Sulphate	Cupric sulfate, blue vitriol	$CuSO_4.5H_2O$	Blue crystalline granules or powder	Emetic, antidote in phosphorus poisoning
Zinc sulphate	White vitriol	$ZnSO_4.7H_2O$	Colourless transparent crystal	Emetic, Astringent

DENTAL PRODUCTS

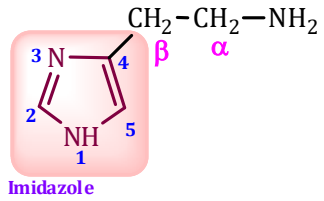
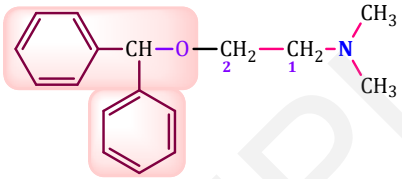
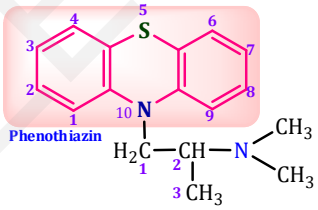
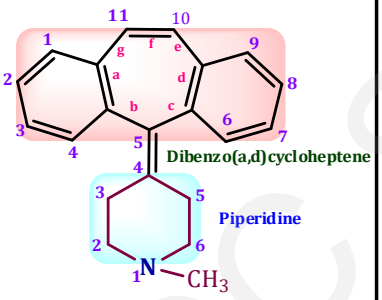
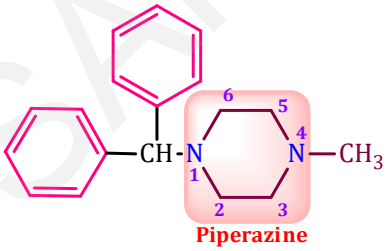
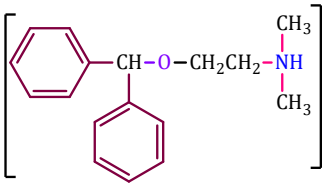
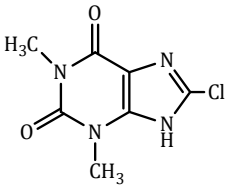
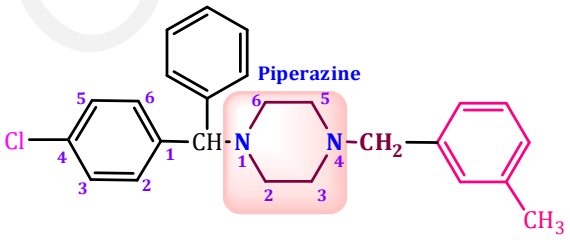
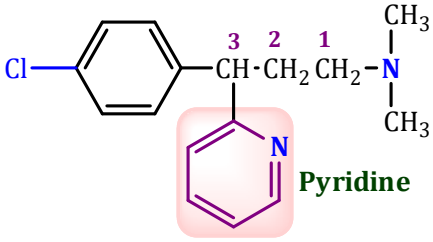
- Products pertaining to teeth are known as **dental products.** Different types of dental products are available.
- **Anticaries agent:** These are the agents which help in the prevention of dental decay. e.g., Sodium fluoride, Stannous fluoride, Sodium monofluorophosphate, **Sodium metaphosphate.**
- **Dentifrices:** These are generally in the form of paste, powder, gel or liquid used to clean and polish natural teeth. eg. **Calcium carbonate, Calcium phosphate, Sodium metaphosphate, Aluminum oxide**
- **Desensitizing agent:** The desensitizers used to decrease hypersensitivity of the teeth. eg. **Strontium chloride, Zinc chloride**
- **Cement and fillers:** Dental cements are used to temporarily cover protection that had gone operation. Eg. **Gold, Silver and ZnO**
- **Abrasive:** This specialty deals with the finishing and polishing of dental appliances. **Pumice (complex silicate of Al, P and Na)**

Autacoids and Non Steroidal Anti-Inflammatory Drugs

❑ HISTAMINE AND ANTIHISTAMINICS

- Histamine, **[β-(imidazole-4yl) ethylamine],** which is biosynthesized by **decarboxylation** of the **basic amino acid histidine**, is found in all tissue of the human body.
- **Cetirizine is an acid metabolite** formed by the oxidation of primary alcohol of **antihistamine hydroxyzine.**

❖ Structures of Histamine and Antihistaminic drugs

HISTAMINERGIC AGONISTS	H_1 ANTAGONISTS (CONVENTIONAL ANTIHISTAMINICS)	
Histamine  β-(Imidazole-4yl) ethyl amine	**Diphenhydramine**  2-(Diphenylmethoxy)-N,N dimethyl ethanamine	**Promethazine**  N,N-Dimethyl-1-(10H-pheno-thiazin- 10-yl)propan-2-amine
Cyproheptadine  4-(5H-Dibenzo[a, d]cyclohepten-5-ylidene)-1-methyl piperidine	**Cyclizine**  1-Benzhydryl-4-methyl-piperazine	**Dimenhydrinate**  **Diphenhydramine**  **8-Chlorotheophylline**
Meclizine  1-[(4-chlorophenyl)(phenyl)methyl]-4-(3-methyl benzyl) piperazine	**Chlorpheniramine**  3-(4-Chlorophenyl)-N, N-dimethyl-3- (pyridin-2-yl)-propan-1-amine	

❑ APPLICATIONS OF SIZE-EXCLUSION (GEL) CHROMATOGRAPHY

- Helpful in the **separation of ions of similar properties**
- Stationary phase is a polymeric matrix with ionic functional groups like **carboxylic acid, and quaternary amine (Ions exchange resin).**
- Particularly applicable to separate high molecular weight substances.

GAS CHROMATOGRAPHY (GC)

❑ INTRODUCTION

- Gas chromatography consists of **Gas Solid Chromatography (GSC)** and **Gas Liquid Chromatography (GLC).**
- In both types, gas is used as the mobile phase and either solid or liquid is used as the stationary phase.

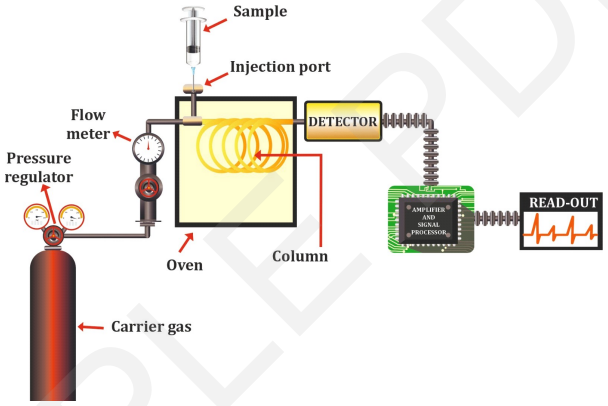


Fig- Gas Chromatography

❑ PRINCIPLE

- The principle of separation in GC is partition. Gas is used as the mobile phase. Liquid coated onto solid support is used as the stationary phase.
- Improved efficiency was achieved by **increasing the column's length and width.**

❑ GAS-SOLID & GAS-LIQUID CHROMATOGRAPHY

GAS-SOLID CHROMATOGRAPHY	GAS-LIQUID CHROMATOGRAPHY
Principle – Adsorption	**Principle – Partition**
• **The mobile phase** is a gas while the stationary phase is a solid. • Used for separation of low molecular gases.	• **Mobile phase** is a gas while the **stationary phase** is a liquid retained on the surface as an inert solid by adsorption or chemical bonding.
MOBILE & STATIONARY PHASE	
MOBILE PHASE	**STATIONARY PHASE**
Carrier gases are used as a **mobile phase.** **Example:** Hydrogen, helium, nitrogen, and argon	Solids are used as a **stationary phase.** **Examples:** Polydimethylsiloxane, Poly (diphenyl) dimethyl siloxane, Poly cyanopropyl phenyl dimethyl siloxane, Polyalkylene glycol, Polyethylene glycol, PEG-modified with Nitro terephthalic acid, Poly bis cyanopropyl siloxane

Spectroscopy

❑ INTRODUCTION

- Spectroscopy is the measurement and interpretation of **Electro Magnetic Radiation (EMR)** absorbed or emitted when the molecules or atoms or ions of a sample move from one energy state to another energy state.
- The amount of radiation absorbed by the sample is **measured as wavelength is varied.**

Energy of the molecule = **Rotational + Vibrational + Electronic energy**

❑ PRINCIPLE OF SPECTROSCOPY

- The basis of spectroscopy is that substances have an absorption spectrum or a variety of **energy absorbed by the substance at various frequencies.**
- Their **atomic and molecular constitution** determines substances' absorption spectrum.

❑ TYPES OF SPECTROSCOPY

TYPES	SUB-TYPES	EXAMPLES
Based on atomic or molecular level	**Atomic Spectroscopy**	Change in energy takes place at atomic level **eg :- AAS, Flame photometry**
	Molecular Spectroscopy	Change in energy takes place at molecular level **eg :- UV, IR, Fluorimetry, Colorimetry**
Based on absorption or emission of EMR	**Absorption Spectroscopy**	Where absorption of radiation is being studied **eg :- UV, Colorimetry, IR, NMR, AAS**
	Emission Spectroscopy	Where emission of radiation is being studied **eg :- Flame photometry, Fluorimetry**
Based on electronic or magnetic levels	**Electronic Spectroscopy**	Study is done using electromagnetic radiation **(without the influence of magnetic field)** **eg:- UV, Colorimetry, Fluorimetry**
	Magnetic Spectroscopy	Study is done using electromagnetic radiation under the influence of magnetic field **eg :- NMR Spectroscopy, ESR Spectroscopy**

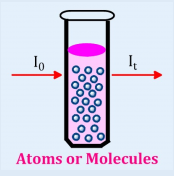
❑ THEORY OF SPECTROSCOPY

THEORY OF SPECTROSCOPY

EMR travels through a medium containing atoms, molecules or ions, any one of the following may take place.

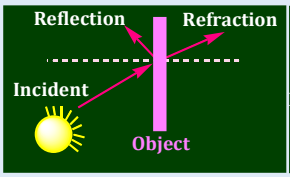
1.

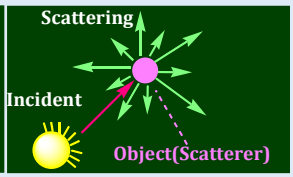
- **Intensity of emergent light (I_t) = Intensity of incident light (I_0)**
- Therefore, no absorption i.e. **$I_t = I_0$ No change in energy** takes place and hence no information about the molecule can be derived.



2.

- **Reflection: -** Refraction or Scattering, (scattering of light by particles) where some studies like **Nephelometry or Turbidimetry** are being made.





❑ VITAMINS, COENZYMES, DEFICIENCY DISEASES (WATER SOLUBLE)

VITAMINS	DAILY REQUIREMENTS	COENZYME	FUNCTIONS OF COENZYME	DISEASES
Thiamine (Vit. B_1)	**1.0-1.5 mg/day**	**TPP** (Thiamine pyro-phosphate)	Oxidative decarboxylation Transketolase reactions	• **Beriberi Wernicke - Korsakoff syndrome**
Riboflavin (Vit. B_2)	**1.2-1.7 mg/day**	**FAD** (Flavin Adenine Dinucleotide) **FMN** (Flavin Mononucleotide)	Oxidation and Reduction reactions	• **Glossitis** • Cheilosis • Dermatitis
Niacin (Vit. B_3)	**15-20 mg/day**	**NAD^+** (Nicotinamide Adenine Dinucleotide) **$NADP^+$** (Nicotinamide Adenine Dinucleotide Phosphate)	Oxidation and Reduction reactions	• **Pellagra**
Pantothenic Acid (Vit. B_5)	**5-10 mg/day**	Coenzyme A	Acyl carrier	• **Burning feet syndrome**
Pyridoxine (Vit. B_6)	**2-2.2 mg/day**	**PLP** (Pyridoxal Phosphate)	Transamination Deamination Decarboxylation reaction of amino acids	• **Peripheral neuropathy** • **Reduction in heme production**
Biotin (Vit. B_7)	**100-300 mg/day**	Biocytin	Carboxylation reaction	• **Anemia, loss of appetite, nausea, dermatitis,**
Folic acid (Vit. B_9)	**200 µg**	**THF** (Tetrahydro Folate)	Carrier of one carbon group	• **Megaloblastic anemia**
Cyanocobalamin (Vit. B_{12})	**Adult** 3 µg of **children,** 0.5-1.5 µg /day **pregnancy and lactation -** 4 µg /day. 3 µg	Methyl cobalamin, Deoxyadenosyl-cobalamin	Transfer of CH_3 group, Isomerization	• **Pernicious anemia**

❑ POINTS TO BE REMEMBER

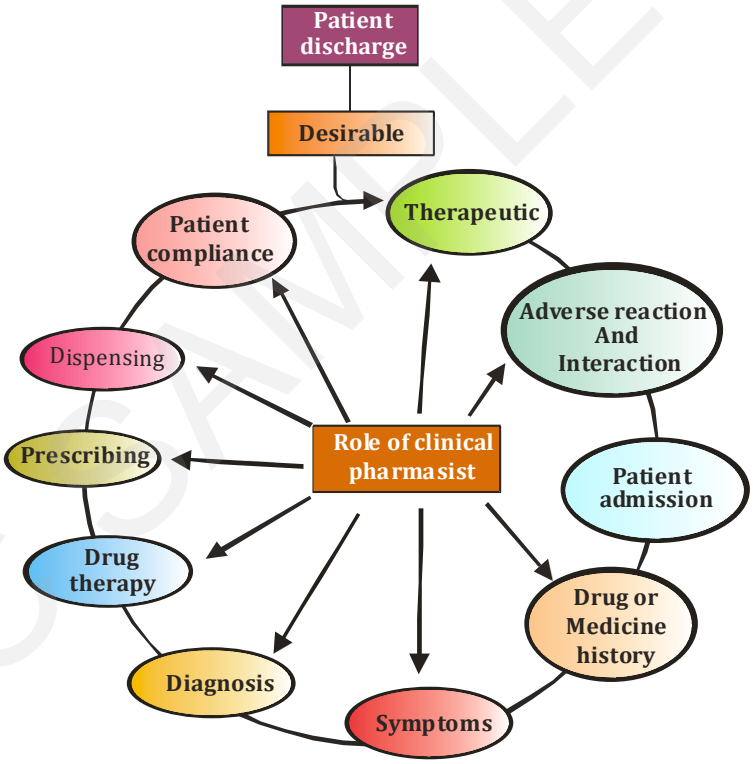
- For humans, the normal **intestinal bacterial synthesis of vitamin K and biotin** is almost sufficient to meet the body requirements.

Introduction to Community Pharmacy Practice

❖ Community Pharmacy

Community pharmacy is defined as a **concepts** which **considers treatment** and **care of patient** by staff of health care team in **presence of pharmacy students,** with regular emphasis on safe and appropriate use of drugs.

❖ Objective



❖ List of drug for which specific advice is required

DRUGS	SPECIFIC ADVICE
Antidiabetic drugs	Don't drink alcohol while using antidiabetics.
MAO inhibitors	Avoid food reach in cheese and yeast.
Antacids	Do not swallow but chew it.
Aluminium hydroxide	May cause sedation
Diphenhydramine	Cause sedation
Nitrates	After long use, don't stop suddenly
Ampicillin	Should be taken on empty stomach

- Minimize the effects of fluid loss from the burnt tissue;
- Reassure the burnt person
- Transport of the casualty to the hospital.

❑ POISONING

Poison is any substance which when **introduced into the body** or come in contact with any part of the body will produce ill effects or death.

❖ Types of poisoning

TYPES OF POISONING	DESCRIPTION	EXAMPLE
Acute poisoning	Several smaller doses of a poison taken over a short interval of time	DDT, copper sulphate
Chronic poisoning	Smaller doses over a long period of time, resulting in gradual worsening.	Arsenic, phosphorus, antimony etc.

❖ Poison and recommended antidotes

POISON	RECOMMENDED ANTIDOTE	TYPES OF ANTIDOTE
Arsenic, Bismuth, Mercury, Copper, Gold	BAL(Dimercaprol)	Physiological
Lead, Cobalt, Cadmium, Nickel	EDTA (Ethylenediamine-tetra acetic acid)	Chelating agent
Heavy metals	Penicillamine	Chelating agent
Iron	Desferrioxamine	Chelating agent
Organophosphate compounds	DAM (Diacyl monoxime)	Cholinesterase reactivators
Cocaine	Lignocaine	Dilator of blood vessels
Opium	Naloxone	Competitive antagonist

❖ Treatment of poisoning

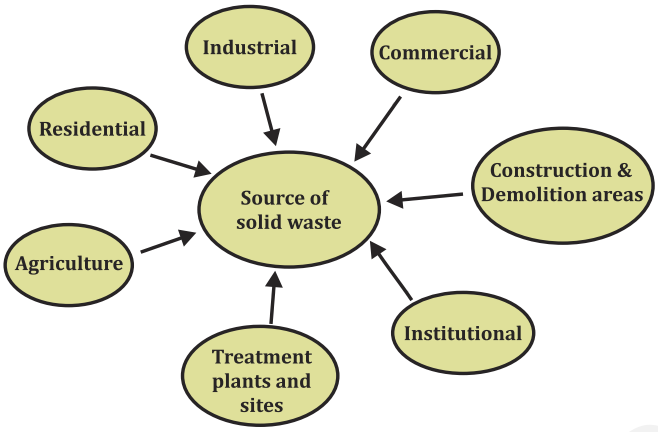
- Removal of unabsorbed poison from the body
- Administration of antidote
- Elimination of poison by excretion
- Symptomatic treatment.
- When the nature of the poison is not known, a general antidote (G.A.) also called **universal antidote i**s used. The universal antidote consists of the following substances

Magnesium oxide	1 Part
Tannic acid	2 Part
Activated charcoal	3 Part

❑ FRACTURE

A break or crack in a bone is called a fracture. This is caused by direct violence, indirect violence, or muscular action. Broadly the fractures can be classified as open or closed.

❖ Source of solid waste



❖ Method of disposal

- Dumping
- Sanitary land filling
- Burning
- Composting
- Manure pits
- Burial

Fundamental Principle of Microbiology

❑ INTRODUCTION

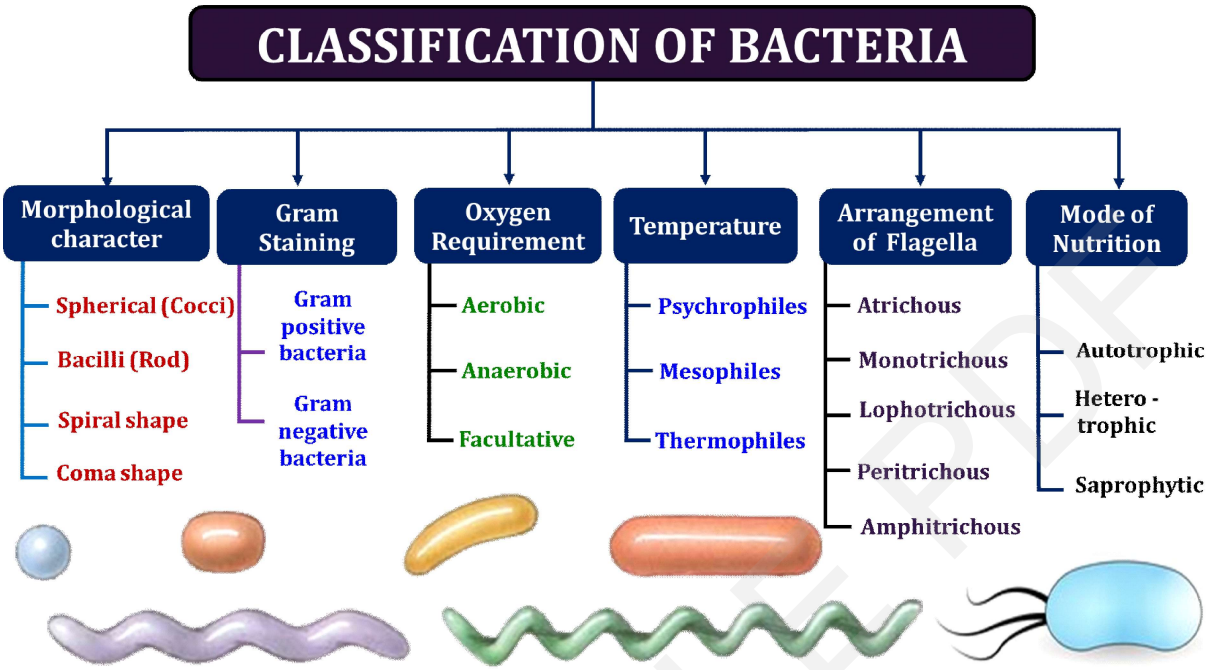
Micro – Small : Bio – Life(Living) : Logy – Study

- **Microbiology –** It is the branch of science which deals with the study of identification, structure, physiology, metabolism and reproduction of microorganisms.
- **Microbes are organisms that are too small to be seen without using a microscope.**
- **Hans and Zacharias Janssen, create the first microscope**

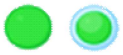
❑ IMPORTANT CONTRIBUTIONS OF SCIENTISTS IN MICROBIOLOGY

SCIENTIST	CONTRIBUTIONS
Robert Hooke 	• **Hooke studied plant sections & saw matrix of tiny cylindrical-like structures he called cells.** • He published famous book called **Micrographia**, which has sketches of various natural things under a microscope.
Carl Linnaeus 	• Proposed first universal **classification system of living beings.** • He created system of naming plants and animals. • Known as the 'Father of modern taxonomy'

❑ CLASSIFICATION OF BACTERIA



➢ On the basis of morphological structure

TYPES	BACTERIA	STRUCTURE	EXAMPLE
Cocci (Spherical)	**Micrococci -** Single cocci		*Micrococcus*
	Diplococci - Cocciin pairs		*Streptococcus pneumoniae*
	Tetracoccci/ Tetrads - Cocciin groups of four		*Gaffkya tetragena*
	Sarcina - Cocci in groups of eight		*Sarcina ventriculi*
	Staphylococci - Clustersof cocci (Grape bunches)		*Staphylococcus aureus* (Positive coagulase test)
	Streptococci - Cocci in chains		*Streptococcus pyogenes*
Bacillus (Rod shaped)	**Bacillus -** Single bacilli		*Bacillus cereus, Salmonella choleraesuis*
	Diplobacillus - Pair of bacilli		*Coxiella burnetii, Klebsiella*
	Streptobacillus - Chain of bacilli		*Bacillus subtilis*

attack), Cerebrovascular disease (stroke), Peripheral vascular disease, Heart failure, Rheumatic heart disease, Congenital heart disease, Cardiomyopathies.

❖ Types of cardiovascular diseases

DISEASE	DEFINITION
Coronary artery disease	The buildup of plaque in the arteries that supply oxygen-rich blood to your heart.
Coronary heart disease	What happens when your heart's blood supply is blocked or interrupted by a build-up of fatty substances in the coronary arteries.
Ischaemic heart disease	It's the term given to heart problems caused by narrowed heart arteries
Pulmonary heart disease	It is the enlargement and failure of the right ventricle of the heart as a response to increased vascular resistance (such as from pulmonic stenosis) or high blood pressure in the lungs.
Hypertensive heart disease	Constellation of changes in the left ventricle, left atrium, and coronary arteries as a result of chronic blood pressure elevation
Inflammatory heart disease	The inflammation of the heart muscles, such as myocarditis, the membrane sac which surrounds the heart called as pericarditis, and the inner lining of the heart or the myocardium, heart muscle as endocarditis is known as the inflammatory heart diseases.
Valvular heart disease	When any valve in the heart has damage or is diseased.
Pericardial disease	It is inflammation of any of the layers of the pericardium
Congenital heart disease	A range of birth defects that affect the normal way the heart works. The term "congenital" means the condition is present from birth.

❖ Prevention and care of cardiovascular disease

- Eat a healthy diet and exercise regularly.
- Control your blood pressure and keep cholesterol under control.
- Maintain a healthy weight and limit alcohol intake.
- Don’t smoke and manage stress.

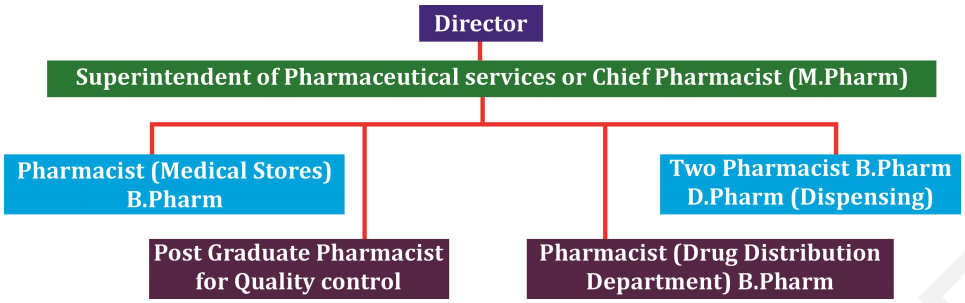
❑ HYPERTENSION

Hypertension is the **chronic elevation of blood pressure** that, in the long term, Causes end-organ damage and result in increased morbidity and mortality. It also known as **high blood pressure.**

❖ Stages of hypertension

STAGES	SBP	DBP
Pre Hypertension	120-139 mmHg	80-89 mmHg
Hypertension Stage I	140-159 mmHg	90-99 mmHg
Hypertension Stage II	160-179 mmHg	100-109 mmHg

❖ Requirement of a Hospital Pharmacist



- **Pharmacist** is a **link between** the **medical professionals and public**
- **Drug required to be hospitals** by purchased for **medical superintendent**
- Minimum **500 hours training** is for a **pharmacy registration**

❖ Floor space requirement

AREA IN SQ. FT. FOR	50 BEDS	100 BEDS	200 BEDS
Compounding and dispensing area	205	350	495
Parenteral solution laboratory		185	200
Store room		125	200
Manufacturing laboratory			120
Office and library			105
Circulation			60
Total	**205**	**660**	**1,180**

- As per drug and **cosmetics act**, **schedule M**, a minimum **250 sq feet area** is essential for a **Hospital pharmacy**.
- It increased **10 sq. m. per bed** for **100 beds**, **6sq. m. per bed** for **200 beds** and **5 sq. m.** for more than **200 beds** Hospital.
- **Minimum space** required for **manufacturing ASU drug** is **1200 sq. ft.**

TERMINOLOGY	DESCRIPTION
Drug overdose	A drug overdose is **taking too much** of a **substance,** whether it's prescription, **over-the-counter**, **legal, or illegal.**
Drug abuse	It refers to use of a drug by **self-medication in a manner** and **amount that deviates** from the **approved medical and social patterns** in a **given culture** at a **given time.**
Polypharmacy	The use of **multiple medications** in a patient, commonly an older adult. **Polypharmacy** is being on **five or more drugs** at the same time on a regular therapeutic basis.

Community Pharmacy

❑ INTRODUCTION

- Community pharmacy includes all the establishments that are **privately owned** and whose **function** is to **serve the society's need for drug products and pharmaceutical services.**
- **Community pharmacies** that are **individually owned** by locals pharmacies are **termed**

HUMAN ANATOMY AND PHYSIOLOGY

Scope of Anatomy and Physiology

ANATOMY:- It is the study of **structures of different parts of the body**, their forms, **position** and relationship to each other.

PHYSIOLOGY:- It is the study of **functions of the body parts** (whole Or Individual structures) and systems present in the body.

❑ VARIOUS TYPES OF MEDICAL TERMINOLOGIES

TERMS	DESCRIPTION
Arthrology	Study of Joints
Angiology	Study of Blood circulation
Bacteriology	Study of Bacteria
Cytology	Study of Cell and Cell organelles
Chondrology	Study of Cartilage
Cardiology	Study of Heart
Craniology	Study of Skulls
Dermatology	The branch of medicine concerned with the diagnosis and treatment of Skin disorders
Endocrinology	Study of Endocrine glands
Gastroenterology	Study of Stomach and Intestine
Gynaecology	Study of Female reproductive
Gerontology	Study of process of Ageing
Geriatrics	Branch of medicine dealing with adults
Hematology	Study of Blood and its disorders
Hepatology	Study of Liver
Histology	Study of Tissue
Karyology	Study of Nuclear Cytology
Myology	Study of Musculature
Microbiology	Study of Microorganisms
Mycology	Study of Fungi
Nephrology	Study of Excretory system
Neurology	Study of Nervous system
Ophthalmology	Study of Eyes
Otology	Study of Ears
Odontology	Study of Teeth
Osteology	Study of Bones
Orthopaedics	Diagnosis and repair of Locomotor system (Bones, Joints, etc)
Otorhinolaryngology	Study of ENT (Ear, Nose and Throat)

❑ DISEASE OF LYMPHATIC SYSTEM

LYMPHATIC SYSTEM	DISEASE
Lymph nodes 	• **Lymphadenitis** • **Lymphomas –** 1. Hodgkin's lymphomas 2. Non-Hodgkin's lymphomas
Spleen	• **Splenomegaly [Enlargement of spleen]** • Infection, Circulatory disorders, Blood diseases, Tumours
Thymus gland	• Thyrotoxicosis, Addison's disease , Myasthenia gravis

Cardiovascular System

❑ INTRODUCTION

- Heart is a **muscular organ** with **four chambers** that is situated in **front of the chest**.
- The Greek name for heart is **Kardia.**
- It pumps blood all through body in a process called **circulation**.

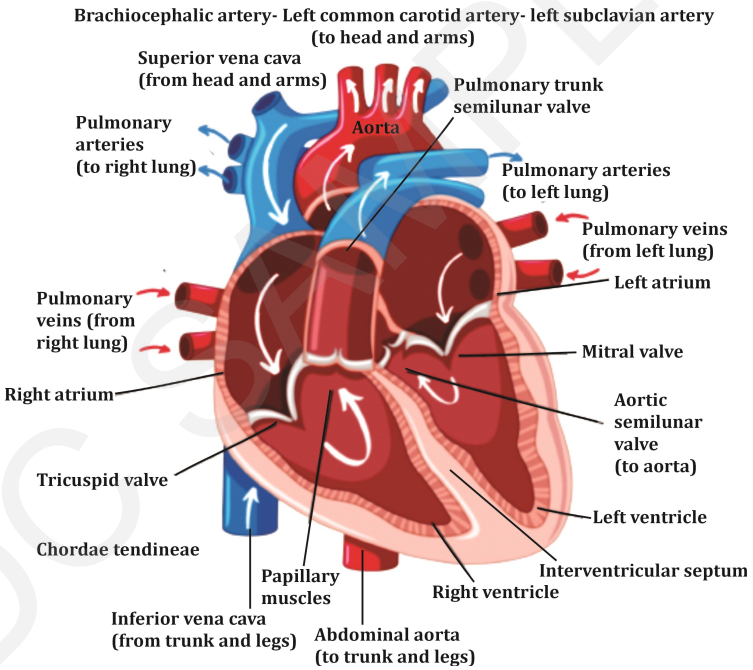


Fig.- Anatomy of Heart

❑ LAYERS OF HEART AND THEIR FUNCTION

LAYERS OF HEART	FUNCTION
Epicardium	Visceral layer of **serous pericardium** Comprised of mesothelial cells, fat & **connective tissues.**
Myocardium	**Myocardium is a Muscle layer** comprised of **cardiomyocytes**
Endocardium	Lines **inner surface of heart chambers** & valves Comprised of a layer of **endothelial cells**, & layer of **subendocardial connective tissue**

❑ CENTRAL NERVOUS SYSTEM

- Central neural system (CNS) includes the **Brain & Spinal cord.** CNS is site of **information processing & control.** It is formed by **neurons & supporting cells neuroglia.**

1. BRAIN

- Brain is **central information processing** organ of body. It is lies in **cranium of skull.**
- Brain & spinal cord are surrounded by **connective tissue membranes meninges.**

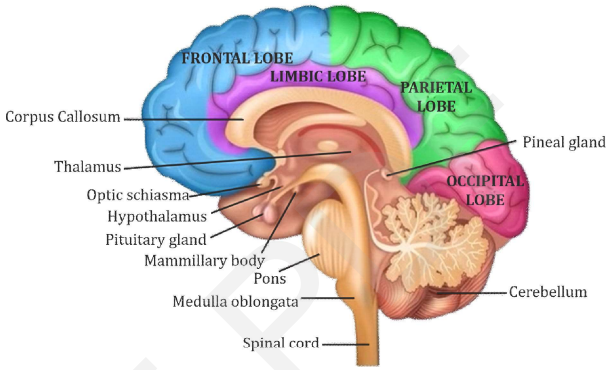


Fig. - Anatomy of Brain

❖ **There are 3 meninges in humans:**

- ✓ **Dura Mater-** Outer layer
- ✓ **Arachnoid-** Thin middle layer
- ✓ **Pia Mater-** Inner layer

- Brain cells has the **least regenerative power** in human body.
- Ventricles of brain are lined by **Ependymocytes.**
- The parts of the brain **involved in NREM sleep** are

(1) Thalamus (2) Hypothalamus (3) Basal forebrain

BRAIN

Consists of three parts

FORE BRAIN (Prosencephalon)

- **Olfactory lobes** (Rhinencephalon)
  - Not well developed in man
  - Cavity called **rhinocoel** is absent in man
- **Cerebrum** (Telecephalon)
  - Contains lateral ventricle
  - Consists of 2 cerebral hemisphere
  - Large part of brain
  - Contains sensory, motor & association area.
- **Diencephalon** (Thalamencephalon)
  - **Epithalamus** (roof)
  - **Thalamus** (sides)
    - Interpret sensory signal & channel them to appropriate cerebral cortex region
  - **Hypothalamus** (floor)
    - Contains a pituitary gland & mammillary bodies.
    - Contains control centres for eating and drinking.
    - Regulating temperature

MID BRAIN (Mesencephalon)

- Passage to hind brain
- Contains narrow cannal called **iter/ aqueduct of Syvius** (mesocoel)
- Contain cerebral **peduncles & corpora quadrigemina** (reflex centre of eye movement & auditory response)
- Contains sensory, motor & association area
- Tectum is the collective term for auditory & optic lobes.

HIND BRAIN (Rhombencephalon)

- **Cerebellum**
  - Consist of hemisphere & a vermis
  - Arbor vitae is present
- **Pons varolii**
  - Acts as bridge carrying ascending tract between brain & spinal cord.
  - Also sends impulses to the cerebellum.

(Metencephalon)

Medulla oblongata

- Contain IVth ventricle (called metacoel)
- Contains cardiac, respiratort & vasomotor centres.

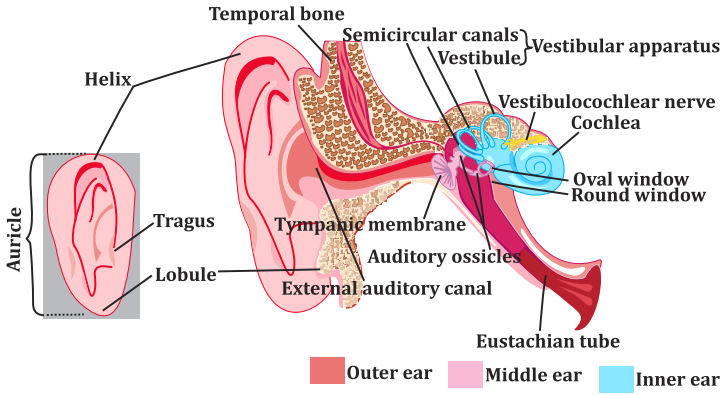


Fig.- Anatomy of Ear

❑ DISEASE RELATED TO EAR

DISEASE	DESCRIPTION
Otitis disease	**Infection or inflammation of the ear.**
Meniere's disease	Fluid problems in your inner ear its symptoms include tinnitus and dizziness.

❑ EYE

- Organs of sight are a **pair of eyes** in human.
- Eyes are situated in deep protective bony cavities, **orbits of eye sockets** of skull.
- It contains lachrymal glands which produces **tear** (lachrymal fluid having **pH 7.4**)
- Epithelium is present in conjunctiva of human eye **Stratified squamous non-keratinized epithelium.**
- Sebaceous glands are **holocrine.**
- The resolving power of unaided human eye is **100 micro meters**.
- The ability of the eye lens to adjust its focal length is called **accommodation**.
- Eye consists of tissues present in three concentric layers:
  i. Outermost fibrous layer consists of **sclera and cornea.**
  ii. Middle vascular layer consists of **Choroid, Ciliary body** and **Iris.**
  iii. Innermost nervous layer consists of **Retina.**

❑ STRUCTURE OF EYE AND THEIR FUNCTION

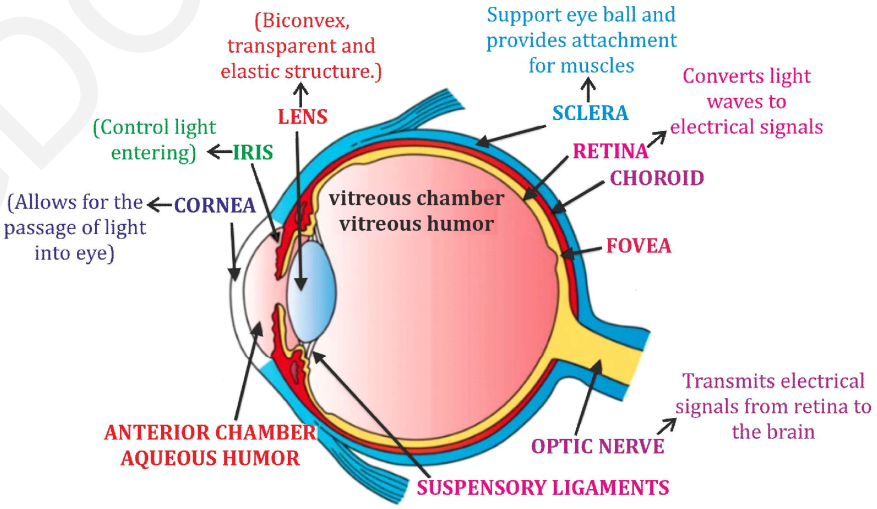


Fig.- Anatomy of Eye

GENERAL INTELLIGENCE AND REASONING ABILITY

Analogy

- Analogy means a similarity or comparability between two things, where both the things are related to each other in a certain way. In these types of questions, a **series** of **numbers** or **alphabetical** letters or **combinations** of both are given.

❑ **TYPES OF VERBAL ANALOGY**

1. Analogy based on words

In these types of questions, three words are given and two words are inter-related to each other in some way. It is required to find out the relationship between the third and fourth word on the basis of the relationship of the first two words.

Example: Skin : Feel :: Eye : _____?

(a) Tears (b) Taste (c) Smell (d) Vision

Answer :- (d) The sense of skin is feeling and that of eye is vision.

2. Analogy based on numbers

In these types of questions, three numbers are given and two numbers are inter-related to each other in some way. The student is required to find out the relationship between the third and fourth number on the basis of the relationship of the first two numbers.

Example: 26 : 5 :: 65 : _____?

(a) 9 (b) 8 (c) 7 (d) 6

Answer :- (b) The relationship between the first two numbers can be identified as Number Analogy eg - The first number is the square+1 of the second number. So, the 65 will be the square+1 of number 8.

3. Analogy based on alphabets

In these types of questions, a student is required to find out the relationship between two given groups of alphabetical letters inter-related to each other in some way and then choose either a letter group or pair consisting of similarly related letter groups.

Example: BUCKET : ACTVBDJLDFSU :: BONUS : _____?

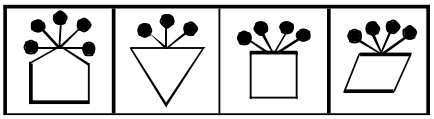
(a) CDPQOPVWTU (b) SUNOR (c) ACNPMOTVRT (d) ACNPMOVWTU

Answer :- (c) In this case each letter of first group gets replaced by two letters, where one letter comes before it and one comes after that particular letter in the second group.

B – AC; O – NP; N – MO; U – TV; S - RT

(a) Feathers (b) Tentacles
(c) Pseudopodia (d) Flagella

5. Choose the figure which is different from the rest



(a) 1 (b) 2 (c) 3 (d) 4

6. In this question, four words have been given, out of which three are alike in some manner and the fourth one is different. Choose out the odd one
(a) Fog (b) Hailstone
(c) Vapour (d) Mist

7. In this question, four words have been given, out of which three are alike in some manner and the fourth one is different. Choose out the odd one
(a) Hydrogen (b) Oxygen
(c) Iodine (d) Nitrogen

8. In this question, four words have been given, out of which three are alike in some manner and the fourth one is different. Choose out the odd one
(a) Raid (b) Assault
(c) Defence (d) Ambush

9. In this question, four words have been given, out of which three are alike in some manner and the fourth one is different. Choose out the odd one
(a) Parrot (b) Pigeon
(c) Kite (d) Penguin

10. In this question, four words have been given, out of which three are alike in some manner and the fourth one is different. Choose out the odd one
(a) Birbal (b) Abul Fazal
(c) Tansen (d) Faiz Ahmed

11. Choose the odd numeral pair/group in the following question
(a) 12-72 (b) 24-144
(c) 60-360 (d) 84–506

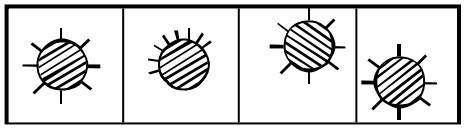
12. Four options are given. There is similarity in three excluding one. Find the option which differs
(a) To hear (b) To climb
(c) To swim (d) To run

13. Choose the pair in which the words are differently related
(a) Captain : Team
(b) Boss : Gang
(c) Prime Minister : Cabinet
(d) Artist : Troupe

14. In this question, four words have been given, out of which three are alike in some manner and the fourth one is different. Choose out the odd one
(a) December (b) February
(c) March (d) July

15. In this question, four words have been given, out of which three are alike in some manner and the fourth one is different. Choose out the odd one
(a) Grapes (b) Pineapple
(c) Cashew (d) Apple

16. Choose the figure which is different from the rest



(a) 1 (b) 2 (c) 3 (d) 4

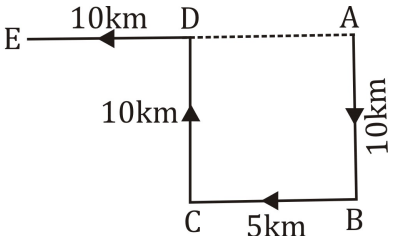
17. In this question, four words have been given, out of which three are alike in some manner and the fourth one is different. Choose out the odd one
(a) Beriberi (b) Scurvy
(c) Anaemia (d) Goiter

18. In this question, four words have been given, out of which three are alike in some manner and the fourth one is different. Choose out the odd one
(a) Mercury (b) Bromine
(c) Aluminium (d) Sodium

ANSWER KEY									
1 –b	2 –d	3 –a	4 –c	5 –a	6 –c	7 –b	8 –c	9 –d	10 –c
11 –d	12 –a	13 –b	14 –a	15 –d	16 –d	17 –b	18 –a	19 –c	20 –a

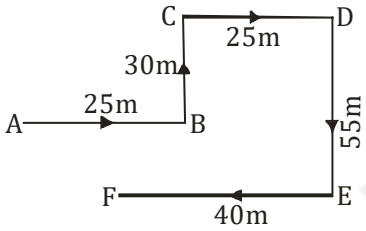
EXPLANATION

1. Ans (b)



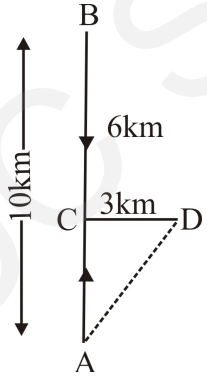
DE is in west direction with respect to A (starting point).

2. Ans (d)



F is to the South-east of A. So, he is to the south-east from his starting point.

3. Ans (a)



AC = (AB-BC) = (10-6) km = 4 km;

CD = 3 km

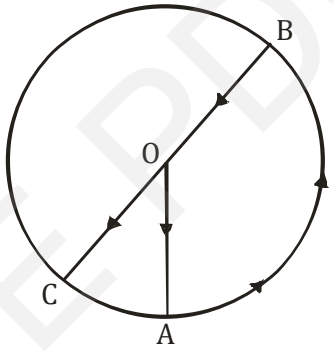
So, Avika's distance from starting point A =

In $\triangle$ ACD, $AD^2 = AC^2 + CD^2$

$\Rightarrow$ AD = $\left(\sqrt{(4)^2+(3)^2}\right)$ km = $\sqrt{25} = 5$ km

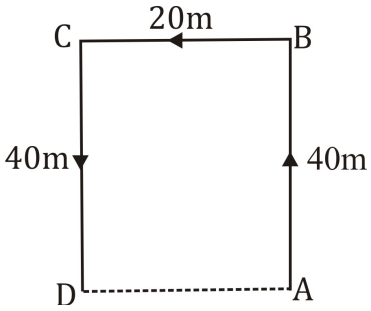
(Solved by Pythagoras theorem)

4. Ans (c)



The movements are as indicated in figure. (O to A, A to B and B to C). Clearly, C lies to the South-west of O.

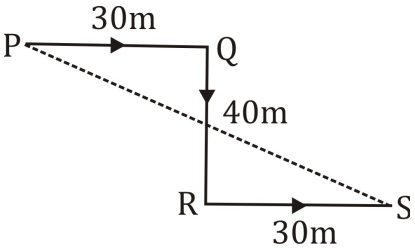
5. Ans (a)



ABCD is a rectangle and so AD = BC = 20 m

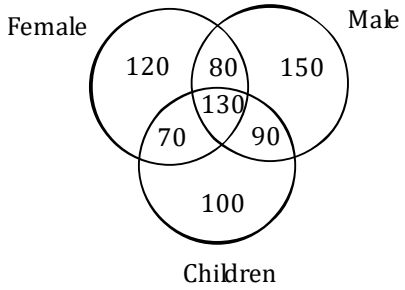
Thus, D is 20 m to the west of A.

6. Ans (c)



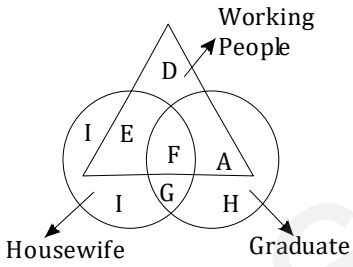
Akshat final position is S which is to the South-east of the starting point P.

5. The diagram shows the survey on sample of 500 persons with reference to the number of males, females and children. 90 represents the group of which of the following persons



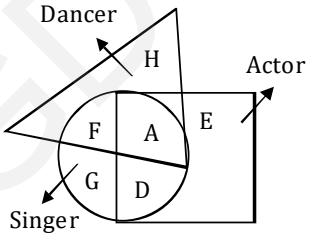
(a) Males, Females
(b) Females, Children
(c) Children, Males
(d) Females, Children, Males

6. Who among the following is Graduate and Housewife but not among Working People



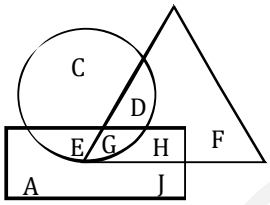
(a) F (b) A
(c) G (d) E

7. In the figure given below, what does D represent



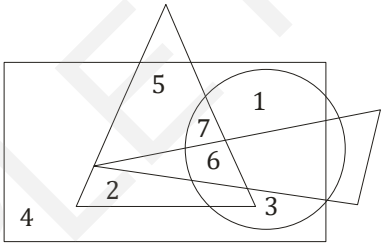
(a) Actors who are not singers
(b) Actors who are singers but not dancers
(c) Actors who are both singer and dancer
(d) Singers who are not actor

8. In the following figure, the circle represents Men, the rectangle represents Doctor and the triangle represents Lawyer. Find out the Men who are Doctor but not Lawyer



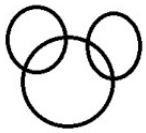
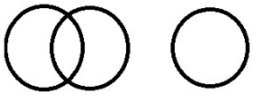
(a) E (b) J and H
(c) G (d) D and E

9. Which of the following numbers is present in only 3 geometrical figure

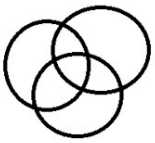
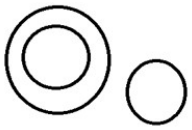
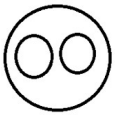
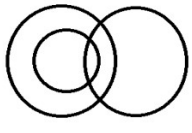


(a) 3 (b) 7 (c) 5 (d) 1

10. Which one of the following venn diagrams correctly illustrates the relationship among the classes: Carrot, Food, Vegetable

(a) 
(b) 
(c) 
(d) 

11. Which one of the following venn diagrams correctly illustrates the relationship among the classes: Women, Mothers, Widows

(a) 
(b) 
(c) 
(d) 

GENERAL MATHEMATICS

Average

- The **average or mean or arithmetic** mean of a number of **quantities of the same kind** is equal to their sum **divided by the number of those quantities**
- Arithmetic average is used for all averages like: average income, average profit, average age, average marks etc.
- It is defined as the sum total of all volumes of items divided by the total number of items

➢ **In individual series.**

$$\text{Average} = \frac{\text{Sum of observation N}}{\text{Number of observation}}$$

$$\text{or } \bar{X} = \frac{x_1 + x_2 + x_3 \ldots\ldots\ldots + x_n}{n}$$

*To calculate the sum of observations, -they should be in the same unit.

Example 1: A man purchased 5 toys at the rate of Rs 200 each, 6 toys at the rate of Rs 250 each and 9 toys at the rate of Rs 300 each.

Calculate the average cost of one toy.

Solutions:

Price of 5 toys = 200 x 5 = 1000

Price of 6 toys = 250 x 6 = 1500

Price of 9 toys = 300 x 9 = 2700

$$\text{Average cost of one toy} = \frac{1000 + 1500 + 2700}{20} = \frac{5200}{20} = \text{Rs. } 260/-$$

Example 2: The average of five consecutive odd numbers is 61. What is the difference between the highest and lowest numbers

Solution: Let the numbers be x, x + 2, x+ 4, x + 6 and x +8

$$\text{Then, } \frac{x + (x+2) + (x+4) + (x+6) + (x+8)}{5} = 61$$

or 5x + 20 = 305 or x = 57.

So, required difference = (57 + 8) – 57 = 8.

* Average of a group consisting two different groups when their averages are known

(a) Let Group A contains m quantities and their average is A and group B contains n quantities and their average is b, then average of group C containing a + b quantities

$$\frac{ma + nb}{m + n}$$

GENERAL SCIENCE AND GENERAL KNOWLEDGE

Scientist With Their Achievements

NAME	WORK
Amidon	BCS Classification
Antonie van Leeuwenhoek	First to observe live cells (animal cells) and called them 'animalcules'
A. Salk	Polio Vaccine
Banting and Best	Insulin discovery
Boyer and Cohen	DNA Technology
Dmitri Ivanovsky	Tobacco mosaic virus (TMV)
Edward Jenner	Small Pox Vaccine/Father of immunology
Ehrlich	Father of Chemotherapy
Einstein	Theory of Relativity
Francisco Bolivar and Raymond Rodriguez	First time constructed the pBR322 cloning vector
Galen	First pharmacist
George Palade	Ribosomes
Gilman and Martin	G-protein
Gustav Embden, Otto Meyerhof & Jakub Parnas	Glycolysis
Hahnemann	Father of Homeopathy
Hippocrates	Father of medicine
Ian Wilmut	Dolly sheep (First clone)
K. Mullis	Invented PCR
Kekule	Structure of Benzene ring
L. Pasteur	Rabies Vaccine
Luc Montagnier and R. Gallo	AIDS virus for HIV
M. W. Beijerinck	Coined the term 'virus'
Martin and synge	Plate theory
Matthias Schleiden (1838) and Theodor Schwann (1839)	Cell theory
Maxam- Gilbert	DNA sequencing
Newton	Law of Gravitation
R. Koch	Germ – cell theory/Father of medical microbiology
Robert Brown	First to discover plant nucleus and coined the term 'Nucleus'.
Robert Hooke	First to observe cells (dead cork cells) and coined the term 'cell'.
Robin milner	Polymorphism
Sanger	(2 Noble prize winner) Structure of DNA and protein (Insulin)

Important Health Days and Weeks

MONTH	DATE	DAY
January	04	Siddha Day (India)
	12	National youth day and National Pharmacist Day
February	04	World Cancer Day
March	06	National Pharmacy Education Day
	24	World Tuberculosis Day
April	07	World Health Day
	22	Earth Day
	25	World Malaria Day
May	05	World Asthma Day
	19	World Hepatitis Day
	31	Anti-tobacco day
June	05	World Environment Day
	14	World Blood Donor Day
	21	International Day of Yoga
July	01	Doctors Day
	11	World Population Day
	28	World Hepatitis Day
	29	ORS (Oral Rehydration Salts) Day
August	12	International Youth Day
September	01-07	National Nutrition Week
	25	World Pharmacist Day
	Last Sunday	World Health Day
	29	World Heart day
October	06	Ayurveda Day (India)
	20	World Malaria Day and World Osteoporosis Day
November	10	World Immunization Day
	12	World Pneumonia Day
	14	World Diabetes Day and Children's day
December	01	World AIDS Day

Some Important Abbreviations

ABBREVIATIONS	FULL FORM
AAAS	American Association of Advancement of Science
AALAS	American Association for Laboratory Animal Science
AIDS	Acquired Immune Deficiency Syndrome
AIOPI	Association of Information Officers of the Pharmaceutical Industry
ALF	American Liberation Front
ANDA	Abbreviated New Drug Application
BEA	Breeding for Experimental Animals

Fathers in Different Field

S.NO.	FATHER NAME	FIELD
1.	Addison	Endocrinology
2.	Alan Emtage	Search engine
3.	Albert Einstein	Physics
4.	Anderson	Gene Therapy
5.	Antoine Lavoisier	Chemistry
6.	Antoni van Leeuwenhoek	Microbiology, Microscopy and Protozoology
7.	Archibald Garrod	Biochemical genetics
8.	Archimedes	Mathematics
9.	Aristotle	Biology, Embryology, Zoology & Natural History
10.	Benjamin Franklin	Electricity
11.	Carolus Linnaeus	Taxonomy
12.	Charaka	Ayurveda and Indian Medicine
13.	Charles Darwin	Evolution
14.	Dmitri Mendeleev	Periodic table
15.	Edward Anthony Jenner	Immunology
16.	Edward Jenner	Vaccine
17.	Einthoven	ECG
18.	Ernest Norman Borlaug	The Green Revolution
19.	Ernest Rutherford	Nuclear Physics
20.	Galileo Galilei	Modern Physics
21.	Gregor Johann Mendel	Genetics
22.	Harrison	Tissue culture
23.	Herodotus	History
24.	Hippocrates	Medicine
25.	Hugo de Vries	Mutation Theory
26.	James B. Sumner	Enzymology
27.	Justus vol Liebig	Biochemistry
28.	Landsteiner	Blood groups
29.	Mahadeva Lal Schroff	Indian pharmacy
30.	Otto Hahn	Nuclear Chemistry
31.	Paul Berg	Genetic engineering
32.	Platter	Parasitology
33.	Prafulla Chandra Ray	Indian Chemistry
34.	Richard Smalley	Nanotechnology
35.	Robert A. Freitas Jr.	Nanomedicine
36.	Robert Hooke	Cytology
37.	Robert Koch	Bacteriology
38.	Ronald Fisher	Statistics
39.	Samuel Hahnemann	Homeopathy
40.	Sushruta	Surgery (early)
41.	Theophrastus	Botany, Ecology

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Nobel Prize Winners from India

S.NO.	PERSON	FIELD	YEAR	CONTRIBUTION
1.	Rabindranath Tagore	Literature	1913	Because of his profoundly sensitive, fresh and beautiful verse, by which, with consummate skill, he has made his poetic thought, expressed in his own English words, a part of the literature of the West.
2.	C.V Raman	Physics	1930	For his work on the scattering of light and for the discovery of the effect named after him.
3.	Har Gobind Khorana	Medicine	1968	For their interpretation of the genetic code & its function in protein synthesis.
4.	Mother Teresa	Peace	1979	Humanitarian work.
5.	Subrahmanyam Chandrasekhar	Physics	1983	For his theoretical studies of the physical processes of importance to the structure and evolution of the stars.
6.	Amartya Sen	Economic Sciences	1998	For his contributions to welfare economics.
7.	Venkatraman Ramakrishnan	Chemistry	2009	For studies of the structure and function of the ribosome.
8.	Kailash Satyarthi	Peace	2014	For his struggle against the suppression of children and young people and for the right of all children to education.
9.	Abhijit Banerjee	Economic Sciences	2019	For his experimental approach to allievating global poverty

- Jointly with Robert W Holley and Marshall W Nirenberg
- Jointly with Thomas A. Steitz and Ada E. Yonath
- Jointly with Malala Yousafzai of Pakistan.
- Jointly with Esther Duflo and Michael Kremer

In addition to the above, Ronald Ross who was awarded the Nobel Prize for Medicine in 1902 and Rudyard Kipling who was awarded the Nobel Prize for Literature in 1907 were born in India. Sir Vidiadhar Surajprasad Naipaul, who was awarded the Nobel Prize in Literature in 2001 is a British citizen of Indian origin born in Trinidad.

Nobel Prize and Laureates - 2020

FIELD	NOBEL LAUREATES	CONTRIBUTION
Physics	Alain Aspect, John F Clauser, Anton Zeilinger	For their work on entangled photon experiments, proving the violation of Bell inequalities, and developing the field of quantum information science.

Chemistry	Carolyn Bertozzi, Morten Meldal, Barry Sharpless	For the establishment of the foundations of click chemistry & bioorthogonal chemistry and also took chemistry into the functionalism era.
Physiology or Medicine	Svante Paabo	For his research on the extinct hominid genomes and the evolution of humans.
Literature	Annie Ernaux	For the bravery and clinical acuity with which she reveals the origins, estrangements, and collective restrictions of personal memory.
Peace	Ales Bialiatski, Memorial Human Rights Organization (Russia), Center for Civil Liberties Human Rights Organisation (Ukrainian)	For encouraging the right to criticise power and protect the citizen's fundamental rights.
Economic	Ben S. Bernanke, Douglas W. Diamond, Philip H. Dybvig	For research on financial crises and banks.

The Youngest Nobel Laureates Till 2022

AGE	NAME	CATEGORY/YEAR	DATE OF BIRTH
17	Malala Yousafzai	Peace 2014	12 July 1997
25	Lawrence Bragg	Physics 1915	31 March 1890
31	Werner Heisenberg	Physics 1932	5 December 1901
31	Tsung-Dao Lee	Physics 1957	24 November 1926

Multiple Nobel Laureates Till 2022

NOBEL LAUREATE	AREA WITH YEAR
J. Bardeen	Physics 1956, 1972
M. Curie	Physics 1903 & Chemistry 1911
L. Pauling	Chemistry 1954 and Peace 1962
F. Sanger	Chemistry 1958 and 1980
ICRC	Peace 1917, 1944 and 1963
UNHCR (United Nations High Commissioner for Refugees)	Peace 1954 and 1981

❑ PADMA SHRI - 2023 (91 PEOPLES)

Padma Shri (IAST: padma srî), also spelled Padma Shree, is the fourth-highest civilian award of the Republic of India, after the Bharat Ratna, the Padma Vibhushan and the Padma Bhushan. Instituted on 2 January 1954, the award is conferred in recognition of "distinguished contribution in various spheres of activity including the arts, education, industry, literature, science, acting, medicine, social service and public affairs". It is awarded by the Government of India every year on India's Republic Day

Gallantry Awards

❑ PEACE-TIME GALLANTRY AWARDS

AWARDS		DESCRIPTION
Ashoka Chakra		The Ashoka Chakra is India's highest peacetime military decoration awarded for valour, courageous action or self-sacrifice away from the battlefield. It Was originally **established on 4 January 1952** as the **"Ashoka Chakra, Class I"** as the first step of a three-class sequence of non-combatant bravery decorations.
Shaurya Chakra		The Shaurya Chakra is an Indian military decoration awarded for valour, courageous action or self-sacrifice while not engaged in direct action with the enemy. **Established as the "Ashoka Chakra, Class III" by the President of India, 4 January 1952.** The statutes were revised and the decoration **renamed on 27 January 1967.**
Kirti Chakra		Established as the "Ashoka Chakra, Class II" by the President of India**, 4 January 1952** (with effect from 15 August 1947). The statutes were revised and the decoration **renamed on 27 January 1967.**

❑ WAR-TIME GALLANTRY AWARDS

AWARDS		DESCRIPTION
Param Vir Chakra		**India's highest military decoration, awarded for displaying distinguished acts of valour during wartime.** Param Vir Chakra translates as the **"Wheel of the Ultimate Brave",** and the award is granted for **"most conspicuous bravery in the presence of the enemy".**
Maha Vir Chakra		Second highest military decoration in India, **awarded for acts of conspicuous gallantry in the presence of the enemy, whether on land, at sea or in the air**. It replaced the British Distinguished Service Order (DSO).

GENERAL COMPUTER KNOWLEDGE

❑ INTRODUCTION

A computer is an electronic machine that helps to process data. It is used to solve problems relating to almost all fields such as education, home, medicine, science and technology, research, designing, publishing, communication etc.

❑ FIVE GENERATION OF COMPUTERS

GENERATION	MAIN ELECTRONIC COMPONENTS	MAIN COMPUTERS
I	Electronic Valve Vacuum Tube	EDSAC, EDVAC,UNIVAC
II	Transistor	IBM-700, IBM-1401, IBM-1620, CDC-1604, CDC-3600, ATLAS, ICL-1901
III	Integrated Circuit	IBM-360, IBM-370, NCR-395, CDC-1700, ICL-2903
IV	Largely Integrated Circuit	APPLE, DCM
V	Optical fibre, Artificial Intelligence	

❖ Programming Languages of Different Generation

GENERATION	PROGRAMMING LANGUAGES
I	FORTRAN-i
II	FORTRAN-ii, ALGOL-60, COBOL, LISP
III	PL/I, ALGOL-W, ALGOL - 68, Pascal, SIMULA-67, APL, SNOBOL, 4 BASIC
IV	CLUE, ALFARD, UCLID, Reformed Pascal, MODULA, EDA, ORACLE
V	Artificial Intelligence Languages

❖ Data Measurements

4 Bit	1 Nibble
2 Nibble (8 Bit)	1 Byte
1024 Byte	1 Kilo Byte (KB)
1024 KB	1 Mega Byte (MB)
1024 MB	1 Giga Byte (GB)
1024 GB	1 Tera Byte (TB)
1024 TB	1 Peta Byte (PB)

RABMN	Remote Area Business Message Network
SNOBOL	StriNg Oriented and symBOlic Language
UPS	Uninterruptible power supply
VDU	Visual Display Unit
VLSI	Very Large Scale Integration
WWW	World Wide Web

IMPORTANT ONE LINERS

1. **The device used to carry digital data on analog lines is called**

   Answer :- Modem
2. **The portion of the CPU that coordinates the activities of all other computer components is the**

   Answer :- Control unit
3. **Step-by-step instructions that run the computer are**

   Answer :- Programs
4. **The process of writing computer instructions in a programming language is known as**

   Answer :- Coding
5. **Which of the following refers to too much electricity and may cause a voltage surge**

   Answer :- Spike
6. **The following is possible with open architecture**

   Answer :- Use to upgrade and add new devices as they come on the market
7. **_____ are special visual and sound effects contained in a presentation graphics file.**

   Answer :- Animation
8. **Rules for exchanging data between computers are called**

   Answer :- Protocol
9. **Which of the following is used to write Web pages**

   Answer :- HTML
10. **_____ is the most important/powerful computer in a typical network**

    Answer :- Network server
11. **Raw, unprocessed facts, including text, numbers, images, and sounds, are called**

    Answer :- Data
12. **The primary job of an operating system is to manage**

    Answer :- Resources

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We are pleased to introduce the First edition of **"THEORY PHARMACIST EXAM AT YOUR FINGERTIPS"** for the students willing to appear in any type of Pharmacist Examination. The prime objective of preparing this book is to help and assist student, learn the basic concepts in simplified way. This book is compiled with well covering all the detailed concepts and informations which can help the students to crack Pharmacist Examination.

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