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Features

- Based on Latest Syllabus
- Previous year question tagging
- Short and Summarized Notes
- Highlighted Key Points
- Fully Coloured Book
- Covers All Pharma and Non-Pharma Syllabus

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A lion never fears the future, he creates history

Theory Book

Boost Your **DRUG INSPECTOR EXAM** Preparation!

DRUG INSPECTOR EXAM AT YOUR FINGERTIPS

Useful For

MPSC, UPSC, TNSPC, OPSC, HPPSC, APPSC, GPSC, KPSC, SSC, DCO and all other State Public Service Commission Drug Inspector Examination

by

GDC EDITORIAL BOARD

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PREFACE

The role of a Drug Inspector is one of great responsibility and precision, requiring deep understanding of pharmaceutical science, regulatory frameworks, and vigilant inspection practices. To help aspiring candidates achieve this career milestone, we present **"Theory Drug Inspector at Your Fingertips"** - a comprehensive, exam-focused guide designed to meet the demands of both central and state-level Drug Inspector examinations.

This book is a result of extensive research, expert analysis, and a commitment to simplifying complex concepts. It includes:

- Complete coverage of both **Pharmaceutical** and **non-pharmaceutical** syllabus as per the latest exam pattern
- Previous year question tagging to highlight high-yield and frequently asked topics
- **Updated content** tailored specifically for Drug Inspector exams conducted by UPSC, SSC, MPSC, TNPSC, OPSC, HPPSC, APPSC, GPSC, KPSC, DCO and various State Public Service Commissions
- Concise theory written in an easy-to-understand, student-friendly format

At GDC Publications, our mission is to empower pharmacy graduates with the best tools for success. We believe this book will not only enhance your exam preparation but also boost your confidence as you step forward into the world of pharmaceutical regulatory affairs.

Wishing you success, clarity, and confidence in your journey ahead !

Dr. PEEYUSH JAISWAL
Director, GDC

CONTENT

DRUG INSPECTOR AT A GLANCE

❑ WHO IS A DRUG INSPECTOR?

The Government appoints drug inspectors to **ensure the quality of drugs**. A Drug Inspector is a Pharmacy professional who specializes in monitoring and executing drug efficiency, safety, quality, and usefulness from the manufacturing stage to the final selling stage. Under the **Drugs and Cosmetics Act, 1940**, Drug Inspectors are appointed by the **Central or State Government**:

- ✓ **Section 21** is for **allopathic drugs**.
- ✓ **Section 33G** is for **Ayurvedic, Siddha, and Unani drugs**

ACCORDING TO DRUGS AND COSMETICS ACT, 1940 AND RULES, 1945

❖ Drug Inspector:

Drugs Inspector means -

1. In relation to any other drug or cosmetic, an Inspector appointed by the Central Government or a State Government under **Section 21.**
2. In relation to Ayurvedic, Siddha or Unani drugs, an Inspector appointed by the Central Government or a State Government under **Section 33G.**

The Central Government or a State Government may appoint such persons having the prescribed qualifications, to be Drug Inspectors and to assign them for definite areas.

Any person who has any financial interest in the import, manufacture or sale of drugs or cosmetics shall be appointed to be a Drugs Inspector.

Every Inspector shall be deemed to be a public servant within the meaning of **section 21** of the Indian Penal Code (45 of 1860), and shall be officially subordinate to such authority having the prescribed qualifications, as the Government appointing him may specify in this behalf.

❖ Power of a drug inspector:

✓ Section 22:

(1) Subject to the provisions of section 23 and of any rules made by the Central Government in this behalf, an Inspector may, within the local limits of the area for which he is appointed-

a. Inspect

i. Any premises wherein any drug or cosmetic is being manufactured and the means employed for standardizing and testing the drug or cosmetic.

ii. Any premises wherein any drug or cosmetic is being sold, or stocked or exhibited or offered for sale, or distributed.

b. Take samples of any drug or cosmetic

(i) Which is being manufactured or being sold or is stocked or exhibited or offered for sale, or is being distributed.

(ii) From any person who is in the course of conveying, delivering or preparing to deliver such drug or cosmetic to a purchaser or a consignee.

c. At all reasonable times, with such assistance, if any, as he considers necessary

(i) Search any person, who, he has reason to believe, has secreted about his person, any drug or cosmetic in respect of which an offence under this Chapter has been, or is being, committed.

(ii) Enter and search any place in which he has reason to believe an offence under this Chapter has been, or is being committed.

(iii) Stop and search any vehicle, vessel, or other conveyance which, he has reason to believe, is being used for carrying any drug or cosmetic in respect of which an offence under this Chapter has been, or is being, committed and order in writing the person in possession of the drug or cosmetic in respect of which the offence has been, or is being, committed, not to dispose of any stock of such drug or cosmetic for a specified period not exceeding twenty days, or, unless the alleged offence is such that the defect may be removed by the possessor of the drug or cosmetic, seize the stock of such drug or cosmetic and any substance or article by means of which the offence has been, or is being, committed or which may be employed for the commission of such offence.

cc. Examine any record, register, document or any other material object found with any person, or in any place, vehicle, vessel or other conveyance referred to in clause (c), and seize the same if he has reason to believe that it may furnish evidence of the commission of an offence punishable under this Act or the rules made thereunder.

cca. Require any person to produce any record, register, or other document relating to the manufacture for sale or for distribution, stocking, exhibition for sale, offer for sale or distribution of any drug or cosmetic in respect of which he has reason to believe that an offence under this Chapter has been, or is being, committed.

d. Exercise such other powers as may be necessary for carrying out the purposes of this Chapter or any rules made thereunder.

(2) The provisions of the Code of Criminal Procedure, 1973 (2 of 1974)] shall, so far as may be, apply to any search or seizure under this Chapter as they apply to any search or seizure made under the authority of a warrant issued.

(2A) Every record, register or other document seized under clause (cc) or produced under clause (cca) shall be returned to the person, from whom they were seized or who produce the same, within a period of twenty days of the date of such seizure or production, as the case may be, after copies thereof or extracts therefrom certified by that person, in such manner as may be prescribed, have been taken.

(3) If any person wilfully obstructs an Inspector in the exercise of the powers conferred upon him by or under this Chapter, or refuses to produce any record, register or other document when so required under clause (cca) of sub- section (1), he shall be punishable with imprisonment which may extend to three years, or with fine, or with both.

❖ Procedure of a drug inspector:

✓ Section 23:

1. Where an Inspector takes any sample of a drug or cosmetic under this Chapter, he shall tender the fair price thereof and may require a written acknowledgement thereof.

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ii. Who have not less than 18 months' experience in testing of at least one of the substances in Schedule C in a Laboratory approved for this purpose by the licensing authority, or

iii. Who have gained experiences of not less than three years in the inspection of firms manufacturing any of the substances specified in Schedule C during the tenure of their services as Drugs Inspector; shall be authorized to inspect the manufacture of the substances mentioned in Schedule C.

Schedule C

Biological and Special Products

1. Sera, Toxins, Antigen, Antitoxins, Insulin, Bacteriophages.
2. Solution of serum proteins intended for injection.
3. Vaccines for parenteral injections.
4. Neo-arsphenamine and analogous substances used for the specific treatment of infective diseases.
5. Pituitary (Posterior Lobe) Extract.
6. Adrenaline and Solutions of Salts of Adrenaline.
7. Antibiotics and preparations in a form to be administered parenterally.
8. Any other preparation which is meant for parenteral administration as such or after being made up with a solvent or medium or any other sterile product and which-
   (a) Requires to be stored in a refrigerator;
   (b) Does not require to be stored in a refrigerator.
9. Sterilized surgical ligature and sterilized surgical suture.
10. Ophthalmic preparations.
11. Sterile Disposable Devices for single use only.

❖ Duties of drug inspector:

✓ Rule 51: Duties of Inspectors of premises licensed for sale

Subject to the instructions of the controlling authority, it shall be duty of an Inspector authorized to inspect premises licensed for the sale of drugs.

(1) To inspect not less than once a year all establishments licensed for the sale of drugs within the area assigned to him.

(2) To satisfy himself that the conditions of the licences are being observed.

(3) To procure and send for test or analysis, if necessary, imported packages which he has reason to suspect contain drugs being sold or stocked or exhibited for sale in contravention of the provisions of the Act or Rules thereunder.

(4) To investigate any complaint in writing which may be made to him.

(5) To institute prosecutions in respect of breaches of the Act and Rules thereunder.

(6) To maintain a record of all inspections made and action taken by him in the performance of his duties, including the taking of samples and the seizure of stocks, and to submit copies of such record to the controlling authority.

(7) To make such enquiries and inspections as may be necessary to detect the sale of drugs in contravention of the Act.

(8) When so authorized by the State Government, to detain imported packages which he has reason to suspect contain drugs, the import of which is prohibited.

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✓ **Rule 52: Duties of Inspectors specially authorized to inspect the manufacture of drugs or cosmetics**

Subject to the instructions of the controlling authority it shall be the duty of an Inspector authorized to inspect the manufacture of drugs.

(1) To inspect not less than once a year, all premises licensed for manufacture of drugs or cosmetics within the area allotted to him to satisfy himself that the conditions of the licence and provisions of the Act and Rules thereunder are being observed

(2) In the case of establishments licensed to manufacture products specified in Schedules C and C(1) to inspect the plant and the process of manufacture, the means employed for standardizing and testing the drugs or cosmetics, the methods and place of storage, the technical qualifications of the staff employed and all details of location, construction and administration of the establishment likely to affect the potency or purity of the product.

(3) To send forthwith to the controlling authority after each inspection a detailed report indicating the conditions of the licence and provisions of the Act and rules thereunder which are being observed and the conditions and provisions, if any, which are not being observed.

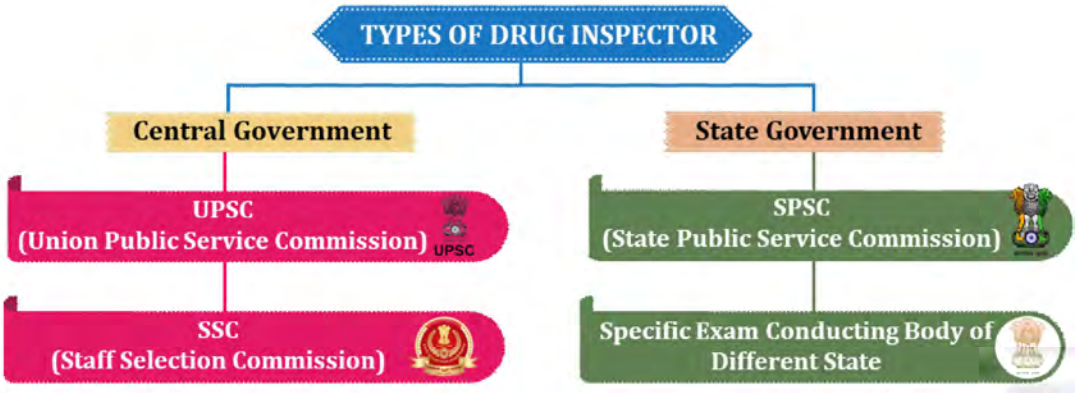
(4) To take samples of the drugs or cosmetics manufactured on the premises and send them for test or analysis in accordance with these Rules.

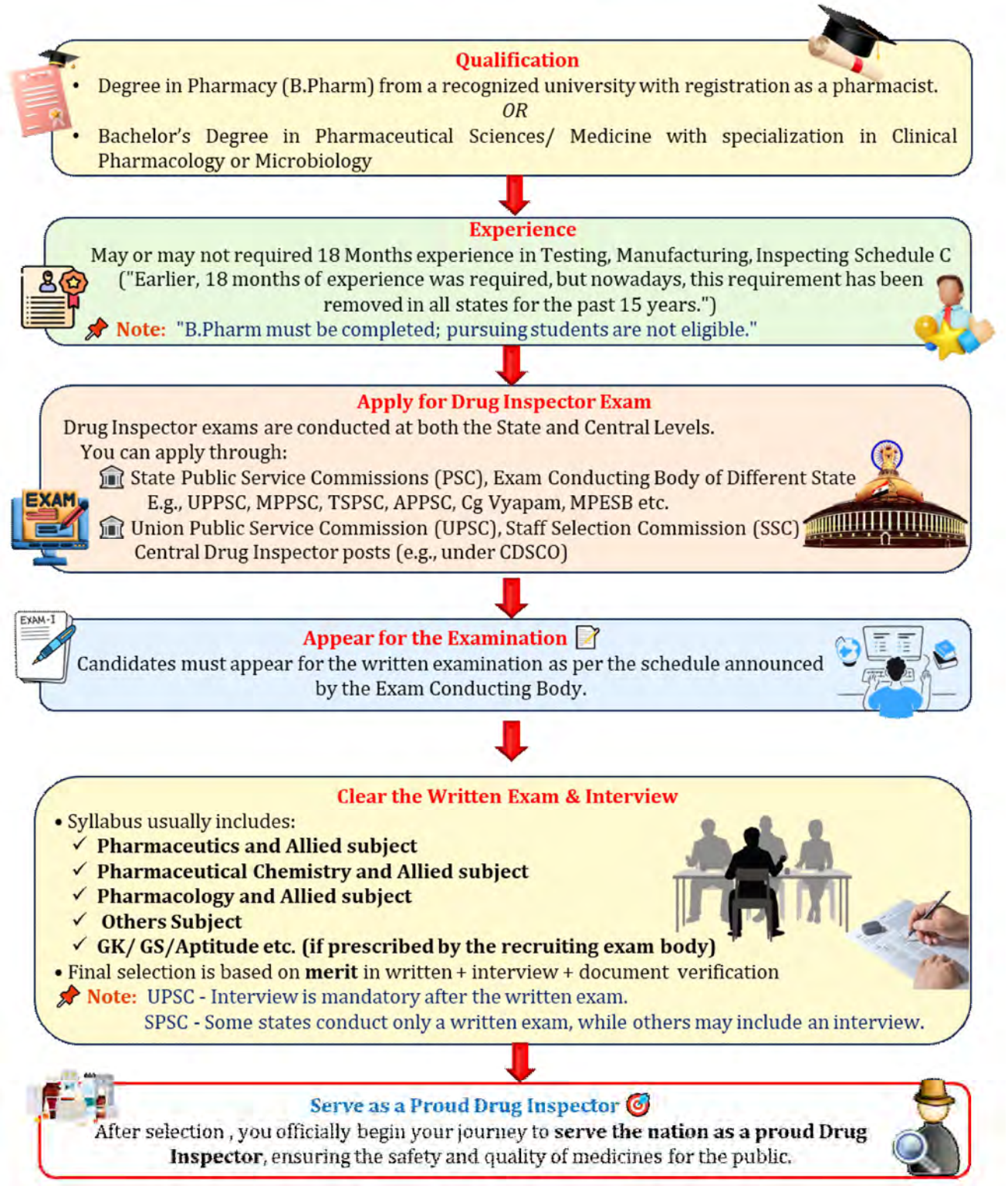
(5) To institute prosecutions in respect of breaches of the Act and Rules thereunder.

❖ **Forms used by drugs inspectors:**

- **Form 15:** Order under section 22 (1)(c) of the Drugs and Cosmetics Act, 1940 requiring a person not to dispose of stock in his possession.
- **Form 16:** Receipt for stock of drugs or cosmetics for record, register, document or material object seized under section 22 (1) (c) or (cc) of the Drugs and Cosmetics Act, 1940.
- **Form 17:** Intimation to person from whom sample is taken.
- **Form 17A:** Receipt for samples of drugs or cosmetics taken where fair price tendered thereof under sub-section (I) of Section 23 of the Drugs and Cosmetics Act, 1940 is refused.
- **Form 35:** Form in which the Inspection Book shall be maintained

❑ **TYPES OF DRUG INSPECTOR**





❑ KEY DETAILS REGARDING THE DRUG INSPECTOR RECRUITMENT

The given information may vary based on the recruiting body (UPSC/SSC/SPSC).

AGE LIMIT	Not exceeding 30 years. **Note-** Age Relaxation may vary State wise for SC/ST/OBC and PWD as per Government Norms
PAY SCALE	As per the level 8 of pay matrix [7th CPC (Central Pay Commission)] Basic pay approx. - ₹47,600 – ₹1,51,100

6. Basics of Energy and Environment: Conservation, Environmental pollution and Degradation, Climate Change, Environmental impact assessment.
7. Basics of Project Management.
8. Basics of Material Science & Engineering.
9. Information and Communication Technologies (ICT) based tools and their applications in Engineering such as networking, e-governance and technology-based education
10. Ethics and Values in Engineering profession.

Note :-

The above information is based on the last official examination notification issued by the Union Public Service Commission (UPSC). Candidates are advised to visit official website for any updates or changes.

SYLLABUS

Considering the examination patterns of various State and Central Drug Inspector recruitments, we have carefully designed a comprehensive exam pattern and syllabus to align with the requirements and standards of these competitive exams.

❖ Syllabus of the exam:

The syllabus for the Drug Inspector exam varies according to the conducting authority (Central or State). Each authority follows its own prescribed syllabus.

PHARMA SECTION

❑ PHARMACEUTICS AND ALLIED SUBJECTS

❖ Pharmaceutical Technology

1. Pharmacy Profession & Pharmacopoeia
2. Preformulation
3. Monophasic Liquids Dosage Form
4. Biphasic Liquids Dosage Form (Suspension, Emulsion)
5. Semisolids Dosage Form
6. Suppositories
7. Powders
8. Tablets
9. Capsules and Microencapsulation
10. Pharmaceutical Aerosols
11. Sterilization
12. Parenteral products
13. Ophthalmic preparations
14. Novel Drug Delivery System
15. Cosmetics
16. Packaging Materials
17. Pilot plant scale up techniques

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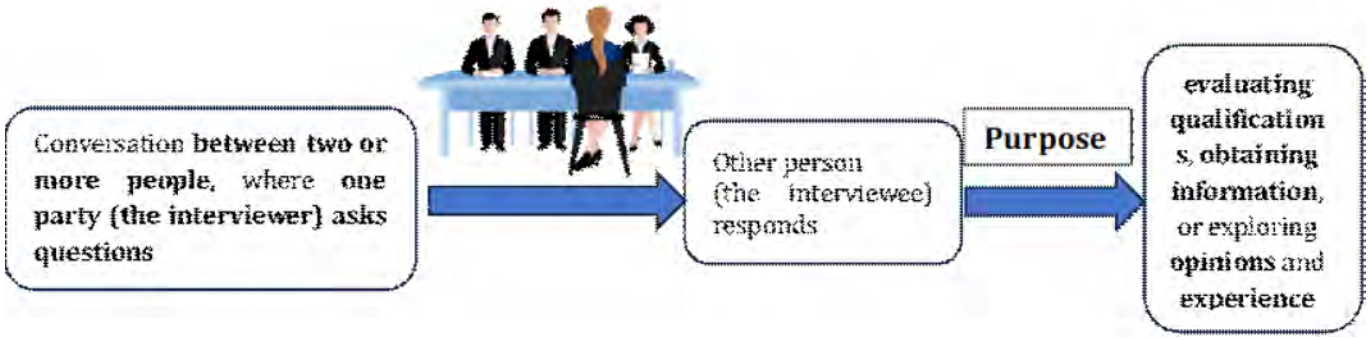
❑ QUESTIONS DURING INTERVIEW



Interview is conducted after the Drug Inspector written examination depends on the recruiting authority — Central or State. At the Central level, the interview is mandatory, whereas at the State level, it is optional."

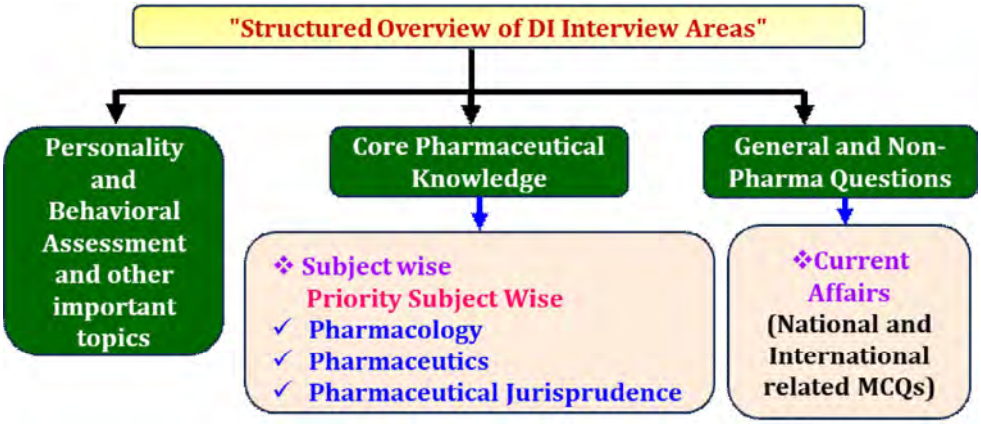
❖ PANEL OF INTERVIEW

"The Drug Inspector interview panel usually consists of 3 to 5 members, including officials from UPSC or State PSC, senior drug control officers, and subject matter experts."

NOTE:-

"No one can predict the exact questions asked in the Drug Inspector interview. However, based on discussions with previously selected candidates, questions are commonly asked from Pharmaceutics, Pharmacology, and Pharmaceutical Jurisprudence - though anything can be asked in the interview."

❑ "KEY FOCUS AREAS IN DRUG INSPECTOR INTERVIEW PROCESS"



PERSONALITY AND BEHAVIORAL ASSESSMENT

1. Personality and Behavioral Assessment

Q. Tell us something about yourself

Q. What are your strengths

Q. What inspired you to pursue a career as a Drug Inspector?

Q. Why do you want to leave your current job (especially if it's a government post)?

e.g.-1. You are already in a government post. Why do you want to switch to the Drug Inspector role?

e.g.-2. What attracts you to the Drug Inspector position over your current job?

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5. General Knowledge ,General Science and Currents affairs

Q. What are some current debate topics related to the pharmaceutical and healthcare sectors, and what is your opinion on them?

Q. Important Days (Health, Pharmacy & Science Related)

Q. Recent Nobel Prizes (Relevant to Medicine and Pharmacy, Sports etc.)

❑ INTERVIEW

Sources to prepare for Drug Inspector exam and interview

SCAN ME

❑ SUBJECT-WISE ANALYSIS OF PREVIOUS YEARS MCQS (STATE AND CENTRAL LEVEL)

S.N	Exam name	Total marks	Pharmaceutics and Allied sub.	Pharmacology and Allied sub.	Pharmacognosy	Chemistry and Allied sub.	Other	Non pharma
1	Gujarat Drug Inspector-2024	300	65	51	21	38	24	101
2	Uttarakhand Drug Inspector - 2024	200	64	74	25	29	8	_
3	Tamil Nadu DI- 2024	200	49	54	37	41	19	_
4	UPSC (Union Public Service Commission) Drug Inspector-2023	150	61	28	2	30	15	14
5	Odisha Drug Inspector - 2023	200	45	70	29	36	20	__
6	MPSC (Maharashtra Public Service Commission) Drug Inspector - 2023	100	23	30	3	11	26	7
7	Telangana Drug Inspector - 2023	300	63	57	4	2	24	150
8	Bihar Drug Inspector - 2023	450	150	100	50	100	50	_
9	Madhya Pradesh Drug Inspector - 2022	200	17	23	2	12	44	102
10	Assam Drug Inspector-2022	100	19	23	4	46	8	_
11	Himachal Pradesh Drug Inspector - 2021	100	17	21	19	14	9	20
12	Gujarat Drug Inspector – 2021 (SHIFT- I)	200	62	43	28	47	20	_
13	Gujarat Drug Inspector-16.9.2021 (SHIFT-II)	200	66	40	23	43	28	_

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❑ THE NUMBER AND WEIGHT DISTRIBUTION

❖ HATCH–CHOATE EQUATIONS FOR COMPUTING STATISTICAL DIAMETERS FROM NUMBER AND WEIGHT DISTRIBUTIONS [TN DI - 2024]

DIAMETER	NUMBER DISTRIBUTION	WEIGHT DISTRIBUTION
Length – number mean	$\log d_{ln} = \log d_g + 1.151 \log^2 \sigma_g$	$\log d_{ln} = \log d'_g + 5.757 \log^2 \sigma_g$
Surface - number mean	$\log d_{sn} = \log d_g + 2.303 \log^2 \sigma_g$	$\log d_{sn} = \log d'_g + 4.606 \log^2 \sigma_g$
Volume – number mean	$\log d_{vn} = \log d_g + 3.454 \log^2 \sigma_g$	$\log d_{vn} = \log d'_g + 3.454 \log^2 \sigma_g$
Volume – surface mean	$\log d_{vs} = \log d_g + 5.757 \log^2 \sigma_g$	$\log d_{vs} = \log d'_g + 1.151 \log^2 \sigma_g$
Weight – moment mean	$\log d_{wm} = \log d_g + 8.059 \log^2 \sigma_g$	$\log d_{wm} = \log d'_g + 1.151 \log^2 \sigma_g$

❖ THE PARTICLE DIAMETER BY MICROSCOPY METHOD

Projected area diameter	• It is the diameter of a circle with the **same area** as that of the particle observed to the surface on which the **particles rests.** • Microscopic method of **evaluation is Projected diameter**
Martin diameter	• The length of the **line bisecting** the image of the particle. • The bisecting line is taken parallel to a **fixed direction, irrespective of the orientation** of the particle.
Feret diameter [GUJARAT DI - 2021]	It is the distance between **two tangents** on opposite sides of the **particle parallel** to some **fixed direction.**

❑ SURFACE AREA

- As the particle size decreases, the surface area of particle increases.
- Two methods are commonly available that permit direct calculation of surface area

1. Adsorption method

2. Air permeability method

✓ Determination of surface area

FEATURES	ADSORPTION METHOD	AIR PERMEABILITY METHOD
Equation used	**BET (Brunaver, Emmett Teller) equation** $\frac{p}{V(p_0 - p)} = \frac{1}{V_m b} + \frac{(b-1)p}{V_m b p_0}$ **Where ,** **V** = Volume of **gas in cm³** adsorbed per gram of powder at **pressure p** p_0 = **Saturated vapour pressure** of **liquified nitrogen** at the temperature of the experiment **b** = **Constant** and it gives the difference b/w the heat of adsorption and heat of liquefaction of the adsorbate (nitrogen)	**Poiseulli's equation** **Kozency – Carman equation** [GUJARAT DI - 2021] $V = \frac{A}{\eta S^2_w} \cdot \frac{\Delta P t}{K l} \cdot \frac{\varepsilon}{(1-\varepsilon)^2}$ **Where ,** **A** = **Cross sectional area** of the bed (pack), m^2 **ΔP** = **Pressure difference** of the plug **t** = **Time of flow seconds** **l** = **Length** of the sample holder , cm **ε** = **Porosity** of the powder

- Near CMC, micelles of the surfactant molecules assume the shape of spherical. [GUJARAT DI - 2024]
- Critical micelle concentration influences by conductivity, viscosity and surface tension. [MP DI – 2012]
- Surfactants form micelles at CMC. [JK DI – 2013]

❖ CLASSIFICATION OF SURFACE ACTIVE AGENTS

SURFACTANT	
Cationic	Quaternary ammonium salts :- Cetyl trimethyl ammmonium bromide(Cetrimide) [RAJASTHAN DI - 2012]
	Pyridinum compounds :- Dodecyl pyridinium chloride
Anionic [MAHARASHTRA DI - 2016]	Alkali soap :- Potassium stearate, Triethanol amine acetate
	Organic sulphates :- Sodium lauryl sulphate (SLS)
	Organic sulphonates :- Sodium cetyl sulphonate
	Bile salt :- Sodium glycolate
Ampholytic	N-dodecylalanine, Lecithin
NON-IONIC	
Hydrophobic	Spans (Sorbitan Fatty acid esters) [GUJARAT DI - 2021]
Hydrophillic	Tweens (Polysorbates) [ASSAM DI - 2022]
	Polyoxy ethylene mono Laurate → 20 L → Tween 20
	Polyoxy ethylene mono Palmitate → 40 P → Tween 40 [BIHAR DI - 1998]
	Polyoxy ethylene mono Stearate → 60 S → Tween 60 [MEGHALAYA DI - 2019]
	Polyoxy ethylene mono Oleate → 80 O→ Tween 80

❑ DETERGENTS [GUJARAT DI - 2021, GUJARAT DI - 2024]

- Detergents are Surfactants that are used for the removal of dirt.
- Detergency is a complex process involving the removal of foreign matter from surfaces.
- The cleaning action of soaps and detergents is due to surface tension

Examples

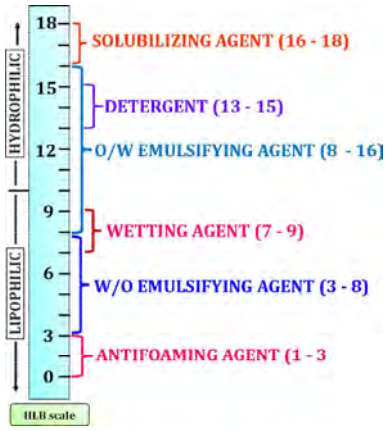
Cationic type	Zephiran, (Benzyldimethylcetyl ammonium chloride) Cetrimide (Cetyltrimethyl ammonium chloride)
Anionic type	Soaps, Sodium lauryl sulfate)

❑ HLB (HYDROPHILIC LIPOPHILIC BALANCE)

- Developed by : **Griffin**, developed in 1949.
- HLB is number system that indicates the extent of **polar – non polar nature of the surfactants.** [TN DI - 2024]
- The **higher the HLB** of an agent, the **more hydrophilic** e.g- Tweens, polyoxyethylene.
- The **lower the HLB** of an agent, **lipophilic** e.g- Spans, Sorbitan esters.

✓ HLB range of surfactants

CATEGORY	HLB RANGE
Antifoaming agent	**1-3**
W/O emulsifying agent	**3-8** [MAHARASHTRA DI – 2008, TN DI - 2012]
Wetting agent	**7-9** [CG DI – 2009, GUJARAT DI – 2021, TN DI - 2024]
O/W emulsifying agent	**8-16** [BIHAR DI – 1998, JK DI – 2013, TN DI - 2019]
Detergents	**13-15** [GUJARAT DI-2021]
Solubilizing agent	**15-18** [GUJARAT DI - 2021]



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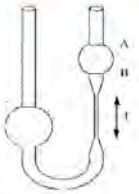
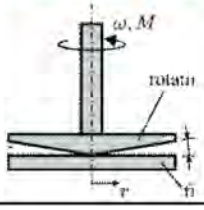
❑ METHODS OF DETERMINATIONS

- Rheometer is an instrument used to measure the flow behavior, if the viscosity is measured the instrument is known as viscometer.

VISCOMETER

- **Single point** → **Equipment** → **Applications**
  - At a single rate of shear one point on the curve
  - Ostwald viscometer, Falling sphere viscometer
  - Newtonian fluids
- **Multi point** → **Equipment** → **Applications**
  - Several rates of shear many points on the curve
  - Cup and bob, Cone and Plate **[RAJASTHAN DI - 2012]**
  - Non-newtonian fluids, Newtonian fluids

❖ TYPES OF VISCOMETER

VISCOMETER	NAME	PRINCIPLE	CHARACTERISTICS/USES
Capillary viscometer 	• **Ostwald viscometer,** • **Ubbelohde suspended level viscometer** • **Cannon – Fenske viscometer**	Measuring time required for liquid to pass between two marks of a capillary $\eta_1 = \frac{\rho_1 t_1}{\rho_2 t_2}\eta_2$ **Poiseuille's law:** $\eta = \frac{\pi r t \Delta P}{8lV}$	Colloids, dilute suspension, emulsion, Liquid paraffin, dextran 40 injection, methyl cellulose solution
Falling sphere viscometer 	**Hoeppler viscometer**	• Time required for sedimentation depends on viscosity • It is based on the **principle of stokes law.**	This instrument can be used over the range 0.5 to 200,000 poise
Rotational viscometer 	**Cup and bob**	The cup or bob is made to rotate and the torque resulting from the viscous drag is measured by a spring in the drive of the bob	• **Couette type** – Revolving cup type - MacMichael viscometer • **Searle type** : Revolving bob type – Stormer viscometer **[JK DI - 2013]** • Disadvantages – Plug flow **[JK DI - 2013]**
Cone and plate 	**Ferranti-Shirley viscometer**	Rate of shear in RPM is increased and decreased by a selector dial and the viscous traction or torque (Shearing stress) produced on the cone is rad on the indicator scale	Rheological evaluation of some pharmaceutical semisolids.

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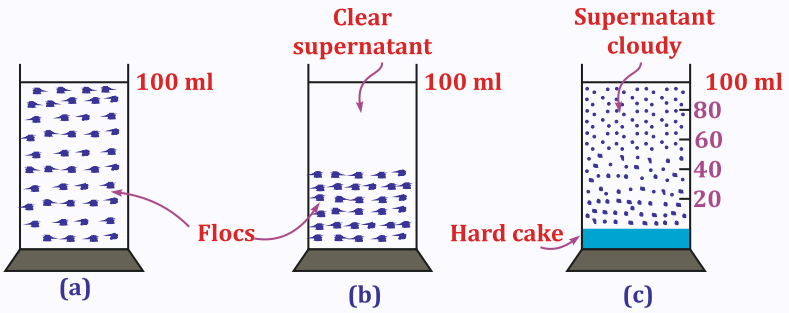
- Even if particles settles they should be easily redispersed with moderate amount of shaking



Flocculated suspension :
(a) Initial state (F = 1.0)
(b) State of suspension on storage after some time (F = 0.6)
(c) Deflocculated suspension

FIG. : SEDIMENTATION PARAMETERS OF SUSPENSION

- **Raising the temperature** often leads to flocculation of sterically stabilized suspensions, that is, **suspensions stabilized** by **nonionic surfactants.**
- When the **suspension is heated**, the **energy of repulsion** between the particles can be reduced owing to **dehydration** of the polyoxyethylene groups of the surfactant.
- The **attractive energy is increased** and the particles flocculate studied the **mechanism of freeze–thaw instability** in **aluminum hydrocarbonate** and **magnesium hydroxide gels.**

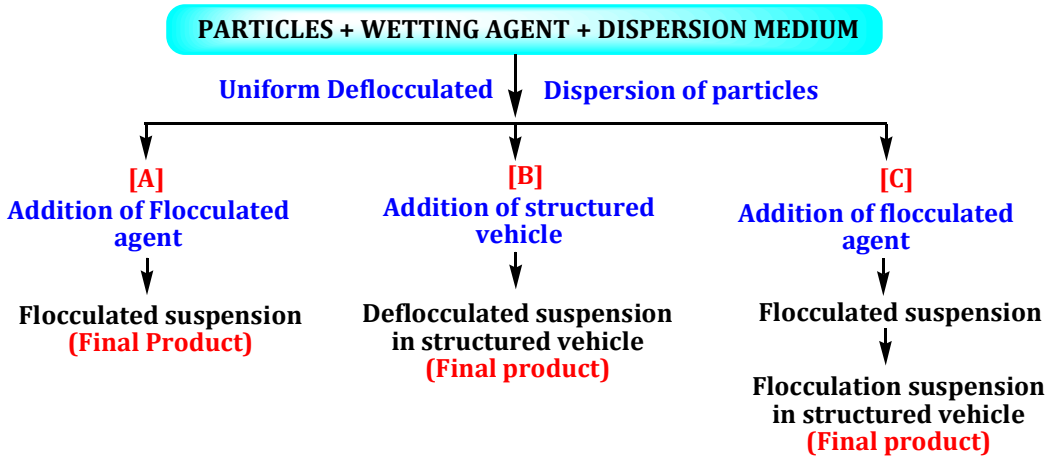
✓ **The extent of sedimentation is quantitatively expressed by two parameters**

SEDIMENTATION VOLUME (F)	DEGREE OF FLOCCULATION (B)
$F = \frac{V_U}{V_0} = \frac{\text{Ultimate volume of the sediment}}{\text{Initial volume of the suspension}}$	$\beta = \frac{V_U}{V_a} = \frac{\text{Ultimate sediment volume of flocculated system}}{\text{Ultimate sediment volume of deflocculated system}}$
F → Dimensionless (between 0 – 1) F = 0 → Complete sedimentation F = 1 → No sedimentation ↑ F, ↑ Physical stability	↑ β results in physical stability

❑ FORMULATION OF SUSPENSION

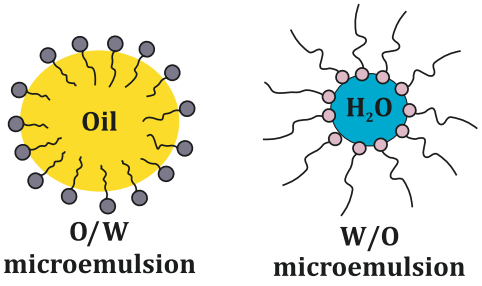
- It depends on whether suspension is flocculated or deflocculated.
- Three approaches are followed in preparation of physically stable suspension

1. Use of structured vehicles to keep particles in deflocculated state.
2. Addition of flocculating agent in order to prevent cake formation.
3. Combination of both approaches to prevent settling.



❑ MICROEMULSIONS

- It is a system of **water, oil and amphiphiles** that is a single **optically isotropic and thermodynamically stable** liquid solution.
- Microemulsions contain globules of the **size about 0.01 µm**
- Microemulsion are **transparent to translucent systems.**
- They exhibit a **viscoelastic gel phase**, when **internal phase** is added in excess.



Complexation

❑ INTRODUCTION

- **Complexation** is association of **two or more species** capable of independent existence. It generally results from :-

(i) Donar acceptor mechanism

(ii) Lewis acid base reaction

❖ THE INTERMOLECULAR FORCES INVOLVED IN THE FORMATION OF COMPLEXES ARE:-

- Covalent or coordinated bonds (Lewis's acid-base type)
- Van der Waals forces of dispersion
- Ion-dipole, dipole – dipole and dipole – induced dipole type
- Hydrogen bonding

❑ CLASSIFICATION OF COMPLEXES [HP DI - 2021]

COMPLEXES

Metal ion complexes
- Inorganic type
  e.g- $[Co(NH_3)_6]^{3+}Cl^-$
- Chelates
  e.g- EDTA
- Olefin type
- Aromatic type
  1. Pi complexes
  2. Sigma complexes
  3. Sandwich compounds

Organic molecular complexes
- Quinhydrone type
  e.g- Quinhydrone of salicylic acid
- Picric acid type
  e.g- Butesin picrate
- Caffeine and other drug complexes
  e.g- Caffeine complexes
- Polymer type
  e.g- Polymer complexes

Inclusion/occlusion compounds
- Channel lattice type
- Layer type
- Clathrates
- Monomolecular type
- Macromolecular type
  e.g.- cyclodextrins

4.	Omnimane	o.m.	Every morning
5.	Omninocte	o.n.	Every night
6.	Internocte	inter noct.	During the night
7.	Nocte	n.	At night
8.	Vespere [AP DI – 2012]	vesp.	In the evening
9.	Jentaculum	jentac.	Breakfast

➢ Hour/Time

S.NO.	LATIN TERM	ABBREVIATION	MEANING
1.	Omni hora [UK DI - 2024]	o.h.	Every hour
2.	Quaque secunda hora	qq.sec.h.	Every alternate hour
3.	Alternis horis	alt.hor.	Every two hours

➢ Correlated Time

S.NO.	LATIN TERM	ABBREVIATION	MEANING
1.	Ante cibos/Ante cibum [TELANGANA DI - 2023]	a.c. [AP DI – 2012] [HP DI - 2016]	Before meal/Before food
2.	Post cibos/ Post cibum	p.c. [AP DI – 2012] [HP DI - 2016]	After meals/After food
3.	Inter cibos/ Inter cibum [AP DI – 2012]	i.c.	Between meal

➢ Other Terms

S.NO.	LATIN TERM	ABBREVIATION	MEANING
1.	Si opus sit [UP DI - 2018]	S.O.S [HP DI - 2011] [AP DI – 2012]	When required
2.	Statim [GUJARAT DI - 2021]	Stat. [AP DI – 2012] [CG DI – 2015]	Immediately /At once
3.	Quantam sufficiat	q.s. [AP DI – 2012]	Sufficient quantity
4.	Semi	ss [AP DI – 2012]	Half
5.	Pro re nata	P.r.n. [AP DI – 2012]	Occasionally
6.	Fiat [UP DI - 2018]	ft	Let it be made

❖ Latin Terms for Parts of Body

S.NO.	LATIN TERM	ABBREVIATION	ENGLISH MEANING
1.	Auris dexter	a.d.	Right ear
2.	Auris laevus	a.l.	Left ear
3.	Oculis dexter	o.d.	Right eye
4.	Oculis laevus	o.l.	Left eye
5.	Brachis	brach.	To the body
6.	Jugulo	jug.	To the throat
7.	Naso	-	To the nose
8.	Pro oculus	pro.ocul.	For the eyes
9.	Sterno	stern	To the chest
10.	Thoraci	thorac.	To the chest
11.	Auri	auri	To the ear
12.	Gutturi	gutt.	To the throat
13.	In oculum sinistram	in ocul. sinist.	For the left eye
14.	In aurem sinistram	in aur. sinist.	Into the left ear
15.	In oculum dextrum	in ocul. dext.	Into the right eye
16.	Pro capillis	Pro capill.	For the hair
17.	Pro oculis	Pro ocul.	For the eyes

ON THE BASIS OF CHILD DOSE WITH RESPECT OF ADULT DOSE

Gaubin's formula

AGE UNDER (YEARS)	PARTS OF ADULT DOSE
Under 1	1/12
1-2	1/8
2-3	1/6
3-4	1/4
4-7	1/3
7-14	1/2
14-20	2/3
21-60	Full adult dose
60-70	4/5
70-80	3/4
Over 90	1/2

QUE: Calculate the dose for 15 years old child, if adult dose is 650 mg.

SOL: Age of child: 15, Adult dose: 650 mg

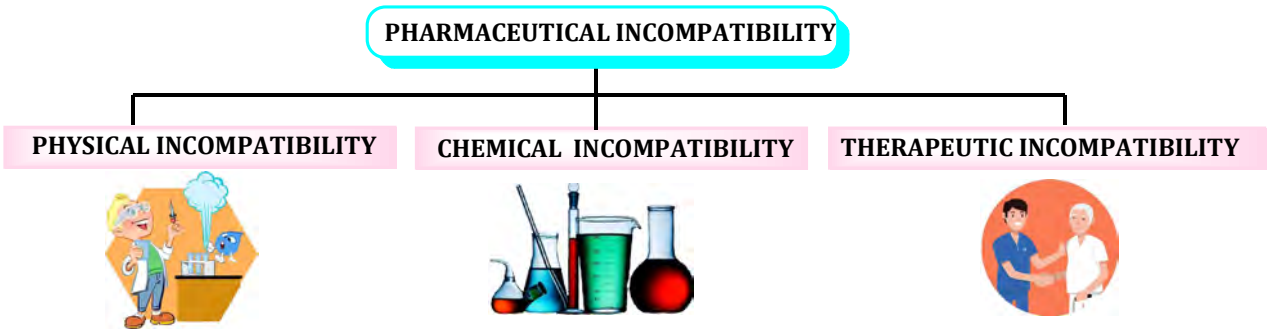
$$\frac{2}{3} \times 650 = \mathbf{433.3\ mg}$$

Incompatibilities

❑ INTRODUCTION

- A change resulting from mixing of two or more than two antagonistic substance is incompatibility.
- Incompatibilities occur when the components of a medicine interact in a way that adversely affects the properties of the medicine, such as its stability, appearance, effectiveness, or safety. **[BIHAR DI - 2023]**

❑ TYPES OF INCOMPATIBILITIES **[TELANGANA DI - 2023]**



❖ Physical Incompatibility:

Mixing of two or more than two substances

⇩

Physical change takes place

⇩

Due to immiscibility, insolubility, precipitate formation and liquefaction of solid materials

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HOSPITAL AND CLINICAL PHARMACY

Hospital Pharmacy

❑ HOSPITAL

A hospital is a healthcare institution providing patient treatment with specialized health science and auxiliary healthcare staff and medical equipment.

❑ PHARMACY

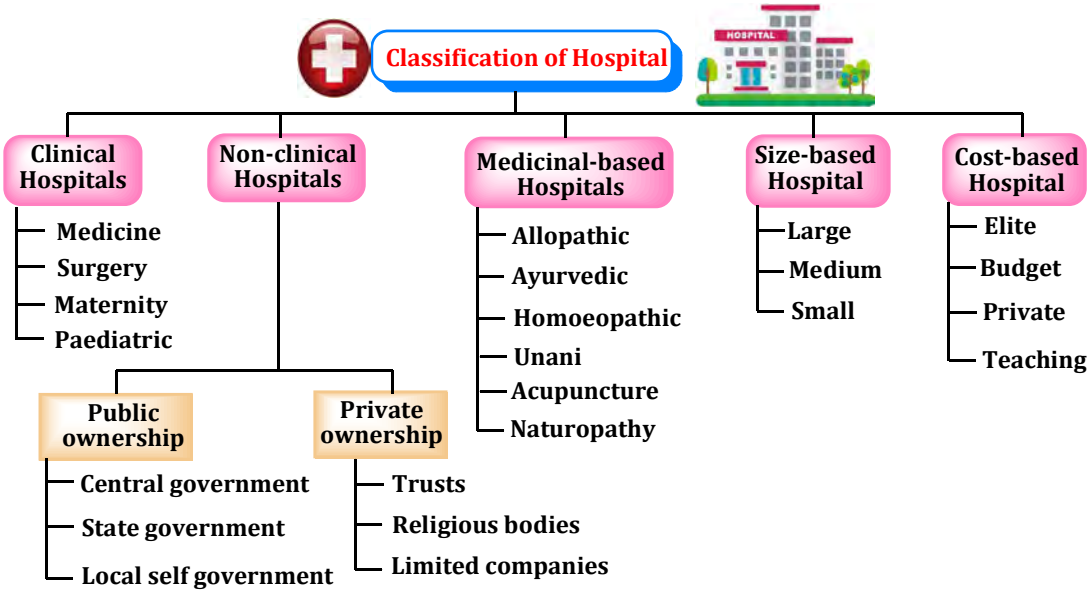
Pharmacy refers to the practice of preparing, storing, and dispensing drugs. **[BIHAR DI - 1998]**

➢ **Hospital pharmacy deals with:**

- ✓ Supply of drug
- ✓ Filling of special prescriptions
- ✓ Manufacturing of the drugs
- ✓ Storage and dispensing of narcotic and biological products
- ✓ Supply and storage of ancillary products **[TN DI - 2009]**

➢ **Factors influencing selection of site for a drug store:** **[TN DI - 2009]**

- Availability of finance
- Existence of hospitals or clinics nearby
- Safety
- Easily reachable by patients and suppliers
- Good frontage and signage attract customers.
- Number of other pharmacies in the area.
- Space and infrastructure



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❖ Catheter

Catheters are medical devices that can be inserted in the body to treat diseases or perform a surgical procedure. Catheters are manufactured for specific applications, such as cardiovascular, urological, gastrointestinal, neurovascular and ophthalmic procedures. The process of inserting a catheter is called catheterization.

Indwelling Catheter

Intermittent Catheter

External Catheter

➢ **Types of catheters**

- Indwelling catheters
- External catheters
- Short-term catheters

❖ **Neps:** These are small knots on fibers caused by uneven growth or formed mechanically in processing.

❖ **Absorbent cotton wool:** It is used for absorbing wound exudates. Used for cleaning wounds and applying antiseptics; cotton wool gives warmth and protects against infection. **[UP DI - 2018]**

❑ SURGICAL INSTRUMENT

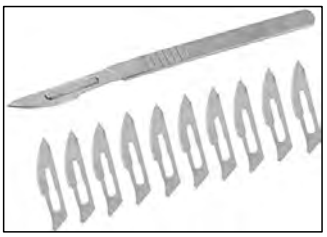
❖ **Towel clips or corner clips:** These are used as surgery accessories to fix surgical towels in such a manner which reduces the risk of contamination. Corner clips are of following types:

1. Gray's type
2. Backhaus towel forceps
3. Moynihan's tetra towel forceps

Backhaus towel forceps

Moynihan's tetra towel forceps

❖ **Scalpels and their blades:** Scalpels are used to make an incision. It is a blade with a handle and blades are detachable type.



❖ Forceps

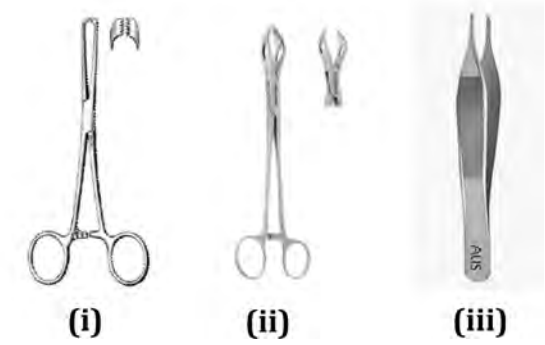
➢ **Tissue forceps:** These forceps are used to hold the tissues. They may be toothed or non-toothed.

(a) Toothed Tissue forceps: **[CG DI – 2015]**

(i) Allis type

(ii) Lane's type

(iii) Mognihan's type



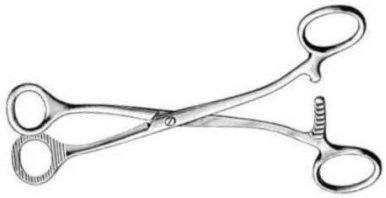
(b) Untoothed Tissue forces like Babcock's un-toothed tissue forceps: These forceps are used to hold delicate structures like the peritoneum, appendix etc.

- **Haemostatic Forceps:** They are used to check the blood flow from the vessels. The characteristic features are blunt tip, transverse ser-rations, clamp and no interval between blades. Following are the examples:

(a) Mosquito type haemostatic forceps: These forceps are small and straight and are used to check the blood flow from the vessels. [CG DI – 2015]

(b) Plain dissecting forceps: These forceps have spring like handle with serrated inner side.

(c) Tongue holding forceps: These forceps hold the tongue during surgery or to prevent it from falling back so as not to obstruct breathing.



(d) Bone cutting forceps: They have sharp blades on the inside edge and are rounded on the outer edge.

(e) Bone holding (lion) forceps: This forcep with stout blunt teeth on the blades resembles lions jaw, which catch bones.

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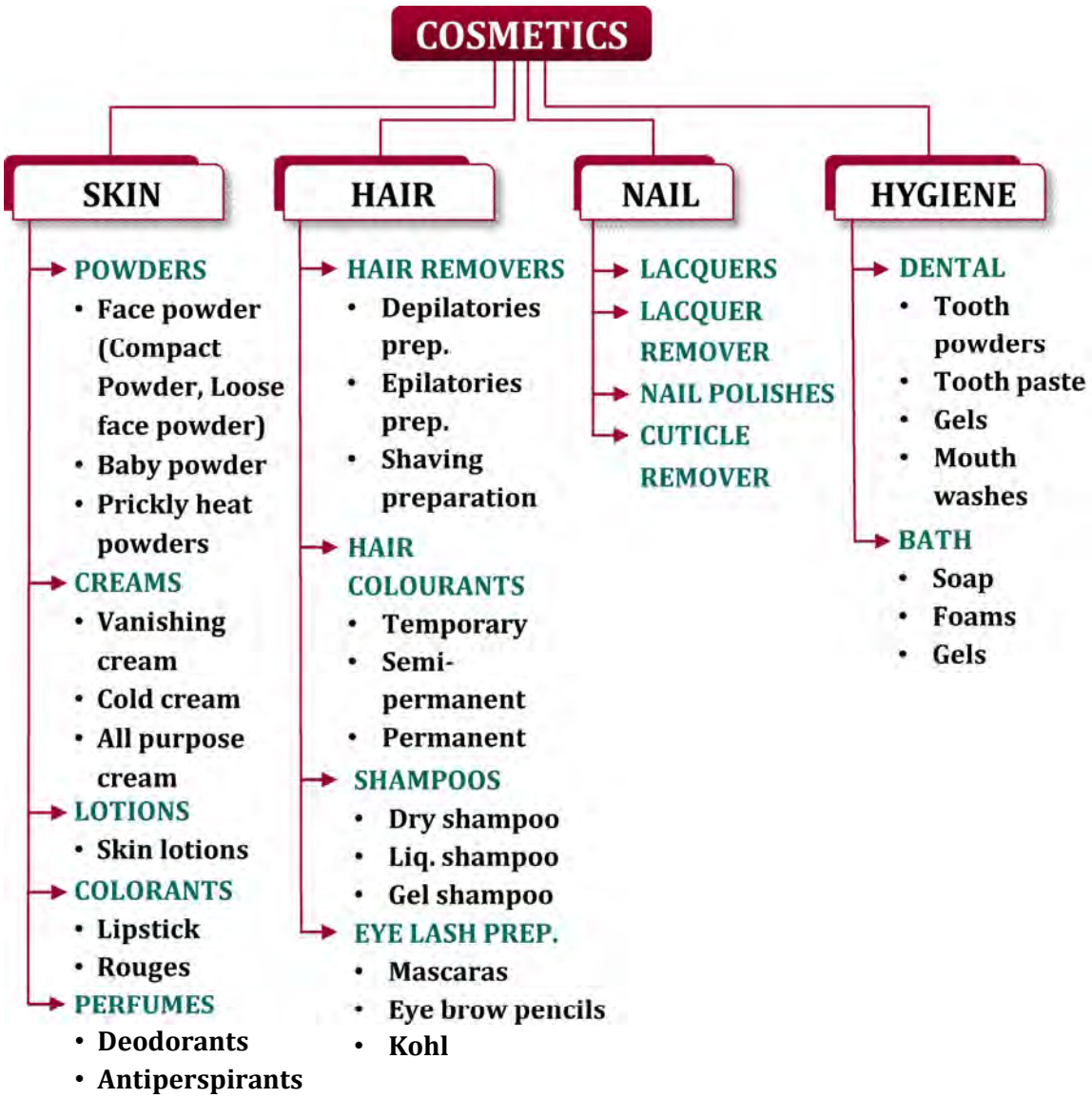
COSMETIC TECHNOLOGY

Cosmetics are substance or product used to **enhance or alter** the **appearance of the face or fragrance and texture of body.**



Cosmetics for Skin

POWDER PRODUCTS	
Face Powders	Zinc stearate, Zinc oxide, Calcium carbonate (light), Talc, Titanium dioxide, Magnesium carbonate (light)

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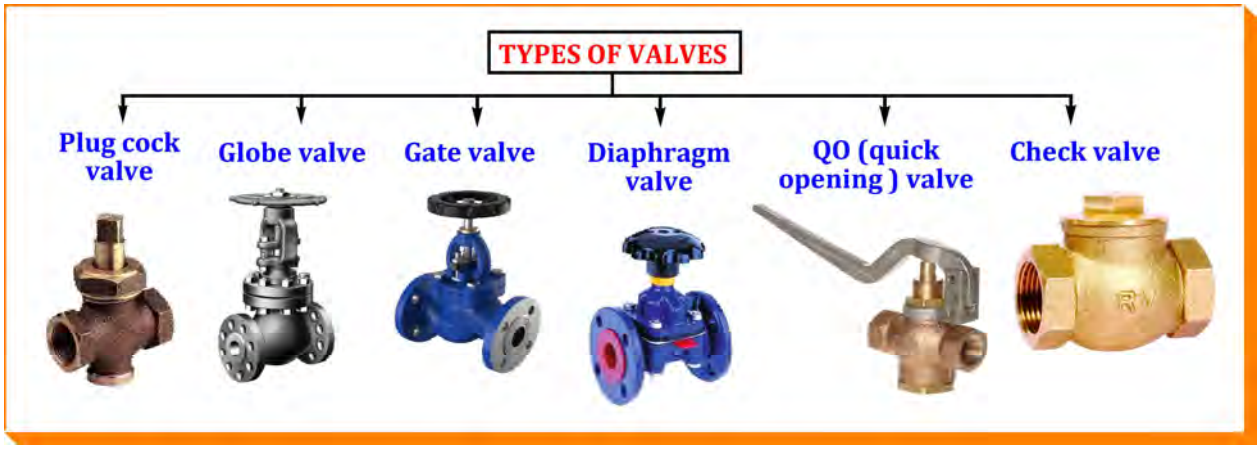
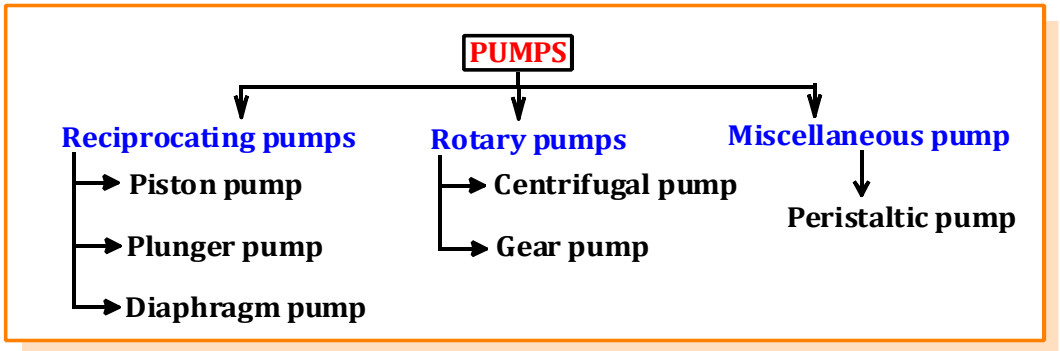
❖ Types of valves



NAME OF VALVE	USES
Plug cock valves	• It is used for handling compressed air • These are used for the purpose of wide opening or complete closing conditions.
Globe valves	• Mainly used in pipes with sizes not larger than 50 millimetres. • These valves prevent complete drainage.
Gate valves	It is minimise the differential pressure during opening and stopping the flow
Diaphragm valves	• Valves are more suitable for fluids containing suspended solids. • Special types of diaphragms can be easily sterilised so that they can be used in the production of sterile products.
Needle valves	• Needle valves are used to control the flow precisely. • Needle valves are used in food industries, pharmaceutical industries where precision is important.
Quick opening valves	Quick opening valves have smooth stems and are opened or closed by lever handle in a simple operation
Check valve	• These valves are used when unidirectional flow is desirable. • Protective mechanism is included to prevent the reversal of flow
Ball valve	• A ball valve is a shut-off valve that allows, obstructs, and controls the flow of liquids, gases, and vapours in a piping system by rotating the ball having a bore inside the valve.
Butterfly valve	A butterfly valve regulates flow by starting, slowing, or stopping media.

❑ PUMPS

- Pumps are mechanical devices use to increase the pressure energy of a liquid.
- Pump is used for raising fluids from a lower level to higher level.



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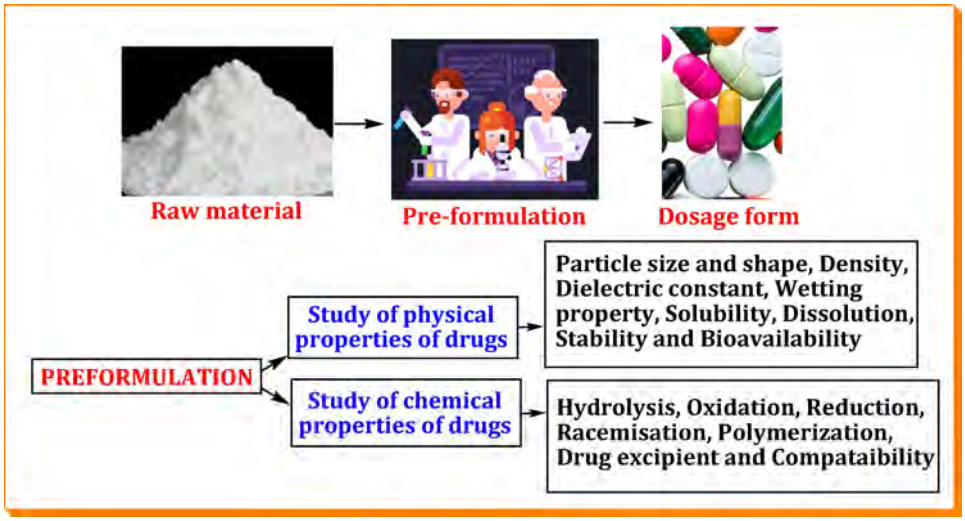
PHARMACEUTICAL TECHNOLOGY

Preformulation

❑ INTRODUCTION

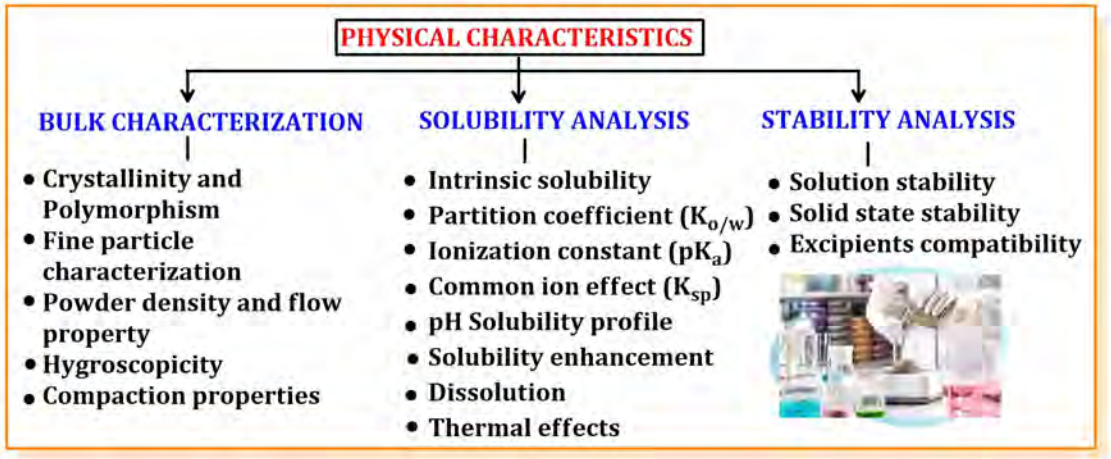
- It is defined as the phase of **research and development** in which pre-formulation studies characterize **physical and chemical properties** of a drug molecule in order to develop **safe, effective and stable dosage form.** [TN DI – 2019, GUJARAT DI – 2024]



❑ OBJECTIVE

- Develop the safest, most stable, and efficacious dosage form with maximum bioavailability.
- Determine the drug's kinetics and stability.
- Generate essential data for developing analytical methods.
- Identify the most stable polymorph and salt forms for optimal bioavailability.
- Reduce formulation development time and cost.

❑ PHYSICAL CHARACTERISTICS



❖ Other additives

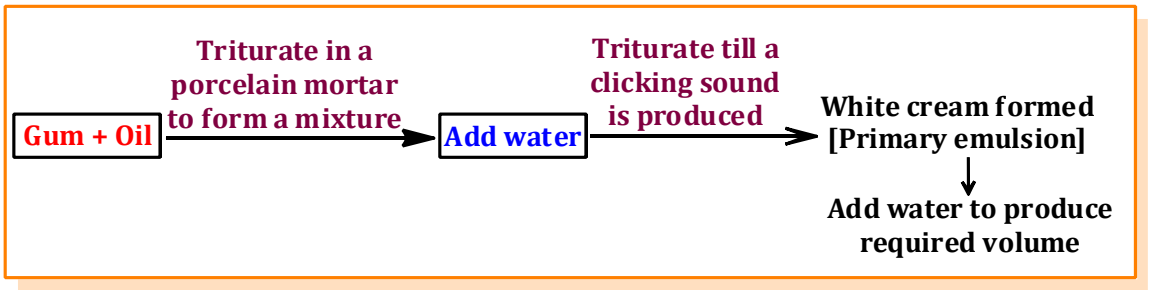
Antioxidants	• Prevent from oxidation • **e.g.- Propyl gallate, Ascorbic acid, Tocopherol**
Preservatives [TN DI - 2018]	• Prevent the growth of microorganism • **e.g.- Benzoic acid, Methyl paraben, Chlorobutanol, Chlorocresol Thimerosal**
Flavouring agent	• Vanillin – For liquid paraffin emulsion • Benzaldehyde – For Cod liver oil emulsion
Humectants	• Reduce water evaporation • **e.g.- Propylene glycol, Glycerol, Sorbitol**

❑ PROPORTION OF OIL, WATER AND GUM REQUIRED FOR DIFFERENT OIL

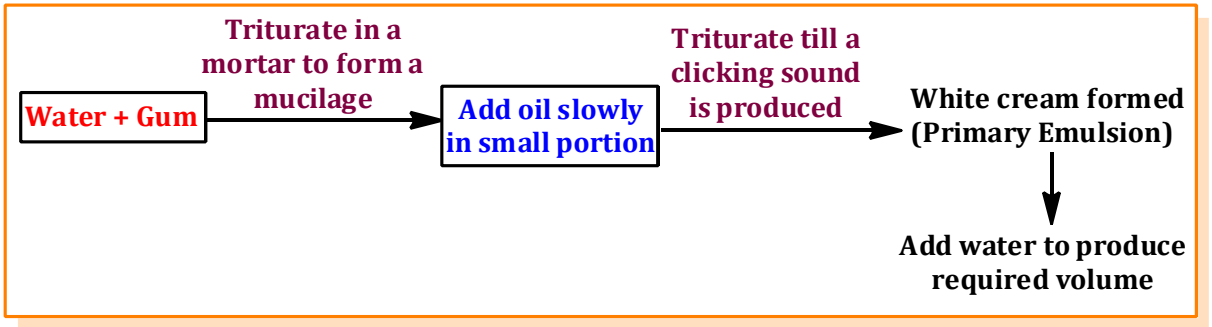
TYPE OF OIL	EXAMPLES	RATIO OF OIL: WATER : GUM
Fixed oil	Castor oil, Almond oil, Arachis oil, Cod – liver oil	4 : 2 : 1
Volatile oil [ODISHA DI – 2012, GUJARAT DI - 2021]	Turpentine oil, Peppermint oil, Cinnamon oil	2 : 2 : 1
Mineral oil	Liquid paraffin	3 : 2 : 1
Oleo – resin [HP DI - 2011]	Male fern extract	1 : 2 : 1

❑ METHODS USED IN THE PREPARATION OF EMULSIONS

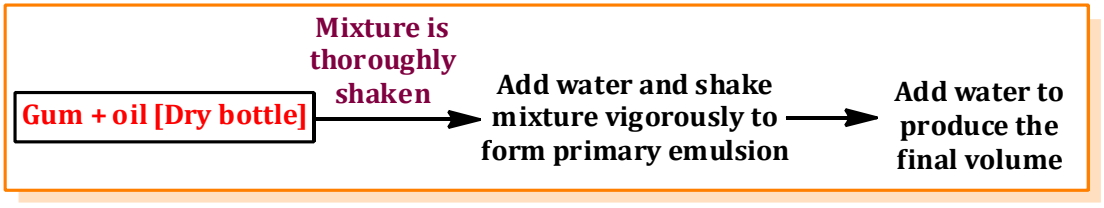
❖ Dry gum or Continental method:



❖ Wet gum or English method:

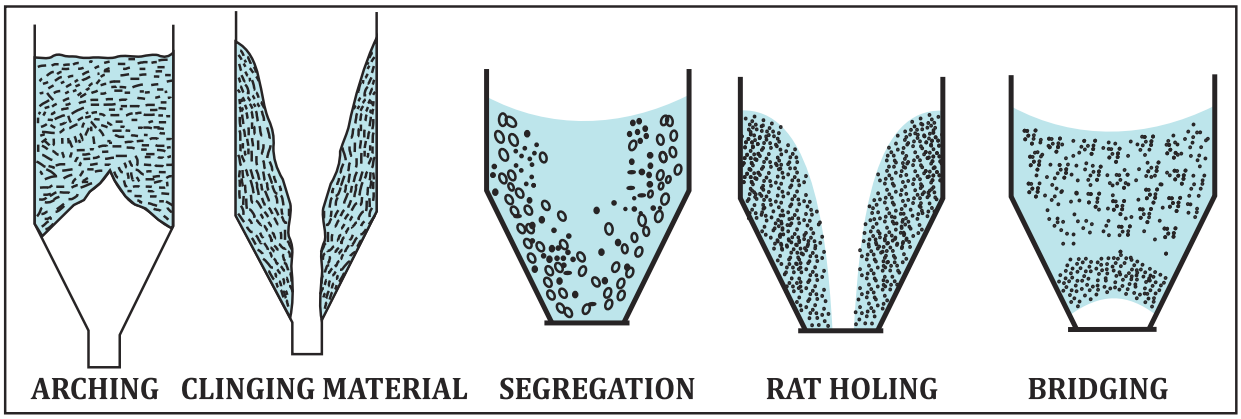


❖ Bottle or forbes method

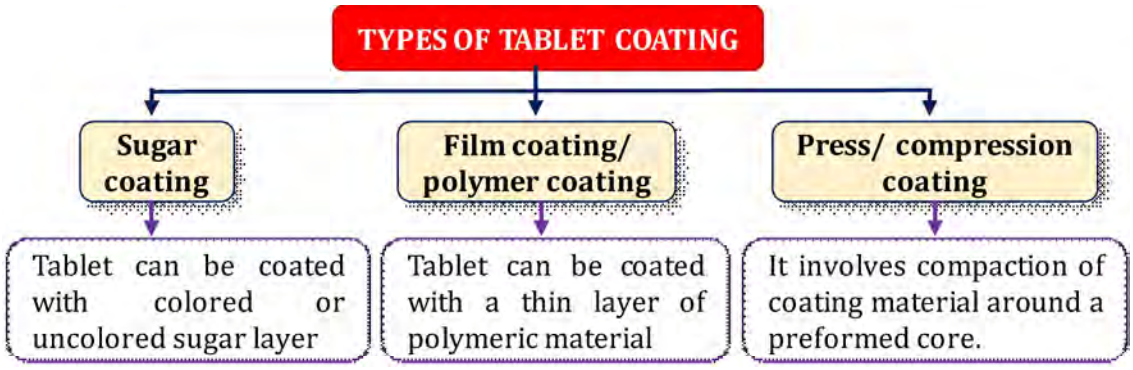


Double Compression 	---	Uncontrolled movement of punches.	• Using anti-turning devices. • Coating of punch faces → chromium. [GUJARAT DI - 2021]
Hardness variation	Tablets having different hardness value	Weight variation in granules	Proper tooling of machine.
Weight variation/ Rat holding/ Arching	Improper feeding of hopper Tablet forms with different weight	Poor flow Lack of glidant and lubricant.	Add sufficient amount of glidants and lubricants

➢ **Defects regarding improper feeding of hopper**



III. COATING OF TABLETS



❖ **STEPS OF SUGAR COATING**

Seal/Sugar Coating → Subcoating → Smoothing → Color Coating → Polishing → Printing

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❑ PACKAGING AND LABELLING CONTROL (TESTING OF GLASS, PLASTIC, RUBBER)

❖ EVALUATION OF GLASS CONTAINER

Evaluation of Glass Container

Powdered Glass Test

- Used to evaluate **Type I, III & IV glass.**
- It is done to estimate the amount of alkali from powdered glass with happen at elevated temperature.
- When glass is powdered, leaching of alkali is enhanced, which can be titrated with **0.02N Sulphuric acid** using **methyl red as an indicator.**

Water Attack Test

- This test is for Type II glass.
- The principle involve in this is whether the alkali leaches from surface of container.

❖ EVALUATION OF PLASTIC

Evaluation of Plastic

Pharmacopeial test

i. Leakage test
ii. Collapsibility test
iii. Clarity of aqueous extract
iv. Water vapour permeability test
v. Heavy metal and non-volatile residue test
vi. Physicochemical testing of container extract
vii. Biological tests
viii. Eye irritation test for ophthalmic containers

Non- Pharmacopieal

i. Measurement of impact strength (Drop weight test & tensile strength test)
ii. Chemical evaluations (UV, IR, chromatographic analysis)
iii. Container closure torque testing
iv. Microbiological testing

❖ EVALUATION OF RUBBER [TN DI - 2019]

Evaluation of Rubber

Pharmacopeial test

i. Sterilization test
ii. Fragmentation test
iii. Self-ability test
iv. Biological tests

Non- Pharmacopieal

i. Tensile and modulus testing
ii. Hardness testing
iii. Compression deformation testing
iv. Tear testing

❑ PHARMACOPEIAL STORAGE CONDITION FOR PARENTERAL PREPARATION

[GUJARAT DI 2010, HARYANA DI - 2019, ASSAM DI - 2022, TN DI - 2024]

STORAGE CONDITION	TEMPERATURE
Cold storage or under refrigeration	Usually 2 to 8°C

P= P1 +P2+P3————————

✓ **Raoults Law**

- The relative **lowering of vapour pressure is equal to the mole fraction of the non-volatile solute.**
- Partial vapor pressure of a propellant in the mixture is calculated by **Raoults law.**
- A solution is said to ideal when it follows **Raoults law equation.**

$$P_a = \frac{n_a}{n_a + n_b} P_A o = N_A P_A O$$

P_a = Partial vapour pressure of Propellant A

$P_A o$ = Vapour pressure of pure Propellant A

n_a = moles of Propellant A

n_b = moles of Propellant B

N_A = moles fraction of component A

3. VALVE AND ACTUATOR

(a) VALVE

- Easy to open and close, deliver the content in desired form.

➢ **There are two types of valve:-**

✓ **Continuous spray valve**

✓ **Metering valve**

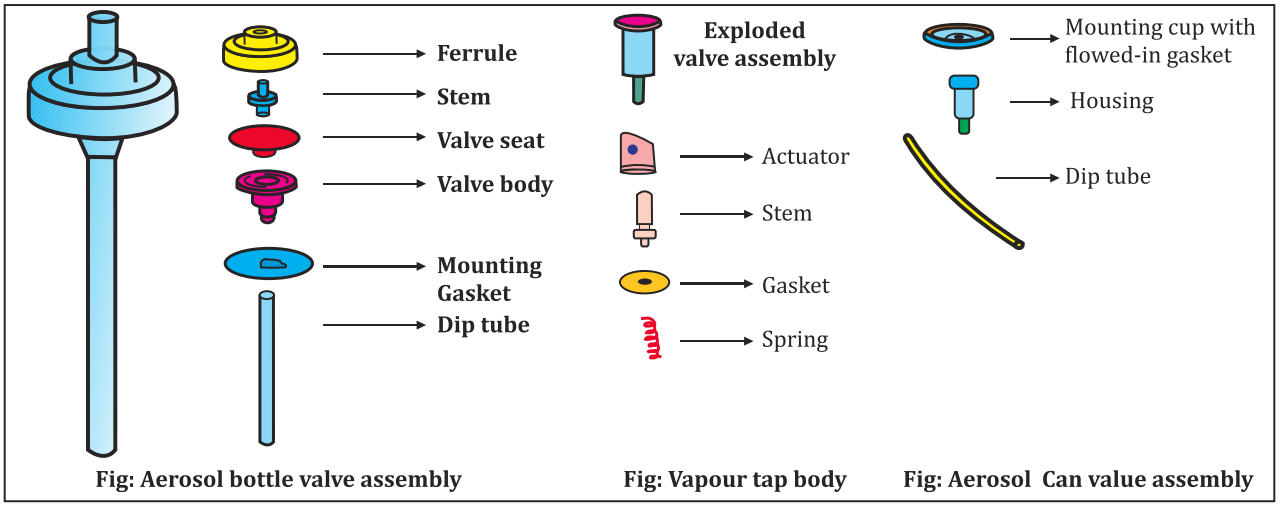


Fig: Aerosol bottle valve assembly | Fig: Vapour tap body | Fig: Aerosol Can value assembly

✓ **Components of Continuous Spray valve**

COMPONENTS	MATERIAL OF CONSTRUCTION	FUNCTION
Ferrule or Mounting cap [GUJARAT DI - 2021]	Tinplate steel, Aluminium with a single or double epoxy or Vinyl coating	• Attach the valve to the containers
Valve body or Housing	Nylon, Delrin	• Links the dip tube and the stem and the actuator • Produce a fine spray and prevent valve • Chocking contain opening (0.013 – 0.080 inch)
Stem	Nylon, Delrin Brass or Stainless steel	• Connect the valve to the actuator. • Provide entry and exit ports to the metering chamber to permit filling and discharge of the metered dose respectively
Gasket	Buna-N & Neoprene rubber	• Seal between the valve and container. • Prevents the leakage

Plasticizer/Lubricant	Paraffinic oil, Silicone oil
Fillers	Carbon black, Clay, Barium sulfate
Pigments	Inorganic oxides, Carbon black

❑ QUALITY CONTROL TEST

QUALITY CONTROL OF GLASS CONTAINERS	
Crushed - glass test	Whole-Container test
Powdered Glass Test	Water Attack Test
QUALITY CONTROL OF PLASTIC CONTAINERS	
Leakage test	Collapsibility Test
Transparency test	Water vapour permeability test
QUALITY CONTROL OF RUBBER CONTAINERS	
Penetrability	Extractive test
Self sealability test	Fragmentation test

❑ OFFICIAL STORAGE CONDITIONS BY USP

STORAGE CONDITION	STORAGE TEMPERATURE
Freezer	Temperature is maintained thermostatically between -25°C and -10°C.
Cold	Temperature is maintained thermostatically between 2°C and 8°C.
Controlled Cold Temperature	Temperature maintained thermostatically between 2°C and 8°C.
Cool	Temperature between 8°C and 15°C.
Controlled Room Temperature	Temperature maintained thermostatically between 20°C and 25°C.
Warm	Temperature between 30°C and 40°C.
Excessive Heat	Heat above 40°C.

❑ IMPORTANT POINTS

- **Amber glass** and **red glass** are effective in protecting the contents of a bottle from the effects of sunlight by screening out harmful **ultraviolet rays.** [GUJARAT DI - 2024]
- Rubber closures for sterile dosage forms are washed with a hot solution of **0.5% sodium pyrophos phate** to remove particulate and chemical residues. [UK DI - 2024]
- **Polypropylene, Polyamide** and **Polycarbonate** Can be autoclaved
- **Poly (methyl methacrylate) PMMA (Acrylic)** Cannot be autoclaved due to its low melting point as it may deform or discolor at high temperatures. [TN DI - 2018]
- **Disposable syringes** are made up of polypropylene and generally sterilized by Gamma radiation, **ethylene oxide gas (EO),** or steam. [JK DI - 2013]
- **Terminally sterilized products** are sterilized in their final container, **after filling and sealing,** typically using methods like autoclaving or dry heat. [TN DI - 2009]

Novel Drug Delivery System

❑ IMPORTANT TERMINOLOY

TERMINOLOGY	DESCRIPTION
Drug Delivery System (DDS)	Formulation or device that delivers drug to a specific site in the body at a certain rate.

BIOPHARMACEUTICS

Introduction to Biopharmaceutics

- **Biopharmaceutics** is defined as the **study of factors influencing the rate** and amount of drug that reaches the systemic circulation and the use of this **information to optimize therapeutic** efficacy of drug products.

PHARMACOKINETICS

- The term **"Pharmacokinetics"** is derived from Greek words **Pharmakon (drug)** and **Kinesis (movement).**

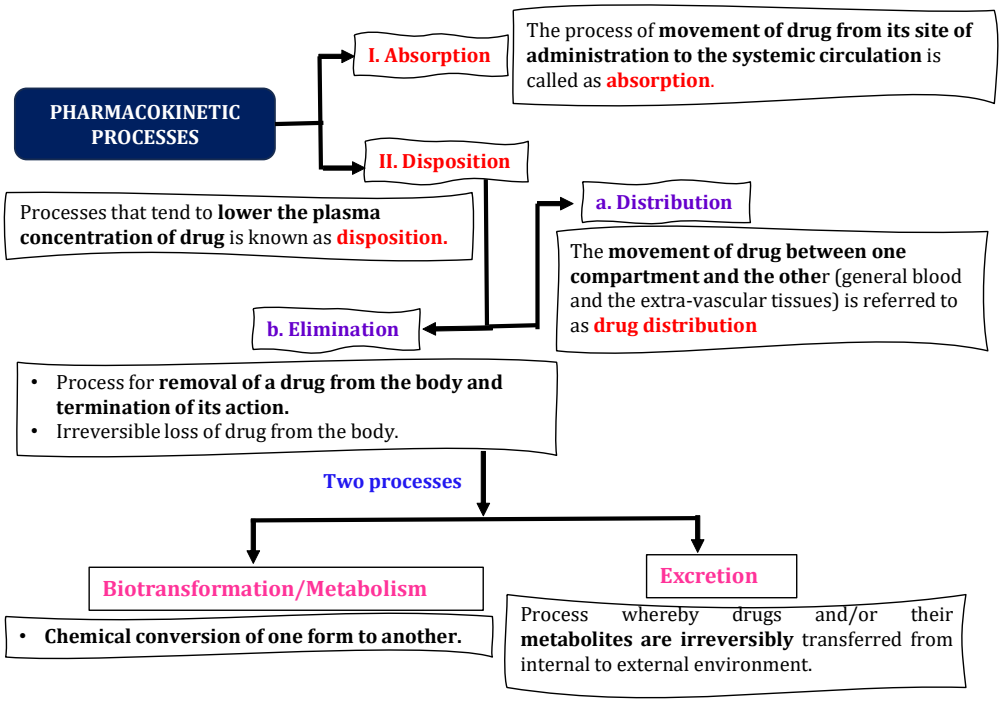
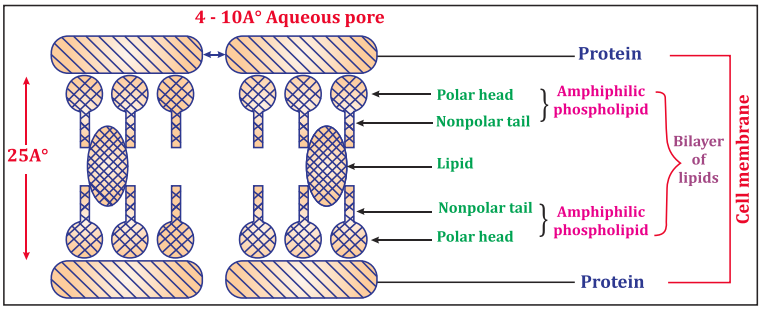


Fig.- Pharmacokinetic Process

Absorption of drugs

❖ The Basic Structure of Cell Membrane



PHARMACEUTICAL JURISPRUDENCE

Important Dates of Different Act and Rules

ACTS	PASSED	RULES	CAME IN FORCE	AMMENDMENTS/ REPLACEMENTS
Pharmacy Act	1948	--	4 March 1948	1976(Major), 1959, 1981
AICTE Act	1987	--	28 March 1988	
Drugs & Cosmetics Act	1940	1945	--	1972,1982 (Major), 2008 2016
Narcotic Drugs and Psychotropic Substances Act	1985	--	14 November 1985	--
Dangerous Drug Act	1930	1957	--	--
Opium Act	1857	--	--	1878
Medicinal and Toilet Preparations (Excise Duties) Act	1955	1956	1st April 1957	--
Drugs and Magic Remedies (Objectionable Advertisements) Act	1954	1955	1st April 1955	1963
Drugs (Prices Control) Order	2013	--	15th May 2013	1966, 1970, 1979, 1987, 1995, 2005
Essential Commodities Act	1955	--	1st April, 1955	
Poisons Act	3rd Sept. 1919	--	--	1904
Medical Termination of Pregnancy Act	1971	1975	10th August, 1971	--
Prevention of Food Adulteration Act	1954	1955	29th September, 1954	1964, 1976, 1986
Prevention of Cruelty to Animals Act	1960	--	26th December, 1960	1890
Patents Act	1970	2003	Acts- 20th April 1972 Rules- 20th May 2013	March 1999, June 2002, 2005
Designs Act	2000	2001	11th May 2001	Acts - 1911 Rules - 1933
Copyright Act	1957	--	21st January1958	1983, 1984, 1992, 1994, 1999, 2012
Trade Marks Act	1999	2002	15th September 2003	1958
Shops and Establishments Act	1939	1948	11th January 1949	--
Insecticides Act	1968	1971	30th October 1971	--
Factories Act	1948	--	1st April 1949	1950, 1951, 1954, 1976

Bhatia Committee	• The Government of India appointed the pharmaceutical Enquiry committee in 1953 under the chairmanship of **Major General S.S. Bhatia** • To make a comphrensive enquiry into the working of the pharmaceutical industry and to recommend what steps the Government should take to establish it on sound line in the interest of the country's health and economy	 **Major General S. S. Bhatia**
Mudaliar Committee	• Health Survey and Planning Committee by Government was appointed in June 1959 under the chairmanship of **Dr. A. Lakshmanswami Mudaliar**. • The committee recommended that is necessary to bring drugs prepared according to indigenous system of medicine also within the purview of the Drug Act.	 **Dr. A. Lakshman swami Mudaliar**
Hathi Committee	• On February 8, 1974, the Government of India constituted a Committee on Drugs and Pharmaceuticals Industry under the chairmanship of **Shri Jaisukhlal Hathi.** • The committee appointed by Government of India to look into the drug industry and various aspects of drugs like licensing price control, imports, role of foreign sector quality control. **[ODISHA DI - 2012]**	 **Jaisukhlal Hathi**

Pharmacy Act, 1948

❑ INTRODUCTION

- Pharmacy Act passed in 1948.
- Came into force in 4th March 1948. **[MP DI – 2012, CG DI – 2015, RAJASTHAN DI – 2018]**
- Major amended -1976 and Minor amended -1959 & 1981.
- Pharmacy Council of India with the approval of the Central Government hereby makes the following regulations. These regulations may be called the Pharmacy Practice Regulations, 2015. **[TN DI - 2024]**

❖ Pharmacy (Amendment) Bill, 2023 [GUJARAT DI - 2024]

- The Pharmacy (Amendment) Bill, 2023 has been introduced in Lok Sabha on August 03, 2023.
- The Bill looks at the insertion of **"new section 32c",** which provides a special provision relating to persons registered or qualified under the Jammu and Kashmir Pharmacy Act, 2011.
- The Bill specifies that anyone who is registered as a pharmacist under the Jammu and Kashmir Pharmacy Act, 2011 or possesses qualifications prescribed under the 2011 Act will be deemed to be registered as a pharmacist under the Pharmacy Act, 1948.

❑ OBJECTIVES [ODISHA DI – 2012, JK DI – 2013, BIHAR DI - 2023]

- To Regulation of Profession and Practice of Pharmacy.
- To regulates the Pharmacy Education for the purpose of registration as a pharmacist.
- To Raising the status of pharmacy profession
- To restoration of pharmacy profession in its due place in the health service
- To frames the education and training of pharmacy professionals and governing control over their professional work.

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CHAPTERS	DESCRIPTION
Chapter I	Introductory
Chapter II	Administrative Bodies: Drugs Technical Advisory Board, Central Drugs Laboratory and Drugs Consultative Committee
Chapter III	Import of Drugs and Cosmetics
Chapter IV	Manufacture, Sale and Distribution of Drugs and Cosmetics
Chapter IVA	Provisions relating to Ayurvedic, Siddha and Unani Drugs [GUJARAT DI - 2024]
Chapter V	Miscellaneous

❑ SECTIONS

CHAPTER I: INTRODUCTORY	
Section 1	Short title, extent and commencement
Section 2	Application of other laws not barred
Section 3	Definitions
Section 3A	Construction of references to any law not in force or any functionary not in existence in the State of Jammu and Kashmir
Section 4	Presumption as to poisonous substances
CHAPTER II: THE DRUGS TECHNICAL ADVISORY BOARD, THE CENTRAL DRUGS LABORATORY AND THE DRUGS CONSULTATIVE COMMITTEE	
Section 5	Drugs Technical Advisory Board
Section 6	Central Drugs Laboratory
Section 7	Drugs Consultative Committee [JK DI – 2013]
Section 7A	Sections 5 and 7 not to apply to Ayurvedic, Siddha or Unani drugs
CHAPTER III: IMPORT OF DRUGS AND COSMETICS	
Section 8	Standards of quality
Section 9	Misbranded drugs [ODISHA DI - 2023]
Section 9A	Adulterated drugs [TELANGANA DI - 2023]
Section 9B	Spurious drugs [TELANGANA DI - 2023]
Section 9C	Misbranded cosmetics [TELANGANA DI - 2023]
Section 9D	Spurious cosmetics
Section 10	Prohibition of import of certain drugs or cosmetics
Section 10A	Power of Central Government to prohibit import of drugs and cosmetics in public interest
Section 11	Application of law relating to sea customs and powers of Customs officers
Section 12	Power of Central Government to make rules
Section 13	Offences
Section 14	Confiscation
Section 15	Jurisdiction
CHAPTER IV: MANUFACTURE, SALE AND DISTRIBUTION OF DRUGS AND COSMETICS	
Section 16	Standards of quality
Section 17	Misbranded drugs
Section 17A	Adulterated drugs
Section 17B	Spurious drugs
Section 17C	Misbranded cosmetics [UPSC DI - 2023]
Section 17D	Spurious cosmetics
Section 18	Prohibition of manufacture and sale of certain drugs and cosmetics
Section 18A	Disclosure of the name of the manufacturer, etc
Section 18B	Maintenance of records and furnishing of information
Section 19	Pleas

FIRST SCHEDULE	SECOND SCHEDULE
Names of books under Ayurvedic, Siddha and Unani Tibbs systems. [TN DI – 2009, JK DI – 2013, GUJARAT DI – 2021]	**Standard to be compiled** with by imported drugs and by drugs manufactured for sale, stocked, or exhibited for sale or distributed. [JK DI – 2013]

❖ Schedules to the Rules

SCHEDULES	SIGNIFICANCE	
A	Proforma for Application	
B	Rates of Fee for test or analysis by the CDL or state drugs laboratories [MAHARASHTRA DI - 2023]	
B_1	Fees for the test or analysis by the Pharmacopoeia Laboratory for Indian Medicine (PLIM) or the Government Analyst	
C	List of Biological and special products (injectable/ parenteral) [HP DI – 2011, ODISHA DI - 2012] e.g. Surgical dressings and ophthalmic preparations etc.	
C_1	List of other special products (non-parenteral) e.g. Digitalis, Ergot, Adrenaline, Fish liver oil etc.	
D	List of drugs exempted from the provision of import of drugs. [HP DI – 2011, HP DI – 2021, MAHARASHTRA DI – 2023, TN DI - 2024]	
D_1	Information and undertaking required to be submitted by the manufacturer with the application form for a registration certificate	
D_2	Information required to be submitted by the manufacturer with the application form for registration of a bulk drug/formulation/special product for its import into India	
D_3	Information and undertaking required to be submitted by the manufacturer or his authorized importer/distributor/agent with the application form for a registration certificate	
E_1	List of Poisonous substances under ASU system of medicines. [MP DI – 2012, MAHARASHTRA DI - 2023]	
F [CG DI – 2015, AP DI – 2018, UPSC DI – 2023, UK DI - 2024]	**Part XII B**	Requirement for the functioning and operation of blood bank and/ or for the preparation of blood component
	Part XII C I	Requirements for manufacture of blood products
	Part XII C II	Requirements for manufacture of blood products from bulk finished products
	Part XIID	Requirements for collection, processing, testing, storage, banking and release of umbilical cord blood derived stem cells
	Part XIII	General
F_1	**Part I A**	Production of bacterial vaccines [MP DI – 2012]
	Part I B	Production of viral vaccines
	Part II	Production of all sera from living animals
	Part III	Manufacture and standardization of diagnostic agents (bacterial origin)
	Part IV	General
F_2	Standards of surgical dressings [JK DI – 2013, MP DI - 2017]	
F_3	Standards of sterilized umbilical tapes	
FF	Standards for ophthalmic preparations [JK DI – 2013, AP DI – 2018, UK DI - 2024]	
G	List of substances to be used under the medical supervision and which are to be labelled accordingly [TN DI – 2009, ODISHA DI - 2012]	
H	List of drugs to be sold on the prescription of an RMP/ List of prescription drugs [GOA DI 2020, UK DI - 2024]	
J	Diseases and ailments which a drug may not purport to prevent or cure or make claims to prevent or cure [HP DI – 2011, ODISHA DI – 2012, MP DI – 2017, UP DI – 2018, UPSC DI – 2019, HP DI – 2020, SIKKIM DI – 2020, GUJARAT DI - 2024]	

By Road	• Raxaul (Road and Railway lines connecting Raxaul in India & Birganj in Nepal) • Petrapole road in West Bengal, Sutarkandi in Assam, Old Raghna bazar and Agartala in Tripura (Road from Bangladesh)
By Air	Chennai, Kolkata, Mumbai, Delhi, Ahmedabad and Hyderabad
By Sea	Chennai, Kolkata, Mumbai, Cochin, Nhava Sheva, Kandla And Inland Container Depots at Tulglakabad and Patparganj in Delhi And Tuticoran in Tamil Nadu

❑ FORMS FOR IMPORT, MANUFACTURE, REPACKAGING AND SALE OF DRUGS

FORMS	DESCRIPTIONS
FORM 1	Memorandum to the Central Drugs Laboratory/ Pharmacopoeial Laboratory for Indian Medicine (PLIM)
FORM 2	Certificate of test or analysis by the Central Drugs Laboratory **[GOA DI 2020]**
FORM 2A	Certificate of test or analysis from the Pharmacopoeial Laboratory for Indian Medicine or Government Analyst
FORMS 3-7	Omitted
FORM 8	Application for licence to import drugs excluding those specified in Schedule X **[MAHARASHTRA DI - 2016]**
FORM 8A	Application for licence to import drugs specified in Schedule X
FORM 9	Form of undertaking to accompany an application for an import licence
FORM 10	Licence to import drugs excluding those specified in Schedule X **[MAHARASHTRA DI - 2016]**
FORM 10A	Licence to import drugs specified in Schedule X **[JK DI – 2013, MAHARASHTRA DI – 2014, 2016, BIHAR DI - 2023]**
FORM 11	Licence to import drugs for the purposes of examination, test or analysis **[UPSC DI – 2015, TELANGANA DI - 2023]**
FORM 11A	Licence to import drugs by a Government Hospital or Autonomous Medical Institution for the treatment of patients
FORM 12	Application for licence to import drugs for purpose of examination, test or analysis **[ODISHA DI - 2023]**
FORM 12A	Application for the issue of a permit to import small quantities of drugs for personal use **[JK DI – 2013]**
FORM 12AA	Application for licence to import small quantities of new drugs by a Government Hospital or Autonomous Medical Institution for the treatment of patients.
FORM 12B	Permit for the import of small quantities of drugs for personal use
FORM 13	Certificate of test or analysis by Government Analyst under section 25
FORM 13A	Certificates of tests or analysis by Government Analyst under section 33H
FORM 14A	Application from a purchaser for test or analysis of a drug under Section 26
FORM 14-B	Certificate of test or analysis by Government Analyst under Section 26
FORM 15	Order under section 22 of the Drugs and Cosmetics Act, 1940 requiring a person not to dispose of stock in his possession **[TELANGANA DI - 2023]**
FORM 16	Receipt for stock of drugs or cosmetics for record, register, document or material object seized under section 22
FORM 17	Intimation to person from whom sample is taken **[TELANGANA DI - 2023]**
FORM 17A	Receipt for samples of drugs or cosmetics taken where fair price tendered thereof under Section 23 of the Drugs and Cosmetics Act, 1940 is refused
FORM 18, 18A	Memorandum to Government Analyst **[ODISHA DI - 2012]**
FORM 19	Application for grant or renewal of a licence to sell, stock or exhibit or offer for sale, or distribute of drugs other than those specified in Schedule C, C(1) and X and /or Drugs specified in Schedules C and C(1) excluding those specified in Schedule X **[JK DI – 2013]**
FORM 19A	Application for the grant or renewal of a restricted licence to sell, stock or exhibit or offer for sale, or distribute drugs by retail other than those specified in Schedule C, C1 and X

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❑ THE SCHEDULE

List of certain names of the diseases disorder or conditions [CG DI – 2015]

Schedule J - Prohibition of advertisement of certain drugs for treatment of certain diseases and disorders
AIDS, Arteriosclerosis, Asthma, Blindness, Blood poisoning, Bright's disease, Cancer, Cataract, Deafness, Diabetes, Diseases and disorders of brain, optical system and uterus; Disorders of menstrual flow, nervous system and prostatic gland; Dropsy, Epilepsy, Female diseases (in general), Fevers (in general), Gall stones, kidney stones and bladder stones; Gangrene, Glaucoma, Goitre, Heart diseases, Leprosy, Leucoderma, Lockjaw, Locomotor ataxia, Lupus, Nervous debility, Obesity, Paralysis, Plague, Pleurisy, Pneumonia, Rheumatism, Sexual impotence, Smallpox, Stature of persons, Sterility in women, Trachoma, Tuberculosis, Typhoid fever, Ulcers of gastrointestinal tract, Venereal diseases including syphilis, Gonorrhea, Venereal granuloma and Lympho granuloma. [MAHARASHTRA DI – 2008, JK DI – 2013]

❑ OFFENCES AND PENALTIES

OFFENCES	PENALTIES
First conviction: Whoever contravenes any provision of this Act or Rules	6 month or with fine or both [JK DI – 2013, BIHAR DI – 2023, UK DI - 2024]
Second conviction: Subsequent of the first conviction	One year or fine or both any subsequent

Medicinal and Toilet Preparations (Excise Duties) Act and Rules

❑ INTRODUCTION

Medicinal And Toilet Preparations Act was passed	1955 [JK DI – 2013]
Medicinal And Toilet Preparations Rules was passed	1956
Came into force	1st April 1957

- An Act to provide for the levy and collection of duties of excise on medicinal and toilet preparations containing alcohol, narcotic drug or narcotics. [BIHAR DI - 2023]
- **Schedule to Act -** Description of dutiable goods. [CG DI – 2015]
- **Schedule to Rules -** List of medicinal and toilet preparations containing alcohol which are capable of being consumed as ordinary alcohol beverages.

❑ CHAPTERS AND SECTIONS OF MEDICINAL AND TOILET PREPARATIONS ACT

CHAPTER I: PRELIMINARY	
Section 1	Short title and commencement
Section 2	Definitions
CHAPTER II: LEVY AND COLLECTION OF DUTIES	
Section 3	Duties of excise to be levied and collected on certain goods.
Section 4	Rebate of duty on alcohol, etc., supplied for manufacture of dutiable goods.
Section 5	Recovery of sums due to Government.
Section 6	Certain operations to be subject to licences.
Section 7	Offences and penalties
Section 8	Power of Courts to order forfeiture.
CHAPTER III: POWERS AND DUTIES OF OFFICERS AND LANDHOLDERS	
Section 9	Power to arrest
Section 10	Power to summon persons to give evidence and produce documents in inquiries under this Act.
Section 11	Officers required to assist Excise Officers.

❑ CRUELTY TO ANIMAL

- Any animals to unnecessary pains or suffering or treatment
- Employing any unfit animals for works or labour.
- Willfully and unreasonably administration any injurious drugs or substance.
- Keeping or confining any animal in any cage of insufficient size not permitting it reasonable movement.
- Failure to provide any animals with sufficient food, drink or shelter by its owner.
- Needlessly mutilating any animal or killing any animal in an unnecessarily cruel manner etc.

❑ INSTITUTIONAL ANIMAL ETHICS COMMITTEE (IAEC) [ODISHA DI - 2012]

- A biological scientist
- Two scientists from different biological disciplines
- Veterinarian invited in the case of animals
- The scientist in charge of animal facility of the establishment concerned.
- Scientist from outside the institution
- Non-scientific socially aware member.
- Representative or nominee of the committee.

❑ OFFENCES AND PENALTIES

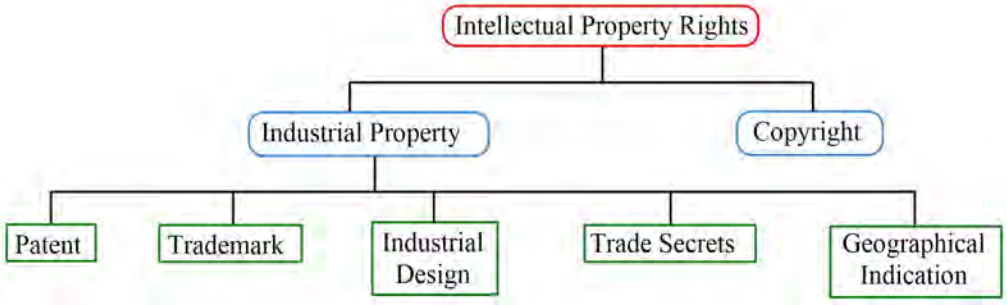
S. NO.	OFFENCES	PENALTIES
1.	Treating animals cruelly	**First offence-** Fine which shall NLT Rs. 10 which may extend to Rs. 50 **subsequent offence:** Fine NLT Rs. 25 but which may extend to Rs. 100 or with imprisonment for a term which may extend to three months, or with both
2.	Contravention of any order made by or committing breach of any condition by the committee	Fine extending 200
3.	Practising Phooka or doom dev	Fine Rs. 1000 or 2 Years or both

Intellectual Property Rights (IPRs)

❑ INTRODUCTION

- Intellectual property refers to creations of the mind, inventions, literary and artistic works and symbols, names, and images used in commerce.
- IPR is to stimulate creativity by providing an exclusive right to creative inventions and works.

❑ TYPES OF INTELLECTUAL PROPERTY RIGHTS [MAHARASHTRA DI - 2008]



Design	Only the features of shape, configuration, pattern, composition of lines or colours applied to any article whether in two dimensional or three dimensional or in both forms,
Controller	Controller-General of Patents, Designs and Trade Marks referred to in section 3

❑ TYPES OF SCHEDULES

First schedule	It prescribes the fees for various application etc. relating to registration of design.
Second schedule	It prescribes 23 different forms used under this act.
Third schedule	It present classification of goods under 99 classes
Fourth schedule	It gives a scale of cost allowable in proceeding before the controller.
Fifth schedule	It depicts the certificate of registration of design.

TRADE MARK ACT

❑ INTRODUCTION

- Trade Marks Act, 1940 was the first statute law on trade marks in India, which was replaced by the Trade & Merchandise Marks Act, 1958.
- The Trade & Merchandise Mark Act, 1958 was revised and replaced by the Trade Mark Act, 1999.
- The Trade Marks Act, 1999 and the Trade Marks Rules, 2002 are effective from September 15, 2003 and extend to the whole of India
- Trade Marks Act, 1999 was passed with the object to amend and consolidate the law relating to trade marks, to provide for registration and better protection of trade marks for goods and services and for the prevention of the use of fraudulent marks. **[BIHAR DI - 2023]**
- Registration of the trade mark for a period of ten years from the date of expiration of the original registration or of the last renewal of registration. **[CG DI – 2015]**

❑ CHAPTERS AND SECTIONS

CHAPTERS	DESCRIPTION	SECTIONS
CHAPTER I	Preliminary	1 - 2
CHAPTER II	The register and conditions for registration	3 - 17
CHAPTER III	Procedure for and duration of registration	18 - 26
CHAPTER IV	Effect of registration	27 - 36
CHAPTER IVA	Special provisions relating to protection of trade marks through international Registration under the madrid protocol	36A – 36G
CHAPTER V	Assignment and Transmission	37 - 45
CHAPTER VI	Use of trademarks and registered users	46 – 56
CHAPTER VII	Rectification and correction of the register	57 – 60
CHAPTER VIII	Collective marks	61 – 68
CHAPTER IX	Certification Trade Marks	69 - 78
CHAPTER X (Omitted)	Special provisions for textile goods	79 – 82
CHAPTER XI	Appellate Board	83 – 100
CHAPTER XII	Offences, Penalties and Procedure	101 – 121
CHAPTER XIII	Miscellaneous	122 - 159

* ***Chapter X -*** *Omitted by the Trade Marks (Amendment) Act, 2010, (w.e.f. 8-7-2013).*

Minimum Wages Act

❑ INTRODUCTION

- A Minimum Wages Bill was introduced in the Central Legislative Assembly on 11th April 1946 and came into force with effect from 15th March 1948.
- This Act is to provide for fixing minimum rates of wages in certain employments.

❑ DEFINITIONS

Appropriate Government [CG DI – 2015]	(i) In relation to any scheduled employment carried on by or under the authority of the Central Government or a railway administration, or in relation to a mine, oilfield or major port, or any corporation established by a Central Act, the Central Government. (ii) In relation to any other scheduled employment, the State Government.
Competent Authority	Means the authority appointed by the appropriate Government by notification in its Official Gazette to ascertain from time to time the cost of living index number applicable to the employees employed in the scheduled employments specified in such notification

❑ WHO ARE ELIGIBLE FOR MINIMUM WAGES

1. Part-time Workers
2. Casual Laborers
3. Agency Workers
4. Apprentices
5. Foreign workers
6. Disabled Workers
7. Agricultural Workers
8. Seafarers.
9. Offshore workers
10. Trainees, Workers on Probation.

❑ FIXATION AND REVISION OF WAGES

- By Appropriate Govt. - Central Govt. and State Govt.
- Fix the minimum wages payable to employee as specified in part I and part II schedule.
- Review at such intervals as it may think fit, such intervals not exceeding five years, the minimum rates of wages so fixed and revise the minimum rates
- A minimum time rate- minimum rate wages to be part for the time work
- A minimum piece rate- minimum rate of wages to be paid piece work.

❑ OFFENCES AND PENALTIES

OFFENCES	PENALTIES
Pays to any employee less than minimum rates of wages fixed for that employee's class of work or less than the amount due to him under the provision of this act.	Imprisonment for a term which may exceed to 6 month or with fine which may extend to Rs. 500 or with both
Contravenes any rule or order made under section 13	
General provision for punishment of other offences: Any employer who contravenes any provision of this Act or of any rule or order made thereunder shall, if no other penalty is provided for such contravention by this Act	With fine which may extend to Rs. 500

Industries (Development and Regulation) Act

❑ INTRODUCTION

- On 6th April, 1948 the Central Government announced its industrial policy.
- Industries (Development and Regulation) Act passed in 1951

Medical Devices

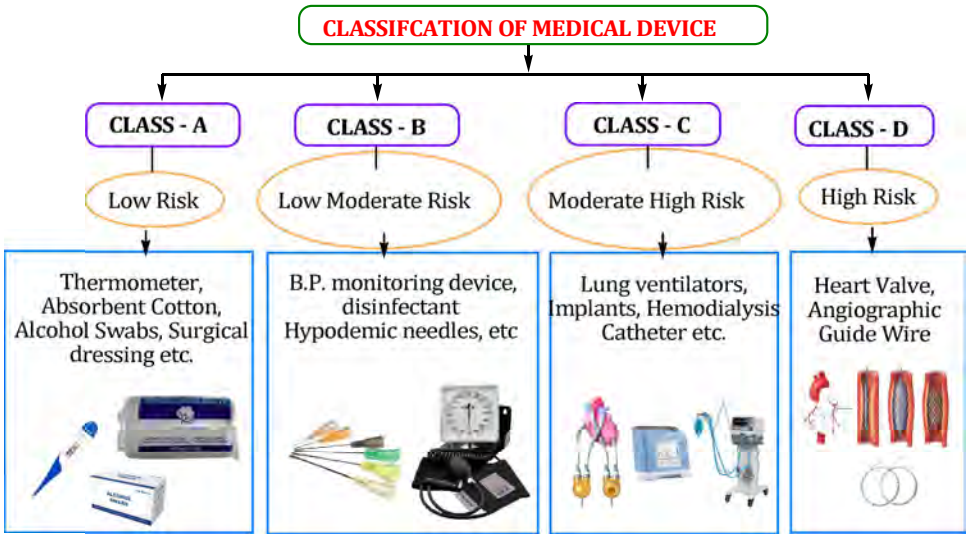
❑ IMPORTANT DATES

Medical Devices Rules passed	**2017**
Come into force	**1st January 2018**
Amendment	**11th February 2020**
Came into effect	**1st April 2020**

❑ SCHEDULE TO MEDICAL DEVICES ACT, 2017

SCHEDULE	DESCRIPTION
First	Parameters for classification of medical devices and in vitro diagnostic medical devices **Part I:** Classification of medical devices other than in vitro diagnostic medical devices (Class A, B, C & D) **Part-II:** Classification for in vitro diagnostic medical devices (Class A, B, C & D)
Second	Fee (payable for licence, permission and registration certificate)
Third	Documents required for registration of Notified Body, its duties and functions **Part-1:** Documents to be furnished along with application in Form MD-1 for grant of certificate of registration **Part-II:** Duties and functions of Notified Body
Fourth	Documents required for grant of licence to manufacturing of medical devices for sale or for distribution or import
Fifth	Quality Management System for medical devices and in vitro diagnostic medical devices
Sixth	Post approval change
Seventh	Requirements for permission to import or manufacture investigational medical device for conducting clinical investigation
Eight	Exemptions

❑ CLASSIFICATION OF MEDICAL DEVICES [UPSC DI - 2023]



❑ STANDARDS FOR MEDICAL DEVICE [UPSC DI - 2023]

The medical device shall conform to the standards laid down by the Bureau of Indian Standards established under section 3

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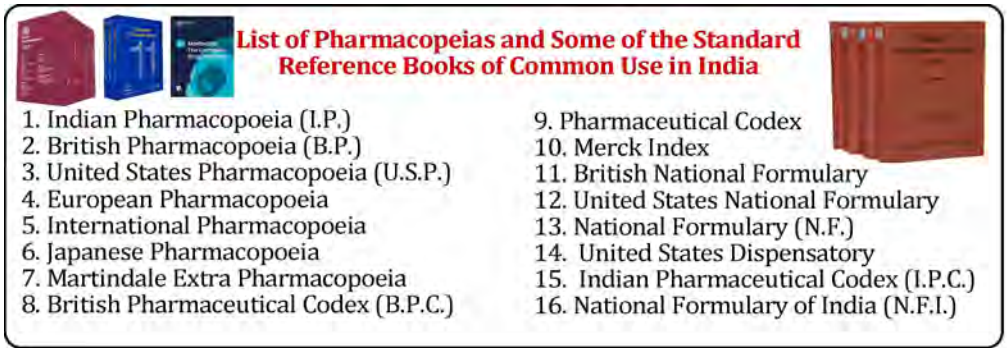
- ✓ Bureau of Indian Standards Act, 1985 (63 of 1985) or as may be notified by the Ministry of Health and Family Welfare in the Central Government, from time to time.
- ✓ Standard laid down by the International Organisation for Standardisation (ISO) or the International Electro Technical Commission (IEC), or by any other pharmacopoeia standards.

❑ INTRODUCTION OF PHARMACOPOEIA

- The term 'Pharmacopoeia' was first used in 1580 in a book on drug standards printed in Bergamo, Italy.
- Pharmacopoeia is a book describing preparation of formulations, describing dispensing techniques, published by a recognized government or regulatory authority. **[UP DI - 2018]**
- Each pharmacopoeia described different strength and method of preparation for the same preparation.
- The first International Pharmacopoeia was published by the World Health Organisation in 1951 (Volume I) and in 1955 (Volume II). **[AP DI – 2012, HP DI – 2016, UP DI - 2018]**
- The object of this was to provide a uniform list which would avoid the confusion caused by different national standards, strengths and names especially for the use of travellers who might need to use the same prescription in different countries.



❑ CLASSIFICATION OF DRUG COMPENDIA

The drug compendia are classified as:

- Official Compendia
- Non-official drug compendia

OFFICIAL COMPENDIA	NON-OFFICIAL DRUG COMPENDIA
These are the compilations of drugs and other related substances which are recognized as legal standards of purity, quality and strength by government agency of respective countries of their origin.	The book other than official drug compendia which are used as secondary reference sources for drugs and other related substances are known as non-official drug compendia.

M7	Mutagenic Impurities
M7 (R2)	Assessment and Control of DNA Reactive (Mutagenic) Impurities in Pharmaceuticals to Limit Potential Carcinogenic Risk
M8	Electronic Common Technical Document (eCTD)
M9	Biopharmaceutics Classification System-based Biowaivers
M10	Bioanalytical Method Validation and Study Sample Analysis
M11	Clinical electronic Structured Harmonised Protocol (CeSHarP)
M12	Drug Interaction Studies
M13	Bioequivalence for Immediate-Release Solid Oral Dosage Forms
M14	Use of real-world data for safety assessment of medicines
M15	General Principles for Model-Informed Drug Development

❑ IMPORTANT POINTS

- The linearity of an analytical procedure is its ability (within a given range) to obtain test results which are directly proportional to the concentration (amount) of analyte in the sample. Its establishment of linearity, a minimum of 5 concentrations is recommended. **[MP DI – 2012]**
- As per ICH GCP guidelines, Study sponsor responsibility is it to ensure that investigators are qualified by education and experience and are trained on the conduct of the protocol. **[UPSC DI - 2023]**
- Determination of the signal-to-noise ratio is performed by comparing measured signals from samples with known low concentrations of analyte with those of blank samples and by establishing the minimum concentration at which the analyte can be reliably quantified. A typical signal-to-noise (S/N) ratio is 10:1. **[GUJARAT DI – 2010]**

International Organization For Standardization (ISO)

❑ INTRODUCTION

- ISO stands for International Organisation for Standardization. **[TN DI - 2012]**
- 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 has 811 Technical committees and sub committees to take care of standards development.
- It is headquartered in Geneva, Switzerland
- ISO 9000 was first published in 1987 by the International Organization for Standardization (ISO).

❑ POPULAR STANDARD OF ISO

ISO 9001	Quality management
ISO 9002	Model for quality assurance in production, installation and servicing
ISO 9003	Quality assurance in final inspection and test
ISO 9004	Guidance on achieving sustained organizational success
ISO 13485	Medical devices

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❑ HISTORY

- **Robert Hooke** discovered the cell in **1665** **[BIHAR DI - 2023]**. He gave the name of his discovery **"Cells"** which means **"a small room"** in Latin.
- **Anton Van Leeuwenhoek** first saw a described a live cell.
- In 1883, **Robert Brown** later discovered the **Nucleus.**

❑ CELL THEORY

- Cell theory was jointly put forward by Matthias Jakob Schleiden and Theodor Schwann in 1839.
- Rudolf Virchow (1855) first explained that cells divide and new cells are formed from pre-existing cells.

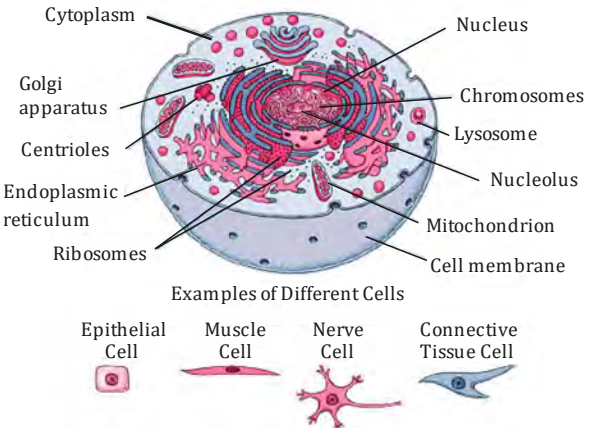
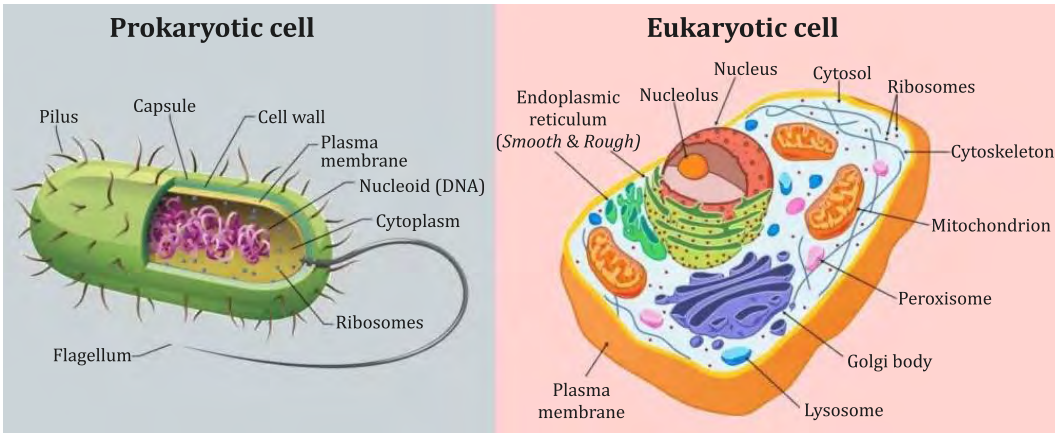


Fig :- Cell Structure

❑ DIFFERENCE BETWEEN PROKARYOTIC AND EUKARYOTIC CELLS

CHARACTERISTIC	PROKARYOTIC CELL	EUKARYOTIC CELL
Size	Small (generally 1-5 µm)	Large (generally 5-100 µm)
Cell membrane	Cell is enveloped by a rigid cell wall	Cell is enveloped by a flexible plasma membrane
Sub-cellular organelles	**Absent**	Distinct organelles are found (e.g., Mitochondria, Nucleus, Lysosomes)
Nucleus	Not well defined; DNA is found as nucleoid, histones are absent	Nucleus is well defined, surrounded by a membrane; DNA is associated with histones
Energy metabolism	Mitochondria **absent**, enzymes of energy metabolism bound to membrane	Enzymes of energy metabolism are located in mitochondria
Cell division	Usually, fission and no mitosis	Mitosis
Cytoplasm	Organelles and cytoskeleton absent	Contains organelles and cytoskeleton
Membrane bounded organelles	**Absent**	Present
Ribosome	70s ribosome present	**80s ribosome present**



Cardiovascular System

- Cardiovascular system is the system of **heart and blood vessels** that circulates blood throughout the body.

❑ HEART

- Heart is a muscular organ that pumps blood throughout the circulatory system. It is situated in between the two lungs in the **mediastinum**.
- **Heart wall is formed of three layers:** Endocardium, Myocardium and Pericardium.

❑ ANATOMY OF HEART [TELANGANA DI - 2023]

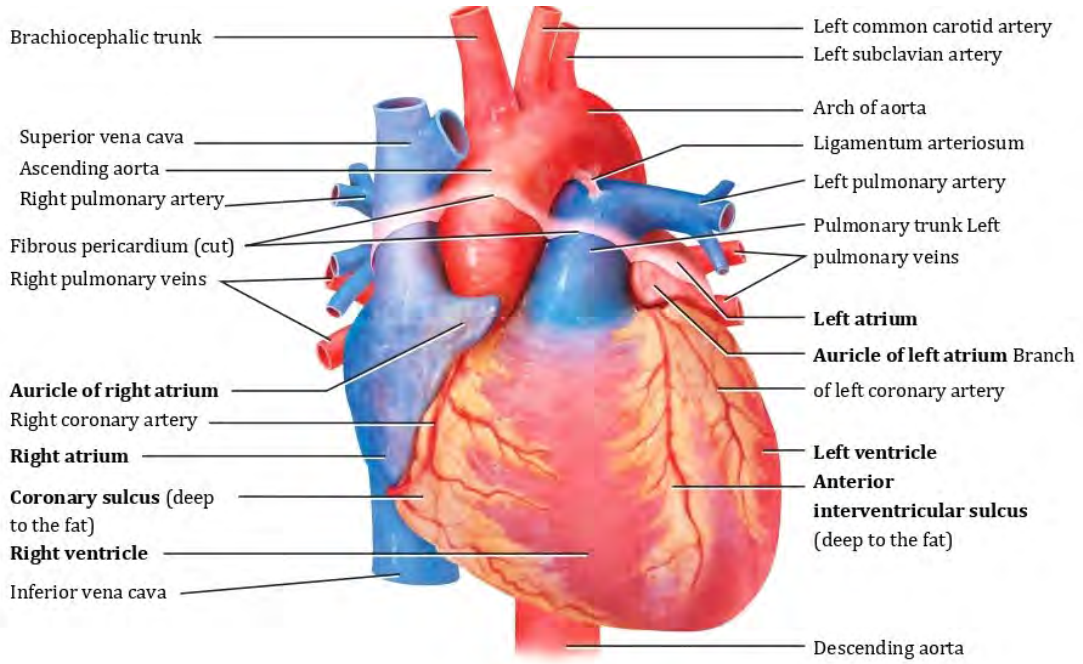


Fig:- Anatomy of Heart

❑ VARIOUS PARTS OF HEART, LOCATIONS AND THEIR FUNCTIONS

PARTS	LOCATION	FUNCTION
Left Ventricle	The bottom chamber on the left side of heart	To pump oxygenated blood to the aorta to go around the body and to the brain
Right Ventricle	The bottom Chamber on the right side of heart	Pumps deoxygenated blood to the pulmonary artery
Left Atrium	The top chamber on the left side of heart	Collect the oxygenated blood from the pulmonary vein and push it through to the left ventricle.
Right Atrium	The top chamber on the right side of heart	Collect the deoxygenated blood from the vena cava and push it through to the right ventricle
Aorta	Tube on top of the left side of the heart	Pump the oxygenated blood to the brain and the rest of the body from the left ventricle
Pulmonary Vein	Tube on the far left on top of the heart	Take the freshly oxygenated blood from the lung to the left atrium
Pulmonary Artery	Tube on right of the aorta	Take deoxygenated blood from the right ventricle to the lung to get oxygen

PATHOPHYSIOLOGY

Introduction of Pathophysiology

PATHOPHYSIOLOGY

- Pathophysiology is a **science dealing** with the **study of diseases.**
- **Rudolf Virchow** coined the term **'Cellular pathology'**

➢ **Four important components of pathology are**

i. **Etiology** (causative factors)
ii. **Pathogenesis** (mechanism or process by which disease develops)
iii. **Morphology** (appearance of cells, tissues or organs)
iv. **Clinical features.**

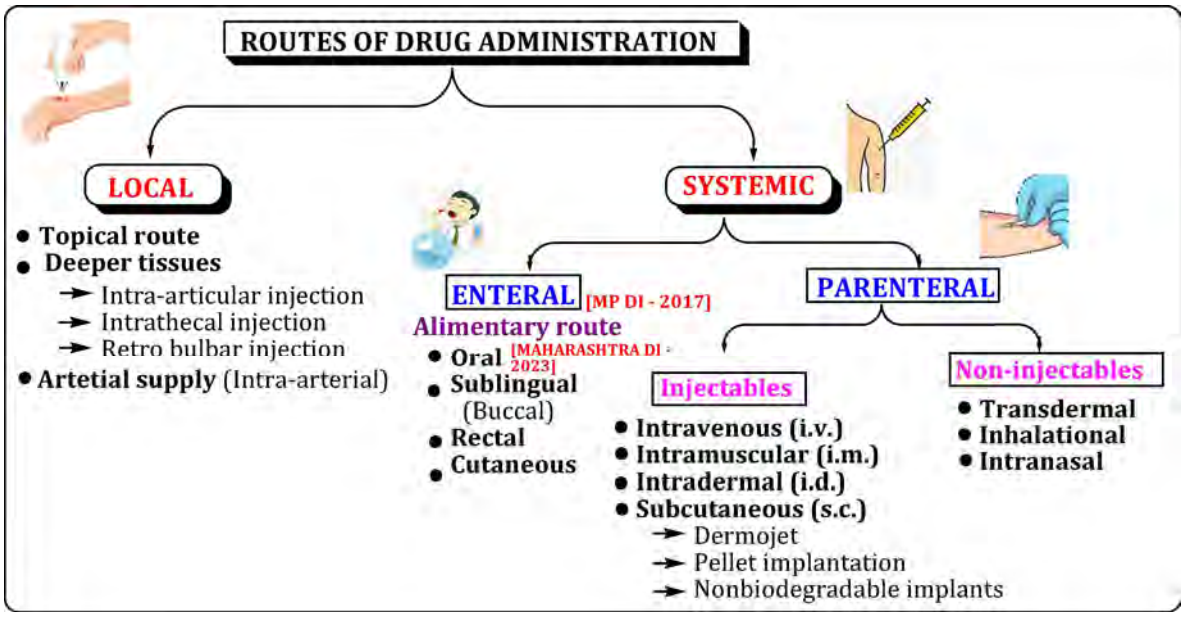
❑ IMPORTANT TERMINOLOGIES AND THIER DESCRIPTION

TERMINOLOGY	DESCRIPTION
Anaplasia	Morphological and functional alteration of mature cell
Aneurysm	Permanent abnormal dilatation of blood vessel (Arteries)
Amenorrhea	Absence of menstrual period
Acromegaly	Over production of Growth Hormone in adults
Apoptosis [JK DI – 2013]	A controlled, preprogrammed cell death occur with aging
Granulocytopenia	A marked decrease in the number of granulocytes.
Aplastic anemia	Is a condition that occurs when your body stops producing enough new blood cells
Anisocytosis	Red blood cells (RBCs) that are unequal in size
Angiogenesis	Formation of new blood vessels
Bartter's syndrome	Kidney disorder (inability to reabsorb salts, Na^+, K^+, Cl^-)
Brucellosis	Bacterial infection spread from animal to humans
Candidiasis	Fungal infection caused by candida
Cholestasis	A decrease or blockage in the flow of bile.
Chemotaxis [HARYANA DI - 2019]	The movement of an organism in response to a chemical stimulus.
Choriocarcinoma	Fast growing cancer that occurs in women's uterus(womb)
Catalepsy	Condition characterized by lack of response to external stimuli and muscular rigidity.
Cyanosis	Bluish discoloration of the skin and mucous membrane due to lack of oxygen in blood
Dyspnea	Shortness of breath
Dysmenorrhea	Cramps and pelvic pain with menstruation
Dysgeusia	An altered or impaired sense of taste (Taste disorder).
Erythropoiesis	The process through which new red blood cells are created; it begins in the bone marrow.
Emphysema	Destruction of alveolar walls and permanent dilation of airspaces distal to terminal bronchioles (Shortness of breath)
Gestational hypertension	Pregnancy induced Hypertension

ROUTES OF DRUG ADMINISTRATION

- Drugs are administered by variety of routes.
- Mostly common considerations, feasibility and convenience defines selection of routes.

❑ CLASSIFICATION OF ROUTES OF DRUG ADMINISTRATION



❑ VARIOUS ROUTES OF DRUG ADMINISTRATION

(I) LOCAL ROUTES

1. **Topical –** Applied to surface of Skin. **e.g.-** Antiseptic & Ointments
2. **Deeper tissue**
   - i. **Intra-articular – Injection into joints.** Large joint – Upto 40mg. Small joints – 5-10mg. e.g. – Hydrocortisone [BIHAR DI - 2023]
   - i. **Intra thecal –** Injection into CSF. Dose ≤20ml. **e.g. -** Lidocaine
   - ii. **Retro bulbar –** Injection into behind eyeball. **e.g.-** Anesthesia
   - iii. **Intra Arterial –** Drugs injected into artery via needle. **e.g. -** Anticancer drug.
   - iv. **Intrapleural** [MP DI - 2022] - Administering drug to pleural space via a chest tube.

(II) SYSTEMIC ROUTES (ENTERAL ROUTE)

1. **Oral route –** Administered via oral route **e.g.-** Paracetamol and Warfarin
2. **Sublingual –** Drug placed below tongue. **e.g.-** Nitroglycerin and Clonidine.
3. **Rectal –** Drug inserted in rectum as suppository.

e.g.- Trick - PEDIA → **P**araldehyde, **E**rgotamine, **D**iazepam, **I**ndomethacin, **A**minophylline

(II) SYSTEMIC ROUTES (PARENTERAL ROUTE)

1. **Intramuscular –** Injected into skeletal muscles at 90^0 angle (deltoid, gluteus maximus). **Dose – 2-4ml** [BIHAR DI - 2008, ODISHA DI - 2023] e.g. Adrenaline
2. **Intravenous –** Injected as **bolus or infusion** in vein at 25^0 angle . Dose – Upto 500ml or more. **Thrombophlebitis** may occurred by I.V. route **e.g.-** Furosemide. [BIHAR DI - 1998]
3. **Intradermal/ Cutaneous –** Drug injected into the skin raising a bleb at 10 – 15^0 angle. Dose – 0.1-0.2ml. It is also used for **drug sensitivity testing. e.g.-** Diazepam.
4. **Subcutaneous –** drug is administered through the **layers of skin into areolar tissue** [BIHAR DI - 2023] via Dermojet, Implantation, Pellet, Sialistic at 45^0 angle.
   - **Suitable site of self-injection** [TN DI - 2009] **eg.** Insulin, Testosterone.
5. **Inhalational –** Absorption from alveoli. **e.g.** General anaesthetic, Ipratropium Bromide
6. **Intranasal –** Mucous membrane of nose absorb drug. **e.g.** Desmopressin.

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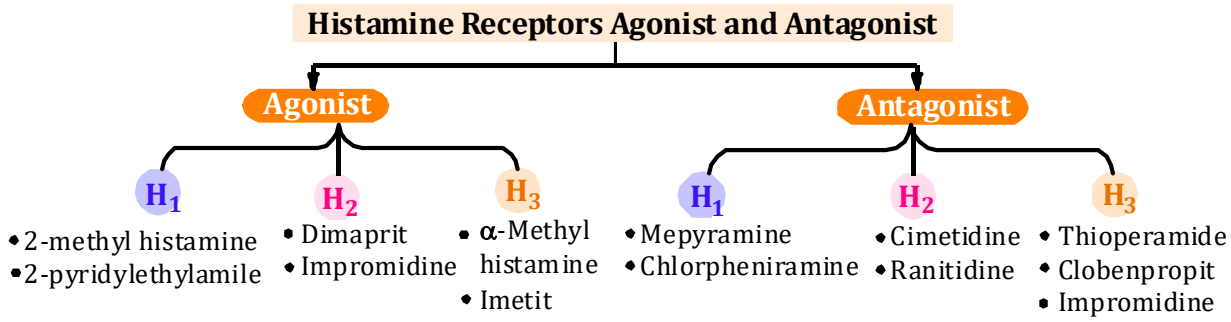

❖ **Distinctive features of Histaminergic receptors**

RECEPTOR	EFFECTOR PATHWAY	DISTRIBUTION IN BODY: ACTIONS MEDIATED	RECEPTOR TYPE
H_1 receptor	PIP_2 hydrolysis → IP_3 / DAG: Release of Ca^{2+} from intracellular stores; Protein kinase-C activation NO release → cGMP	• Smooth muscle (intestine, Bronchi, uterus) - contraction, • **Blood vessels** ✓Increased capillary permeability ✓Cause vasodilatation.	Gq-protein coupled
H_2 receptor	**Adenylyl cyclase activation ↑ cAMP – Phosphorylation of specific proteins**	• Increase Gastric acid secretion, • Blood vessels (Smooth muscle) – dilatation **[GUJARAT DI - 2021]** • Heart ✓Atria: +ve chronotropy ✓Ventricles: +ve inotropy	Gs-protein coupled
H_3 receptor (Auto receptor)	• Restricting Ca^{2+} influx • K^+ channel activation • ↓ cAMP	Inhibition and decrease of histamine release	Gi/Go-protein coupled

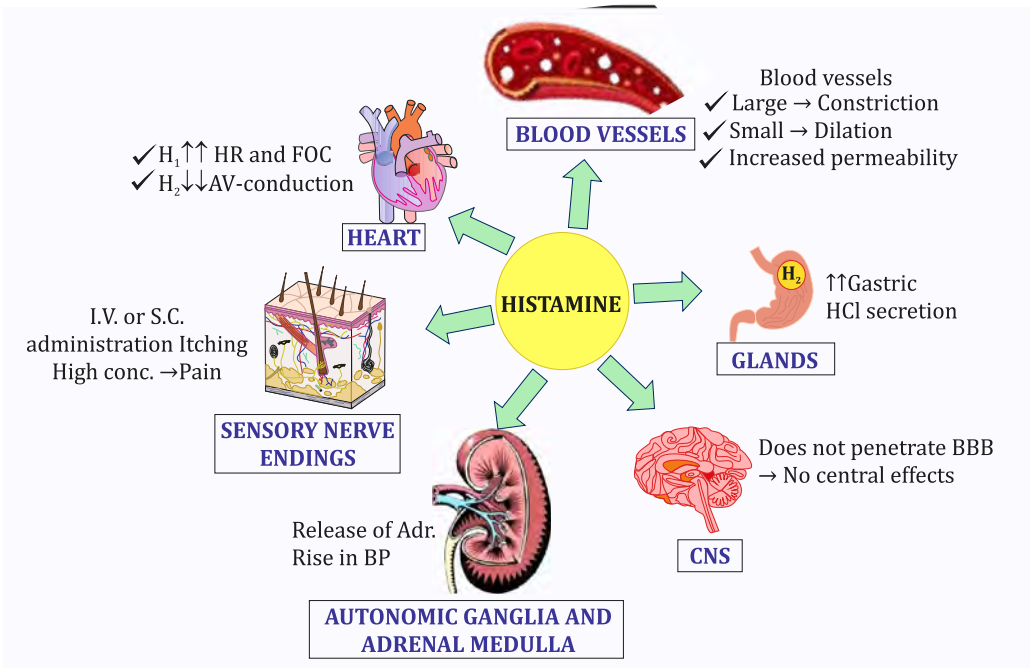

FIG- PHARMACOLOGICAL ACTIONS OF HISTAMINE

α-Adrenergic Receptor Antagonist	
Phenoxybenzamine	It acts by blockade of α-receptor by forming covalent bond.
Phentolamine	It blocks both **α_1 and α_2** receptor by competitive antagonist.
Prazosin, Doxazocin [RAJASTHAN DI - 2018]	This prototype selective **α_1-antagonist dilate both resistance and capacitance vessel, effect on the former predominating.**
β_1–adrenergic selective receptor antagonist Atenolol, Metoprolol [RAJASTHAN DI - 2018] **Non-selective β-adrenergic receptor antagonist** Propranolol [AP DI – 2012]	• These drugs inhibit adrenergic responses mediated through beta receptors. • **β -blocker act by blocking following mechanism:** ✓ Decrease heart rate ✓ Decrease force of contraction ✓ Decrease cardiac output
α + β – antagonist Labetalol, Carvedilol	• They are useful for hypertension in special condition like pheochromocytoma, clonidine withdrawal and cheese reaction. [AP DI - 2018] • They act faster than pure β blockers • Carvedilol is a nonselective β + weak selective α_1 blocker produces vasodilatation and has additional antioxidant/free radical scavenging properties.
Vasodilator	
Arteriolar dilator Diazoxide, Minoxidil, Hydralazine [TN DI – 2012, RAJASTHAN DI – 2018]	• It is a powerful vasodilator. [SIKKIM DI - 2020] • Active metabolite of Minoxidil is an **opener of ATP sensitive K^+ channel**; cause vasodilation by hyperpolarization smooth muscle. [TN DI - 2009] • It acts by binding to adrenergic neurons and displaces noradrenaline and other catecholamine and also inhibit their uptake. **Uses of Minoxidil** [TN DI - 2018] • **In alopecia –** Hirsutism was observed as a side effect of oral Minoxidil but applied topically (2% twice daily) it promotes hair growth in male pattern baldness and in alopecia.
Arteriolar venodilator Sodium Nitroprusside [AP DI – 2012]	• Endothelial cells, RBCs (and may be other cells) split nitroprusside to generate NO which relaxes vascular smooth muscle [RAJASTHAN DI – 2018, TELANGANA DI - 2023] • Prolonged use of this drug may cause cyanide toxicity, especially in renal patients. [TN DI - 2009] • Nitroprusside is short-acting and requires constant IV infusion for hypertensive emergencies. [MAHARASHTRA DI – 2012]
Diuretics	

Diuretics: Hydrochlorothiazide (HCZ) and chlorthalidone are the diuretic of choice for uncomplicated hypertension. [GUJARAT DI – 2010, ODISHA DI - 2023]

The proposed mechanism of antihypertensive action of diuretics is:

(i) Diuretics **reduce plasma and Extra-cellular fluid** volume by **5-15%** and decrease cardiac output.

(ii) Subsequently compensatory mechanism operates to almost regain **Na^+ balance and plasma volume,** cardiac output is restored but the **fall in BP is maintained** by a slowly developing reduction total peripheral resistance.

(iii) The **reduction** in **total peripheral resistance** is most probably an indirect consequence of a small persisting Na^+ and volume deficit.

- Aldosterone antagonists like spironolactone and eplerenone mildly lower BP. Combined with thiazide diuretics, they prevent K^+ loss and enhance antihypertensive effect. [ASSAM DI - 2022]

Antimicrobial Agents

GENERAL CONSIDERATION

❑ SOME IMPORTANT TERMS AND THEIR DEFINITIONS

TERMS	DEFINITION
Chemotherapy	Process of uses of **chemicals (synthetic or natural)** to **destroy harmful microbes without disturbing the host cell body.**
Antibiotics	**Produced by microbes** and **inhibits the growth of microbes** at very low concentration.
Antimicrobial agent	Antimicrobial agent is the **synthetic or natural substance** that are used to **treatment** of various infection e.g.- **bacterial, fungi and viral.**
Bactericidal	Means that **kills bacteria**.
Bacteriostatic	Means that the agent **prevents the growth** of bacteria.
Antibiotics Resistance	When germs like bacteria or fungi **no longer respond** to the drugs designed to kill them.

❑ SOURCES OF ANTIMICROBIAL DRUGS

MICROORGANISMS	DRUGS
Fungi	Penicillin, Griseofulvin, Cephalosporin
Bacteria	Polymyxin B, Tyrothricin, Colistin, Aztreonam, Bacitracin
Actinomycetes	Aminoglycosides, Macrolides, Tetracycline, Polyenes, Chloramphenicol
Synthetic antibiotics	Cephalosporins, [RAJASTHAN DI – 1996, GUJARAT DI - 2021] Sulfonamides, and Quinolones, Chloramphenicol [GUJARAT DI - 2021]

❑ CLASSIFICATION OF ANTIMICROBIAL DRUGS

(A) According to their types of action

BACTERICIDAL [UK DI - 2024]

I M Bactericidal Because A Very Quiet Person is Rarely Protected

Isoniazid, **M**etronidazole, **B**eta-lactam antibiotics, **B**acitracin, **A**minoglycosides, **V**ancomycin, **Q**uinolones, **P**yrazinamide **R**ifampicin and **P**olymyxin B

BACTERIOSTATIC

Static **C**auses **N**on **T**otal **O**r **N**on **C**omplete **T**hrough **M**assive **E**limination

Sulphonamide, [HP DI - 2016] **C**hloramphenicol, [AP DI – 2012, AP DI – 2012] **N**itrofurantoin, **T**etracycline, [UPSC DI - 2011] **O**xazolidinone, **N**ovobiocin, [BIHAR DI - 2023] **C**lindamycin, **T**rimethoprim, **M**acrolides, **E**thambutol

REMEMBER THE FACTS

- All **cell wall** synthesis inhibitors are **Bactericidal**.
- All antibacterial drugs that act on **cell membrane** are **Bactericidal**.
- All **protein** synthesis inhibitors are **Bacteriostatic;** EXCEPT "Aminoglycoside and Streptogramins" which are Bactericidal.
- All **first line antitubercular drugs** are **Bactericidal;** EXCEPT Ethambutol that is bacteriostatic.
- All drugs affect **intermediary metabolism** are **Bacteriostatic**.
- If the drug ends with **'mycin'** then it is obtained from *Streptomyces* species.
- If the drug ends with **'micin'** then it is obtained from *Micromonospora* species.

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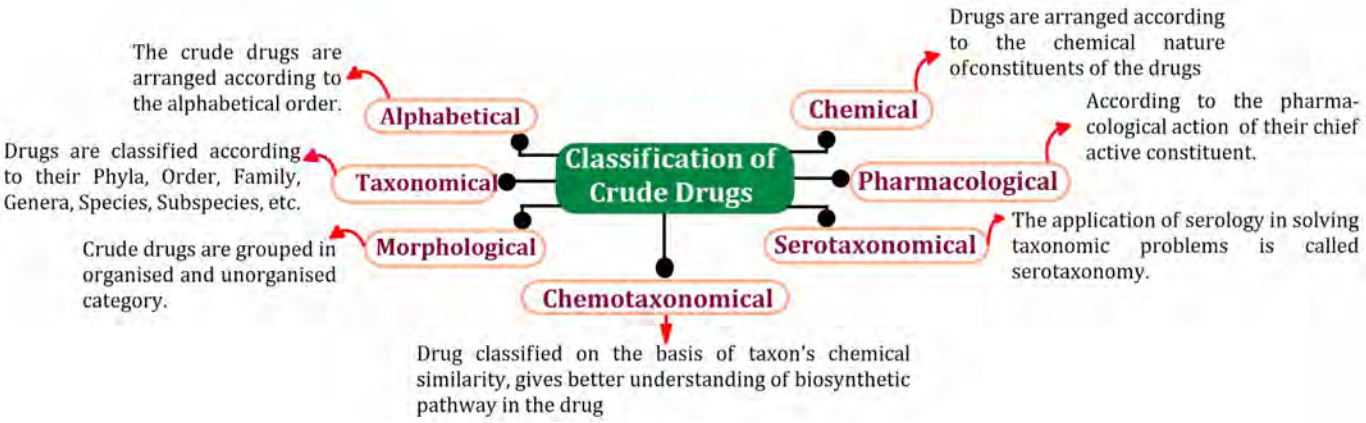
❑ WHO GUIDELINES ON GOOD ARIGRICULTURAL AND COLLECTION PRACTICES (GACP) FOR MEDICINAL PLANTS

The WHO Guidelines on Good Manufacturing Practices (GMP) for Herbal Medicines include explicit sections on: [TN DI - 2018]

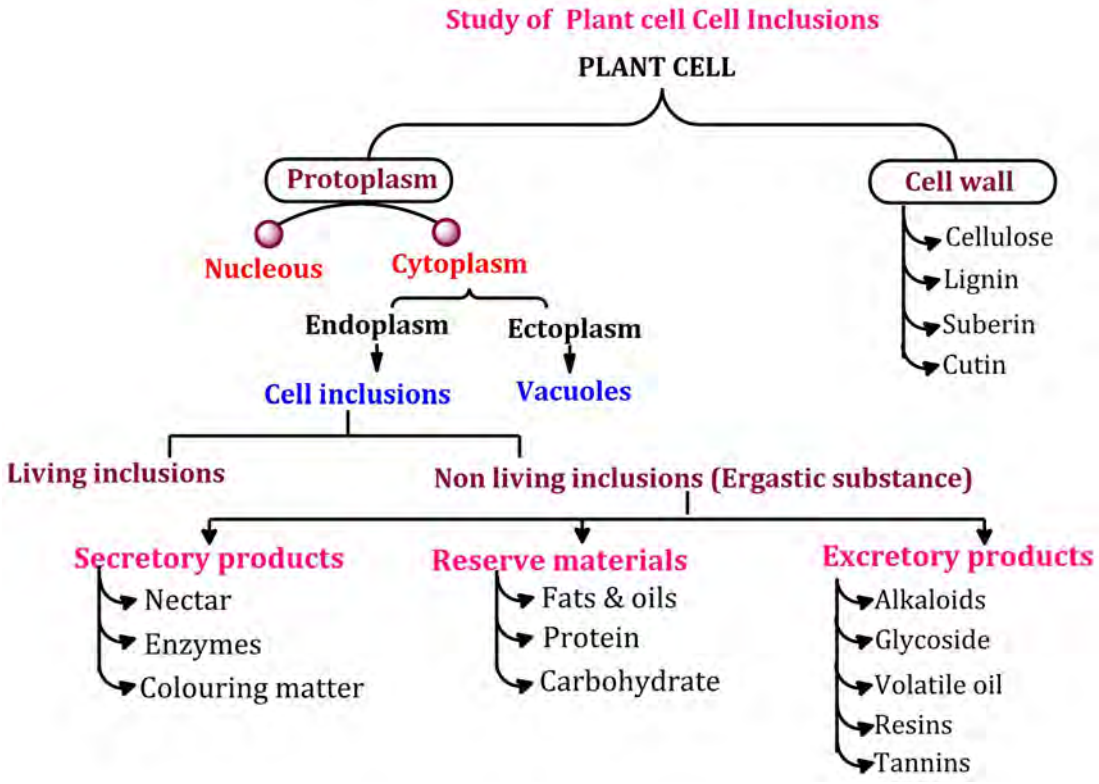
- **Sanitation and hygiene –** Important to ensure clean processing environments and prevent contamination.
- **Training –** Personnel must be adequately trained in GMP principles, especially in handling herbal raw materials.
- **Quality control –** A critical component, ensuring the safety, efficacy, and consistency of herbal products.

CLASSIFICATION OF CRUDE DRUG



- In European Pharmacopoeia the crude drugs are arranged according to their LATIN titles. [TN DI - 2024]

PLANT CELL INCLUSION



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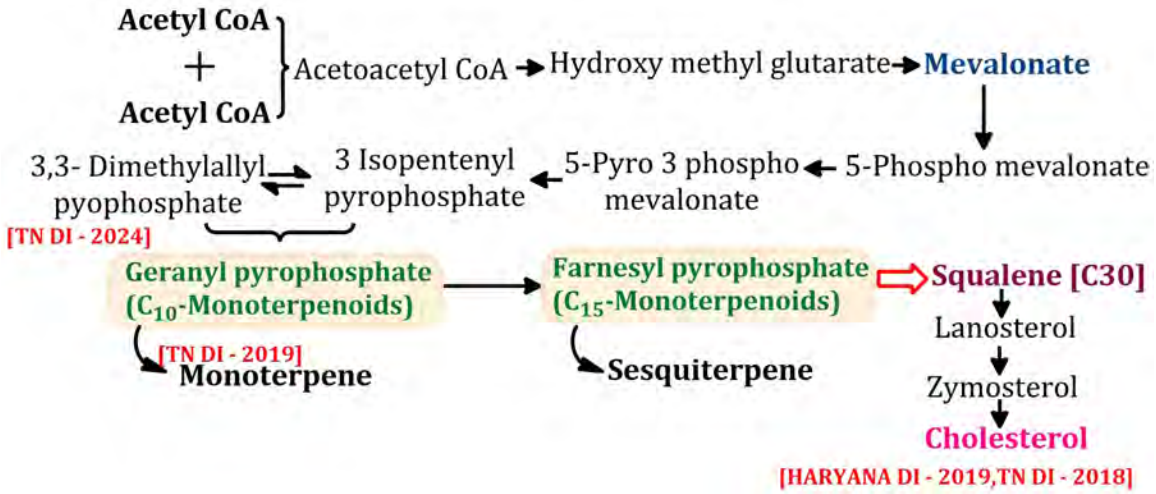
Mevalonic acid pathway [GUJARAT DI - 2021]



Biosynthesis of Alkaloids

Alkaloids	Biosynthesis
Quinoline Alkaloid	Tryptophan [MP DI - 2012] → Tryptamine + Secologanin → Quinine
Tropane Alkaloid [BIHAR DI – 2008, HP DI -2011, UPSC DI – 2015, TN DI – 2018, ODISHA DI – 2023]	Ornithine → Nicotine (Nicotinic acid); Tropine (Methionine + 2 Acetate unit); Acetate → Cocaine ← Tropic acid (Methionine, Phenylalanin) [HARYANA DI - 2019]; Hyoscyamin/ Atropine → Scopolamine [TN DI - 2010]
Isoquinoline Alkaloid	Tyrosine → Papaverine; Reticuline → Codeine → Morphine; Dihydroxyphenylalanine + Dopamine → Emetine, Colchicine
Amino Alkaloid	Phenylalanine → Ephedrine, Mescaline
Piperidine Alkaloid	Lysine → Lupinine, Anabasine
Indole Alkaloid	Tryptophan, Tryptamine → Mevalonic acid participation → Dimethyl allyl pyrophosphate → Dimethyl tryptophane → Lysergic acid → Ergot alkaloids; Serpentine; Strychnine

➢ **Classification of alkaloids based on biosynthetic pathway:**

PATHWAY	GROUP OF ALKALOIDS	EXAMPLE
Ornithine derived	Pyrrolidine	Nicotine
	Tropane	Atropine, Cocaine, Hyoscine, Duboisia
Lysine derived	Piperidine and Pyridine	Coniine, Lobeline, Anabasine
	Quinazolidine	Lupinine

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❖ BUFFER [MP DI - 2022]

BUFFERS	
• Buffers are compounds or mixtures of compounds that by their presence in the solution resist changes in the pH upon the addition of small quantities of acid or alkali. • Example: Soda ash (Sodium carbonate Na_2CO_3), Boric acid (H_3BO_3).	
Acidic buffers	An acidic buffer is a combination of weak acid and its salt with a strong base. i.e. Weak acid & salt with Strong base (conjugate base). Example: CH_3COOH and CH_3COONa, H_2CO_3 and $NaHCO_3$ [TN DI - 2024], H_3PO_4 and NaH_2PO_4
Basic buffers	A basic buffer is a combination of weak base and its salt with a strong acid. i.e. Weak base & salt with Strong acid (conjugate acid). Example: NH_4OH and NH_4Cl, NH_3 and NH_4Cl, NH_3 and $(NH_4)_2CO_3$

❖ GASTROINTESTINAL AGENTS

GASTROINTESTINAL AGENTS		
Acidifiers	Ammonium chloride and Dil. HCl	
Antacid are the agents used for neutralizing excess acid in stomach. [JK DI – 2013, GUJARAT DI – 2024]	**Systemic antacids** [JK DI – 2013]	Sodium bicarbonate (Baking Soda), Sodium citrate
	Non-Systemic antacids	Aluminum hydroxide gel, Magnesium hydroxide mixture, Calcium Carbonate
Cathartics	Magnesium sulphate [AP DI – 2012], Sodium orthophosphate, Kaolin [MEGHALAYA DI - 2019] and Bentonite, Sodium potassium tartrate (**Rochelle salt**, Seignette's salt). [UPSC DI - 2023]	

PROTECTIVE AND ADSORBENTS		
COMPOUND	**CHEMICAL FORMULA**	**USES**
Bismuth sub carbonate	$[(BiO)_2CO_3]_2.H_2O$	Good adherence to the skin and mucous membranes. It also has an antidiarrheal Action.
Bismuth sub nitrate	$Bi_5H_9N_4O_{22}$	Adsorbents and as astringents
Kaolin [MEGHALAYA DI - 2019]	$Al_2O_3.2SiO_2.2H_2O$	It is used as a filtering aid.

MILD PURGATIVE OR LAXATIVE		STRONG PURGATIVE	
Bulk forming	**Stool softener**	**Stimulant purgatives**	**Osmotic purgatives**
High fiber, absorbs water to increase bulk, distends bowel to initiate reflex bowel activity.	Stool softeners and lubricants, promote more water and fat in the stools, and lubricate the fecal material and intestinal wall.	Increases peristalsis via intestinal nerve stimulation.	They absorb water by osmosis.Increases watercontent in the bowel by osmosis.
Example: Psyllium, Methylcellulose	**Example**: Docusates, Liquid paraffin.	**Example**: Senna, Sodium Pico sulfate, Castor oil	**Example:** Magnesium salts sulfate, hydroxide, Sodium salts, Sulfate

- Isomers formed by the inter-conversion, based on the rotations about single bonds are called Conformational isomers / Conformers / Rotamers / Stereoisomers **[MAHARASHTRA DI – 2012]**

Anomers

- The **α and β cyclic forms of D-glucose** are known as anomers. They differ from each other in the configuration only around **C_1 known as anomeric carbon** (hemiacetal carbon).

Mutarotation

- Mutarotation is defined as the change in the specific optical rotation representing the **interconversion of α and β forms of D-glucose to an equilibrium mixture**.

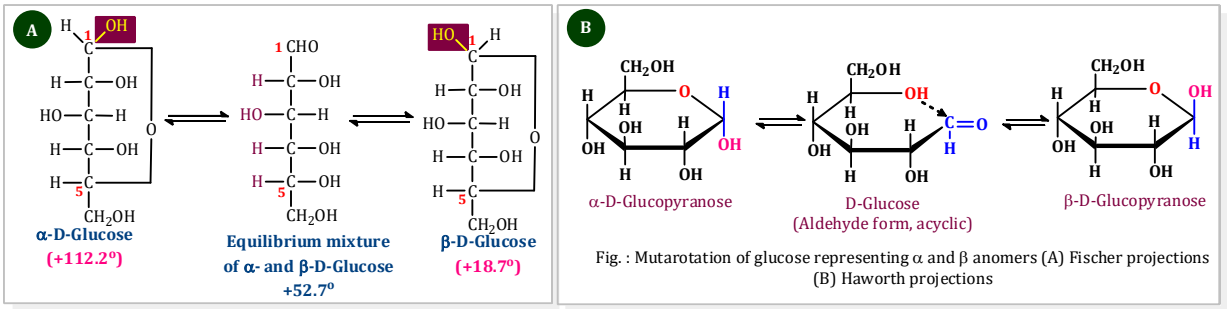
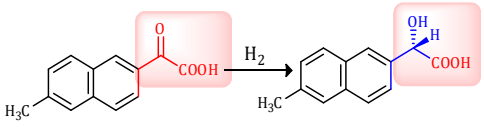


Fig. : Mutarotation of glucose representing α and β anomers (A) Fischer projections (B) Haworth projections

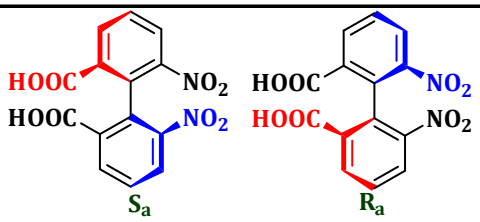
Asymmetric Synthesis

Asymmetric synthesis is **synthesis of optically active** compound from an **optically inactive molecule.**



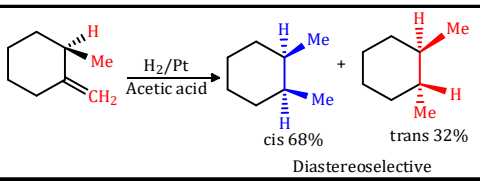
Atropisomer

Atropisomer are stereoisomers resulting **from hindered rotation about single bond.**



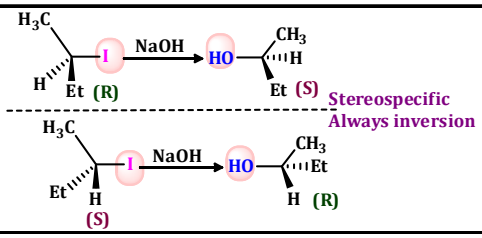
Stereoselectivity

Stereoselectivity is the **property of a chemical reaction,** in which a single reactant forms an **unequal mixture of stereoisomers.**



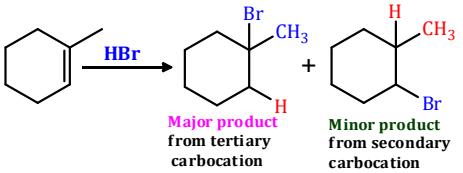
Stereo Specificity

Stereo specificity is the property of a reaction mechanism that leads to **different stereoisomeric reaction** products, from different stereoisomeric reactant.



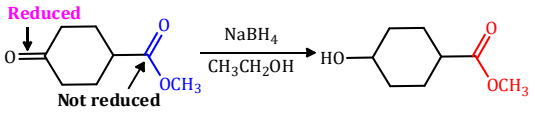
Regioselectivity

A regioselective reaction is one in **which one direction of bond making** or **breaking occurs preferentially** over all other possible direction.
A regioselective reaction produces a selective constitutional isomer. **[GUJARAT DI - 2021]**



Chemoselectivity

Chemoselectivity refers to the **selective reactivity of one functional group** in the presence of others



MEDICINAL CHEMISTRY

Drug Design, Computer Aided Drug Design And QSAR

MEDICINAL CHEMISTRY

Medicinal chemistry is the science, which deals with the discovery and design of new and better therapeutic chemicals and development of these chemicals into new medicines and drugs.

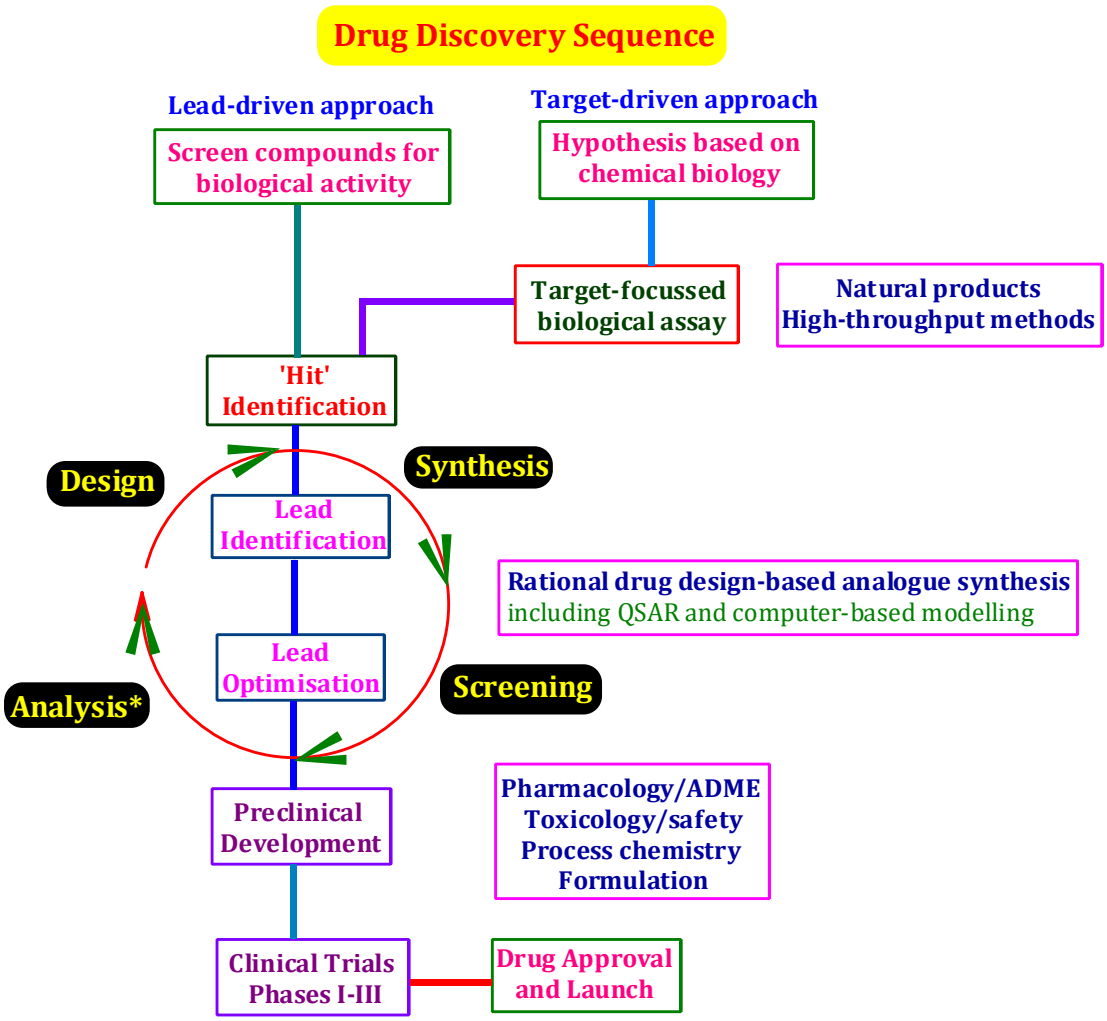
DRUG DESIGN

Drug design may be defined as effort to develop a new drug by molecular modification of lead compound for optimization of desired effects and minimization of side effects.

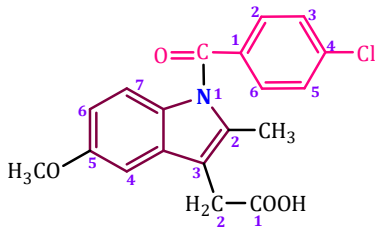
LEAD COMPOUND/PARENT COMPOUND

A lead compound is a compound having a particular biological activity obtained either from natural or synthetic source.

DRUG DISCOVERY SEQUENCE

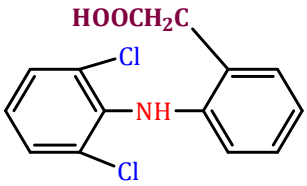


Indomethacin



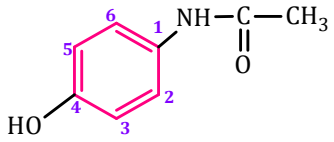
2-{1-[(4-Chlorophenyl) carbonyl]-5-methoxy-2-methyl indol-3-yl} acetic acid

Diclofenac [HP DI – 2011, TN DI - 2012]



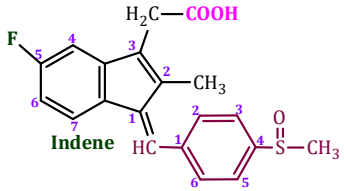
[O-(2,6-Dichloroanilino) phenyl acetic acid

Paracetamol [MP DI – 2017, UPSC DI - 2019]



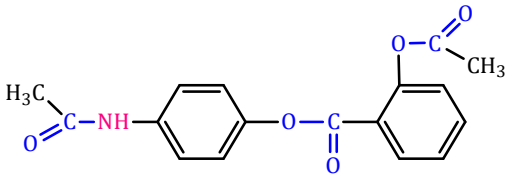
N-(4-Hydroxyphenyl) acetamide

Sulindac [BIHAR DI - 2023]



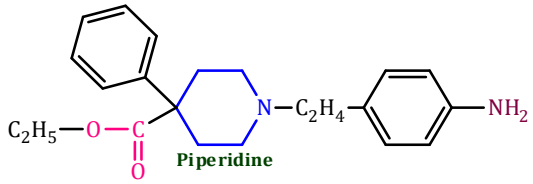
{5-Fluoro-2-methyl-1-[4-(methylsulfinyl) benzylidene] -indene-3-yl}acetic acid

Benorilate



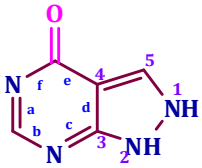
4-acetamidophenyl 2-(acetyloxy)benzoate

Anileridine



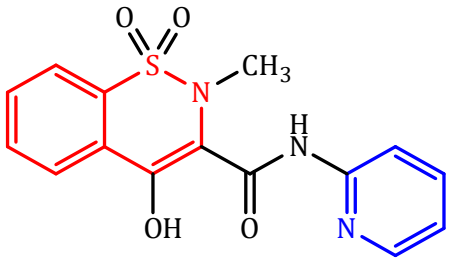
Ethyl 1-[2-(4-amino phenyl) ethyl]-4 phenyl piperidine -4-carboxylate

Drug for gout (Allopurinol)



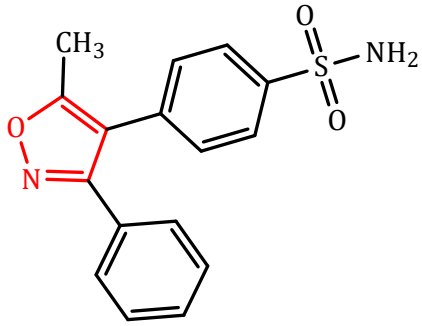
1H-Pyrazolo[3,4-d]pyrimidin-4(2H)-one

Piroxicam [TN DI – 2009, MAHARASHTRA DI - 2016]



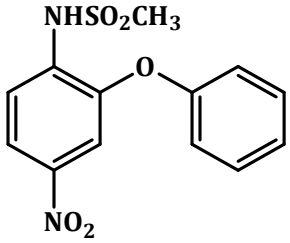
4-Hydroxy-2-methyl-N-2 pyridinyl-1,2 benzothiazine-3 carboxamide-1,1-dioxide

Valdecoxib [JK DI – 2013]



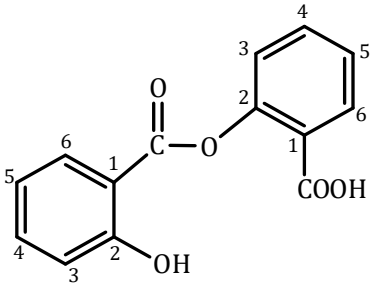
4-[5-Methyl-3-phenyl isoxazol-4-yl]-benzene sulphonamide

Nimesulide [JK DI – 2013]



N-(4-nitro-2-phenoxyphenyl)methanesulfonamide

Salsalate



2-(2-Hydroxybenzoyl) oxybenzoic acid

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✓ Classification of Corticosteroids related Drugs

Corticosteroids

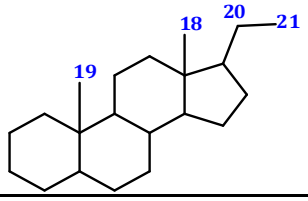
Glucocorticoids [JKDI - 2013]

Short acting	Intermediate acting	Long acting
Hydrocortisone (Cortisol)	Prednisolone Methyl prednisolone Triamcinolone Deflaxacort	Dexamethasone Betamethasone

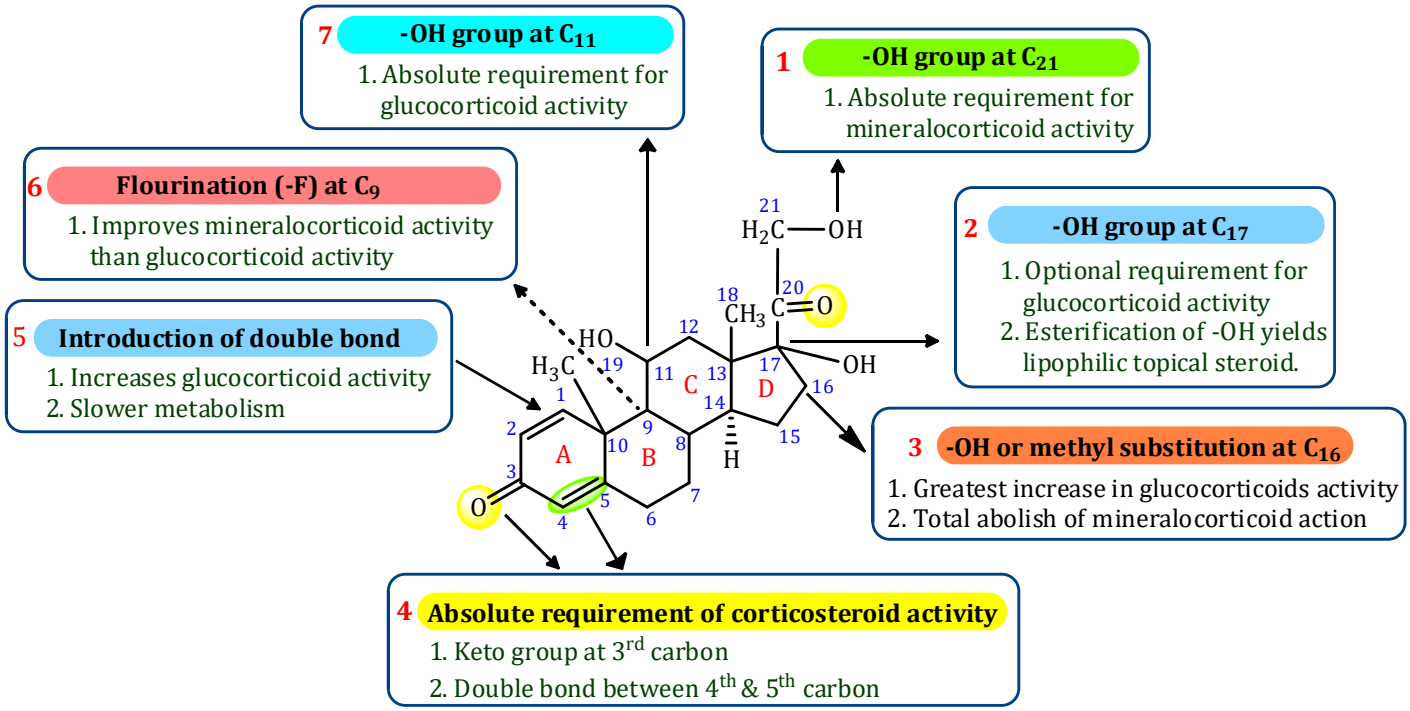
Mineralocosteroids

Desoxycorticosterone acetate(DOCA)
Fludrocortisone
Aldosterone

✓ Basic moiety presents of Corticosteroids Hormones

DRUG NAME	BASIC MOIETY
Dexamethasone, Betamethasone, Hydrocortisone Triamcinolone, Prednisolone, Aldosterone & Cortisone	**Pregnane** 

✓ SAR of Corticosteroids



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PHARMACEUTICAL ANALYSIS

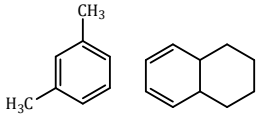
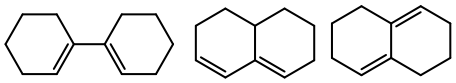
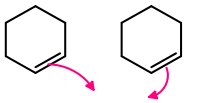
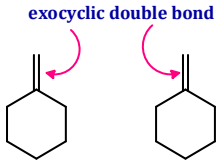
Analytical Method Validation

S. NO	PART	DETAILS
1.	**Accuracy** [TN DI - 2009]	The accuracy of an analytical procedure expresses the closeness of agreement between the value which is accepted either as a conventional true value or an accepted reference value and the value found.
2.	**Specificity**	Specificity is the ability to assess unequivocally the analyte in the presence of components which may be expected to be present. Typically, these might include impurities, degradants etc.
3.	**Precision** [MP DI – 2012]	The precision of an analytical procedure expresses the closeness of agreement. [ODISHA DI - 2023]
4.	**Repeatability**	Repeatability expresses the precision under the same operating conditions over a short interval of time.
5.	**Intermediate precision** [UPSC DI - 2023]	Intermediate precision expresses within-laboratories variations: different days, different analysts, different equipment, etc.
6.	**Reproducibility** [MP DI – 2012]	Reproducibility expresses the precision between laboratories collaborative studies, usually applied to standardization of methodology.
7.	**Detection limit**	The detection limit of an individual analytical procedure is the lowest amount of analyte in a sample which can be detected.
8.	**Quantitation limit** [MAHARASHTRA DI – 2012]	The quantitation limit of an individual analytical procedure is the lowest amount of analyte in a sample which can be quantitatively determined with suitable precision and accuracy.
9.	**Linearity** [MAHARASHTRA DI – 2012]	The linearity of an analytical procedure is its ability (within a given range) to obtain test results which are directly proportional to the concentration (amount) of analyte in the sample.
10.	**Range**	The range of an analytical procedure is the interval between the upper and lower concentration (amounts) of analyte in the sample.
11.	**Robustness** [MP DI – 2012]	The robustness of an analytical procedure is a measure of its capacity to remain unaffected by small, but deliberate variations in method parameters.
12.	**Error**	The difference between the true value or standard value and observed value is called error.
13.	**Determinate errors or Systematic errors**	These errors have definite values. [GOA DI 2020]
14.	**Indeterminate or Random errors**	These errors arise due to random fluctuations in procedures and measuring devices. [GOA DI 2020]
15.	**Relative error** [GUJARAT DI - 2021]	The ratio of absolute error and the actual value is called the relative error.

❖ INSTRUMENTATION

Source of light	H_2 discharge lamp, Deuterium lamp [UPSC DI – 2015, TN DI - 2019], Xenon arc [RAJASTHAN DI - 2012], Mercury vapor	
Monochromator	Grating - Transmission grating, Diffraction grating [BIHAR DI - 2023]	
Sample Cells	Cylindrical, quadrangular - 1cm path length Quartz cells only must be used in UV spectroscopy since glass cells will absorb UV radiation [TN DI - 2019]	
Detectors	Photo voltaic cells, Photo tubes, Photo Multiplier Tubes (PMT) [MP DI – 2017, BIHAR DI - 2023]	
Recorder	As in calorimeter are used	
Calibration	Potassium dichromate [UPSC DI – 2019, 2023]	
Solvents [UK DI - 2024]	**Solvent**	**Wavelength cutoff**
	Acetonitrile [HP DI - 2016]	190
	Ethanol, Hexane, Methanol, Cyclohexane, Diethyl ether	210
	Water	205
	Benzene	280

➢ WOODWARD FIESER RULE [GUJARAT DI – 2021, UPSC DI - 2023]

Alicyclic dienes	Where basic unit is butadiene system
Homoannular Diene	It is a cyclic diene having conjugated double bond in the same ring 
Heteroannular diene	It is a cyclic diene in which double bonds in conjugation are present in different rings. 
Endocyclic double bond	A double bond present in a ring. 
Exocyclic double bond	A double bond in which one of the double bond is a part of a ring system shown in ring B. 

For dienes, trienes and polyenes		
Parent value	Homoannular conjugated diene	253 nm
	Heteroannular conjugated diene	215 nm
	Acyclic conjugated diene	217 nm
	Acyclic triene	245 nm
Increments	Each alkyl substituent or Ring residue	+ 5 nm
	Exocyclic double bond	+ 5 nm
	Double bond extending conjugation	+ 30 nm
Auxochromes	-Cl, -Br	+ 5 nm
	-OH/-OR/-SH	+ 6 nm
	-SR	+ 30 nm
	$-OCOCH_3$	+ 0 nm
	$-NR_2$	+ 60 nm

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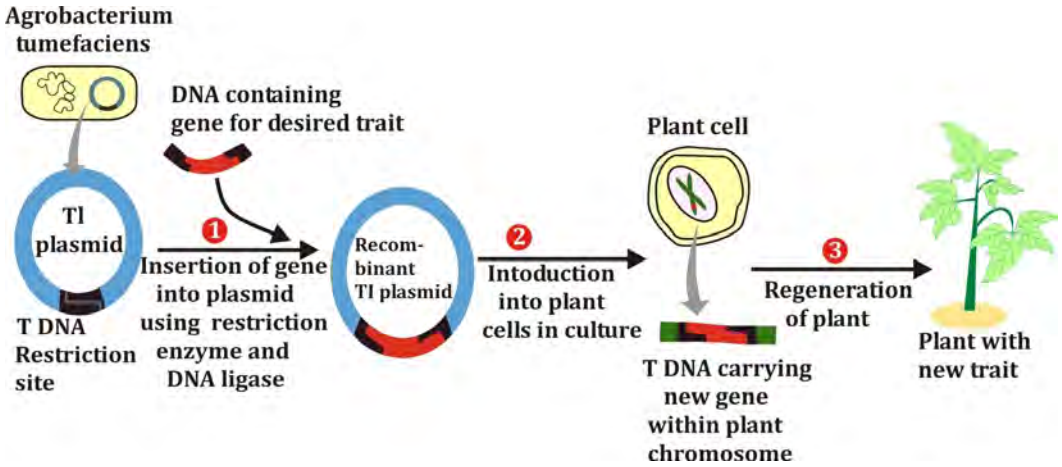
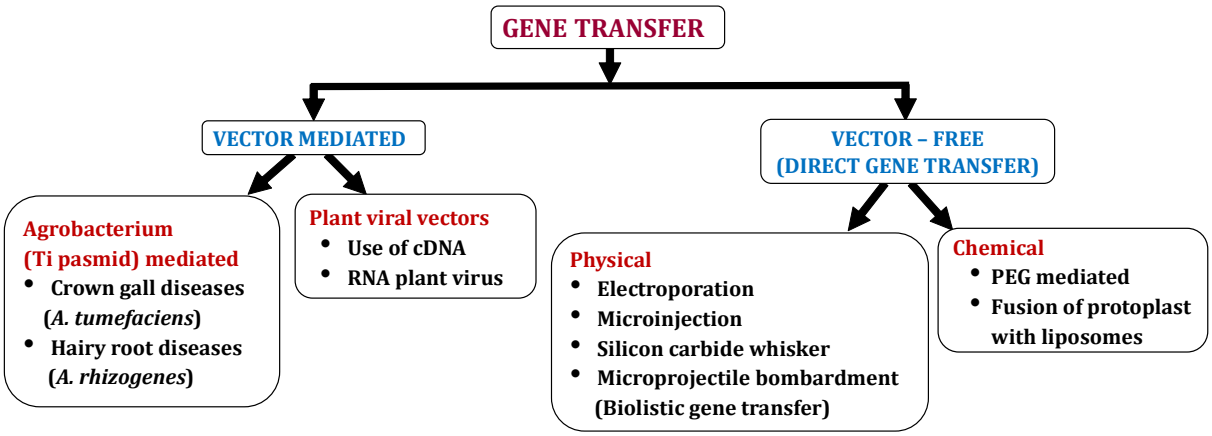


❑ GENE TRANSFER TECHNIQUES IN PLANTS



METHOD	SALIENT FEATURE
Vector-mediated gene transfer	
Agrobacterium (Ti plasmid)-mediated gene transfer Plant viral vector	• *Agrobacterium tumefaciens* is a soil-borne, Gram-negative bacterium. • Very efficient, but limited to a selected group of plants Ineffective method, hence not widely used. • The Ti plasmid of *Agrobacterium tumefaciens* is used to transfer insect-resistant *Bt* gene into plant cells during genetic engineering. [GUJARAT DI - 2021]
Direct or vector less DNA transfer	
(A) Physical methods	
Electroporation	• Mostly confined to protoplasts that can be regenerated to viable plants. Many cereal crops developed. • Electroporation basically involves the use of high field strength electrical impulses to reversibly permeabilize the cell membranes for the uptake of DNA.
Microprojectile or Particle bombardment (Biolistic)	• A technique of using very small metal particles coated with desired DNA in the gene transfer is called **biolistic.** • DNA is bombardment into intact cell using a biolistic device such as **gene gun.**
Microinjection	• **Microinjection is a direct physical method** involving the mechanical insertion of the desirable DNA into a target cell. • Microinjection has been successfully used with **large frog eggs, mammalian cells, mammalian embryos, plants and tissues.**

BIOCHEMISTRY

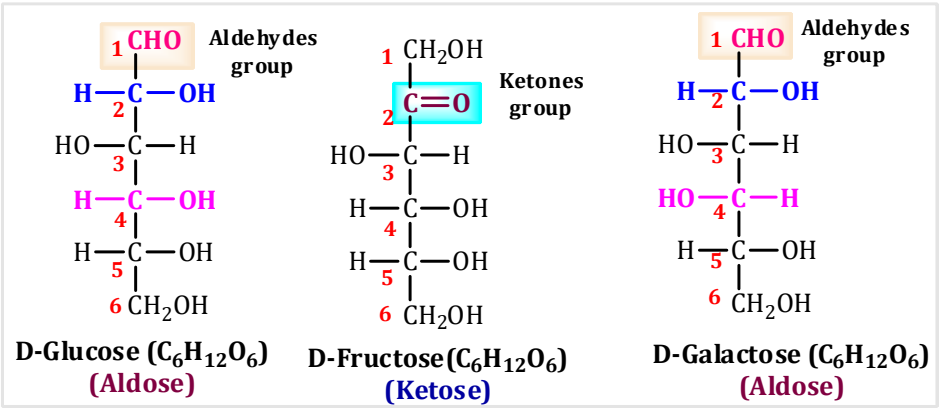
❖ INTRODUCTION

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

Carbohydrate

❖ INTRODUCTION

- Carbohydrates are the most abundant organic molecules in nature.
- Carbohydrates are the main **sources of energy in the body.**
- **Brain cells and RBCs are** almost wholly dependent on carbohydrates as the energy source. **[MP DI - 2022]**
- The general molecular formula of **carbohydrates is $C_n(H_2O)_n$.** For example, glucose has the molecular formula $C_6H_{12}O_6$.
- Ratio of hydrogen and oxygen is 2:1.
- Carbohydrates may be defined as polyhydroxy alcohols with aldehydes or ketones and their derivatives.



D-Glucose ($C_6H_{12}O_6$) **(Aldose)**

D-Fructose ($C_6H_{12}O_6$) **(Ketose)**

D-Galactose ($C_6H_{12}O_6$) **(Aldose)**

❖ CLASSIFICATION OF CARBOHYDRATES

CLASSIFICATION	TYPES	EXAMPLE
MONOSACCHARIDES These are often called "simple sugars" **which cannot be hydrolyzed** into a simpler form.	Triose ($C_3H_6O_3$)	Glyceraldehyde **[GUJARAT DI - 2021]**, Dihydroxyacetone
	Tetrose ($C_4H_8O_4$)	Erythrose, Erythrulose
	Pentose ($C_5H_{10}O_5$)	Ribose, Ribulose, Deoxyribose, Xylose **[UK DI - 2024]**, Xylulose
	Hexose ($C_6H_{12}O_6$)	Glucose, Galactose, Mannose, Fructose
	Heptose ($C_7H_{14}O_7$)	D-Sedoheptulose

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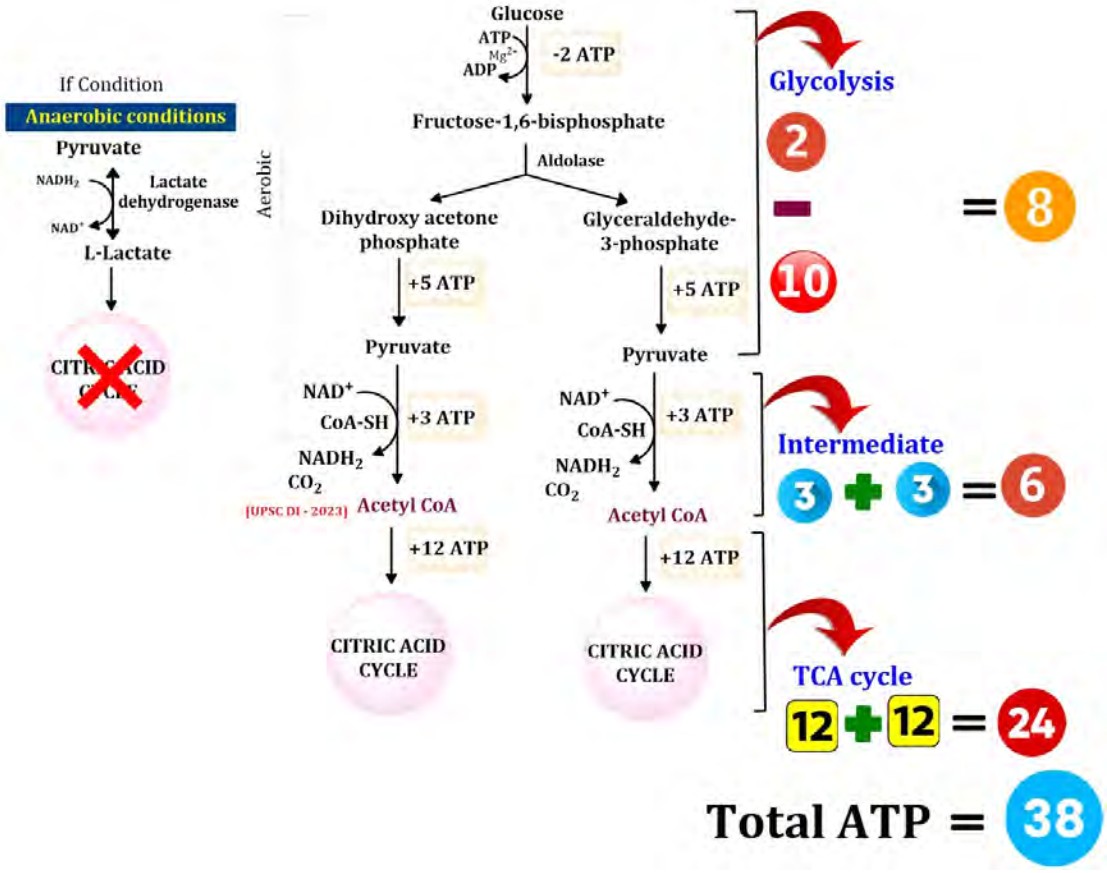
- Oxaloacetate is considered to play a catalytic role in citric acid cycle.
- Four B-complex vitamins are essential for Krebs cycle, and thus energy generation e.g. Thiamine, Riboflavin, Niacin and Pantothenic acid.
- Three enzymes namely citrate synthase, isocitrate dehydrogenase and α-ketoglutarate dehydrogenase regulate citric acid cycle.

❖ GENERATION OF ATP IN GLUCOSE METABOLISM

- Formation of Acetyl-CoA is the link between Glycolysis and Citric acid cycle. [UPSC DI - 2023]
- The complete oxidation of one mole of glucose generates 38 ATP (34).



GENERATION OF ATP IN GLUCOSE METABOLISM		
PATHWAY	**ENZYME (METHOD OF ATP SYNTHESIS)**	**NUMBER OF ATP SYNTHESIZED**
GLYCOLYSIS	Glyceraldehyde 3-phosphate dehydrogenase (2 NADH, ETC, oxidative phosphorylation)	6**(5)**
	Phosphoglycerate kinase (substrate level phosphorylation)	2
	Pyruvate kinase (substrate level phosphorylation)	2
	Two ATP are consumed in the reactions catalysed by hexokinase and phosphofructokinase	-2
	Net ATP synthesis in glycolysis in aerobic condition	8**(7)** [TELANGANA DI - 2023]
INTERMEDIATE CYCLE	Pyruvate dehydrogenase (2 NADH, ETC, oxidative phosphorylation)	6**(5)**

Phospholipid synthesis	Phosphocholine cytidylyltransferase (CT)	Endoplasmic reticulum

❖ FATTY ACID OXIDATION

- The fatty acids in the body are mostly oxidized **by β-oxidation.**

❒ β-oxidation

- β-Oxidation may be defined as the oxidation of fatty acids on the β-carbon atom.

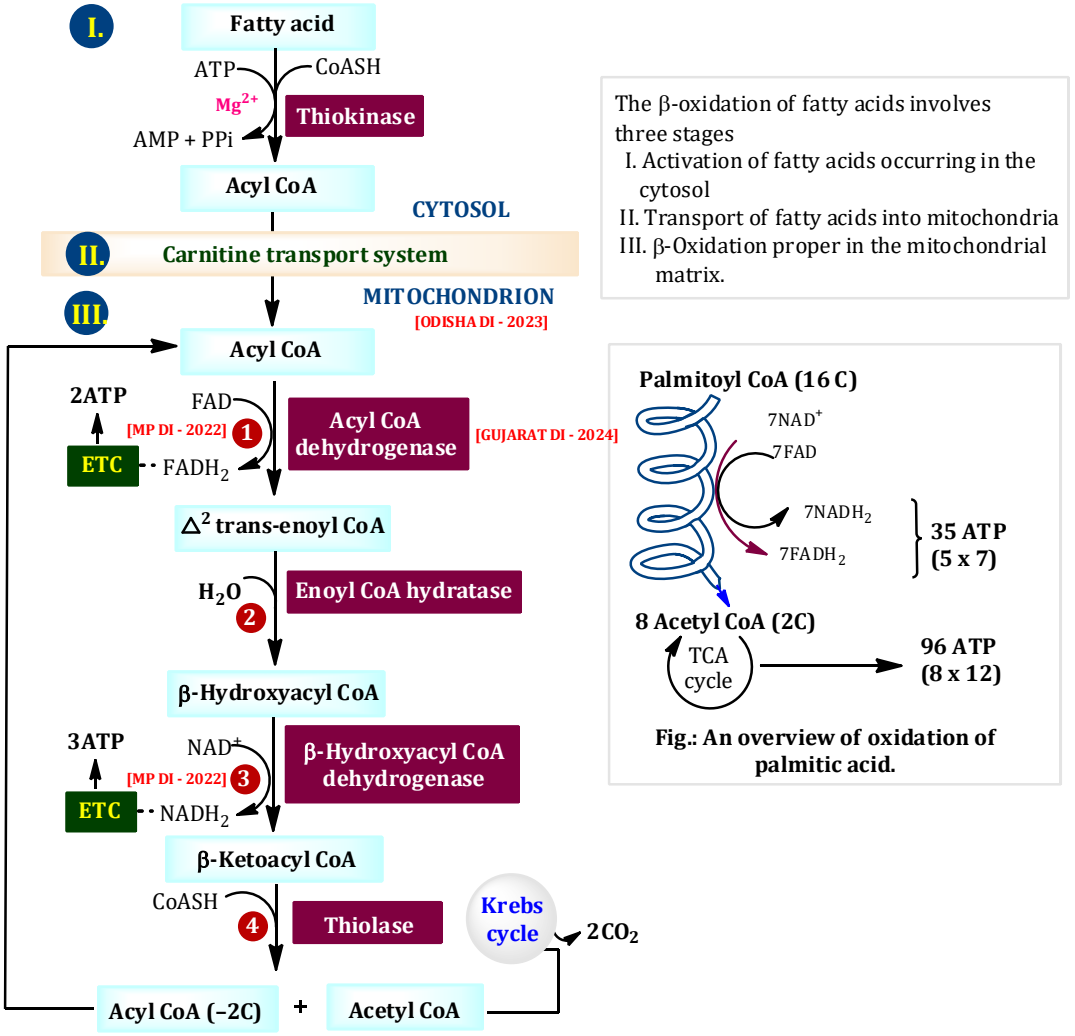


Fig. : β-Oxidation of fatty acids : Palmitoyl CoA (16 carbon) undergoes seven cycles to yield 8 acetyl CoA [I– Activation; II–Transport; III– β-Oxidation proper— (1) Oxidation, (2) Hydration, (3) Oxidation and (4) Cleavage

❑ Energetics of palmitic acid oxidation

S.NO.	MECHANISM	NUMBERS OF ATP
I.	**β-Oxidation 7 cycles** • **7 $FADH_2$** [oxidized by electron transport chain (ETC), each $FADH_2$ gives **2 ATP**]	14
	7 NADH (oxidized by ETC, each NADH liberates **3 ATP**)	21
II.	• **From 8 acetyl CoA** [GPAT-2017] • Oxidized by citric acid cycle, each acetyl **CoA provides 12 ATP**	96
Total Energy	One mole of Palmitoyl CoA	131
Energy utilized for activation (formation of Palmitoyl CoA)		-2
Net yield	One molecule of Palmitate	**129**

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❖ VITAMINS, RINGS, CHEMICAL NAMES AND THEIR ACTIVE FORM

VITAMINS	CHEMICAL NAME	RINGS	ACTIVE FROM
Fat Soluble Vitamins			
A	Carotenes [TN DI - 2018] / Retinoids	β- ionone ring [HP DI - 2016]	Retinol, Retinal, Retinoic acid
D	Cholecalciferol	Steroidal ring [UPSC DI – 2015]	1,25, dihydroxy cholecalciferol [HP DI - 2016]
E	Tocopherol [TN DI - 2018]	Chromane ring	α-tocopherol
K	Phylloquinone Menaquinone Menadione	Naphthoquinone	Vitamin K_1 (Phylloquinone) Vitamin K_2 (Menaquinone) Vitamin K_3 (Menadione)
Water Soluble Vitamins			
B_1	Thiamine	Pyrimidine +Thiazole [BIHAR DI - 2008]	Thiamine Pyrophosphate (TPP)
B_2	Riboflavin	Isoalloxazine	FMN, FAD
B_3	Niacin [MP DI - 2017]	Pyridine-3- carboxylic acid [UPSC DI - 2023]	NAD^+, $NADP^+$
B_5	Pantothenic acid	Amide between Pantoic acid + β-alanine	Coenzyme A (CoA)
B_6	Pyridoxine	Pyridine ring	Pyridoxal phosphate (PLP)
B_7	Biotin	Imidazole + thiophene(Sulphur group) [JK DI – 2013] [MEGHALAYA DI – 2019]	Biocytin (bound biotin)
B_9	Folic acid	Pteridine + PABA+ Glutamic acid [UPSC DI – 2015]	Tetrahydrofolic acid (THF)
B_{12}	Cobalamin	4-Corrin ring+ Center Cobalt atom [ASSAM DI - 2022] [TN DI - 2024]	Methyl cobalamin
C	Ascorbic acid	Resemble with hexose	Ascorbic acid

❖ DEFICIENCY DISEASES DUE TO VITAMINES (FAT SOLUBLE)

VITAMIN	DAILY REQUIREMENTS	DEFICIENCY DISEASES
Vitamin A	800-1000 retinol equivalents	Night blindness [BIHAR DI - 1998], Xerophthalmia, Keratomalacia, Bitot's spots, Corneal Xerosis [GUJARAT DI - 2021], Conjunctival xerosis [MEGHALAYA DI - 2019]
Vitamin D	200-4000 IU	Bone- Rickets (In children), Osteomalacia (In adults) [GUJARAT DI - 2021]
Vitamin E	8-10 mg	Sterility in males and abortions in females, Weak immune system Vitamin E has the Antioxidant & Deodorant Property. [KERALA DI – 2017]
Vitamin K	70-140 µg	Bleeding diathesis Since dietary vitamin K is not absorbed in obstructive jaundice it is very important to administer the vitamin before biliary surgery. [TN DI - 2019]

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14	Tube Agglutination test	Typhoid
15	Widal test [MAHARASHTRA DI – 2008, HP DI – 2011, CG DI – 2015]	
16	Lepromin test [UK DI - 2024]	Leprosy
17	Kahn test	Syphilis
18	VDRL test [HP DI - 2011]	
19	Wassermann test	
20	Elek's test	Diphtheria
21	Schick test	
22	Dick test	Scarlet Fever
23	Schultz Charlton test	
24	Cold hemagglutination test	Pneumonia
25	Coombs test	Brucellosis
26	Ducrey test	Haemophilus
27	Radial immunodiffusion test	Influenza virus
28	Rose water test	Rheumatoid arthritis
29	RIA test	Histoplasmosis, Blastomycosis
30	Gothlin test	Scurvy
31	Frie test	*Lymphogranuloma venereum*
32	Weil Felix test	Typhus fever

❑ IMPORTANT DIAGNOSTIC, SEROLOGICAL, AND SENSITIVITY TESTS IN MICROBIOLOGY

S.NO.	NAME OF TEST	USES
1	ELISA test	**ELISA** is the primary screening technique used for the **serological diagnosis of AIDS** by detecting antibodies against HIV. [CG DI – 2015, RAJASTHAN DI - 2018]
2	Western blot test	**Western blot** is the confirmatory test for AIDS as it detects specific antibodies against HIV proteins. [MAHARASHTRA DI – 2014]
3	RIA test	**A scintillation counter** is used in Radioimmunoassay (RIA) to detect radiation from labeled compounds. [MAHARASHTRA DI – 2012]
4	Schick test	Determination of susceptibility to diphtheria [BIHAR DI – 2008, TN DI – 2009, HP DI – 2011, ODISHA DI – 2012, CG DI – 2015, AP DI – 2018, ASSAM DI - 2022]
5	Dick test	Determination of susceptibility to scarlet fever [HP DI – 2011, JK DI – 2013]
6	Lepromin test	The **Lepromin test is negative in *Lepromatous leprosy*** due to the absence of cell-mediated immunity. [RAJASTHAN DI - 1996]
7	Paul Bunnell test	The **Paul-Bunnell test** detects heterophile antibodies in infectious mononucleosis by agglutination of sheep red blood cells. [MAHARASHTRA DI - 2016]
8	Tine test/Heaf test	Tuberculin test for check susceptibility of tuberculosis
9	Mantoux test	Tuberculin test for check susceptibility of tuberculosis The Mantoux test in India is performed using **5 Tuberculin Units (TU)** of Purified Protein Derivative (PPD) to screen for tuberculosis. [MEGHALAYA DI - 2019]
10	Tuberculin test	For determining allergy to the tubercle bacillus
11	VDRL test	The VDRL test is a non-treponemal screening test that detects regain antibodies, not specific to *Treponema pallidum*. [MAHARASHTRA DI – 2014, ASSAM DI - 2022]
12	Widal test	In the Widal test, **antibodies to the O antigen appear first and persist**, helping in the early diagnosis of typhoid. [MAHARASHTRA DI – 2012]
13	Frie test	For determining sensitivity to the causative agent of *Lymphogranuloma venereum*
14	Ducrey test	For determining sensitivity *Thermophilus ducrevi*
15	Brucellergin test	For demonstrating allergy to brucella
16	Trichinella test	For determining sensitivity to trichinella protein

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PHARMACEUTICAL MANAGEMENT

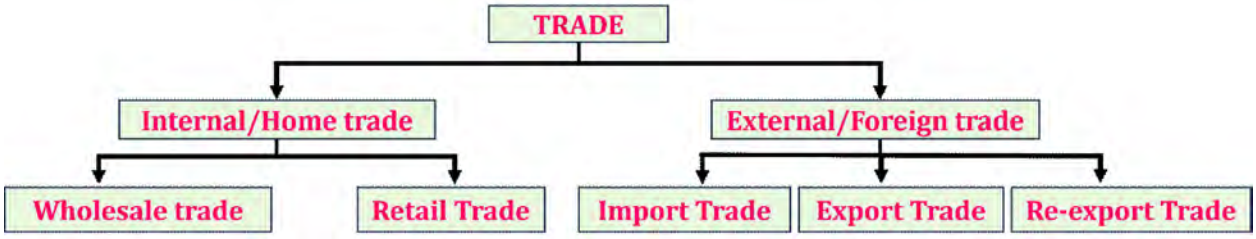
Commerce, Trade and Industry

❑ **INTRODUCTION TO COMMERCE: FUNCTIONS AND SUBDIVISIONS**

- Commerce encompasses activities that facilitate the exchange of goods and services, linking manufacturers, traders, and consumers.
- It includes trade and essential services like insurance, transport, banking, financing, and warehousing.

❑ **TRADE:** The trade is defined as to sale, transfer or exchange of goods and services.

Trade is mainly divided into two types :



❖ **Internal/Home trade :** Sales, transfer, or exchange of goods and services within a country, with payment in national currency.

Divided into two main categories:

✓ **Wholesale Trade :** Involves purchasing goods or medicines in bulk from manufacturers and distributes these goods to retailers

✓ **Retail Trade :**Involves selling goods in smaller quantities directly to consumers. Retailers maintain stock and provide a variety of goods acts as a link between wholesalers and consumers.

❖ **Foreign Trade :** Buying and selling of goods between countries, requiring currency conversion for payments. Primarily conducted on a wholesale basis.

➢ **Types of Foreign Trade:**

✓ **Import Trade:** Purchasing goods from other countries.

✓ **Export Trade:** Selling goods to foreign countries.

✓ **Re-export Trade:** Importing goods from one country and exporting them to another.

❑ **INDUSTRY :** Concerned with the production of goods, including activities like production, conversion, extraction, and formulation. Industries produce either consumer goods (for final consumers) or producer goods (for further production).

Pharmaceutical Management

❑ **PHARMACEUTICAL MANAGEMENT**

- **The process of conducting and managing various business activities.**

❖ **Levels of management**

1. **Top level management -** It is the ultimate source of authority which **frame the policies** for the enterprise.

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NON-PHARMA

GENERAL INTELLIGENCE AND REASONING

Analogy

"Analogy implies similarity or resemblance, used to compare relationships between pairs of items."

❑ SEMANTIC ANALOGY/WORD ANALOGY

❖ INTRODUCTION

A comparison that highlights relationships between pairs of words or concepts based on their meanings or functions.

Key Steps to Solve:

- ✓ Analyze the relationship in the question pair.
- ✓ Find the answer choice with a similar relationship.
- ✓ Re-examine multiple correct options.
- ✓ Eliminate non-optimal choices.
- ✓ Ensure matching parts of speech.

CATEGORY	EXAMPLE	OTHER EXAMPLES
Measurement Units	Length : Metre :: Mass : Kilogram	Area : Hectare, Time : Seconds, Pressure : Pascal, Temperature : Degree
Worker and Workplace	Chef : Kitchen :: Farmer : Field	Doctor : Hospital, Engineer : Site, Scientist : Laboratory, Cobbler : Shoes
Study and Topics	Ornithology : Birds :: Cardiology : Heart	Seismology : Earthquakes, Astrology : Future, Hematology : Blood, Paleontology : Fossils
Instrument and Measurement	Barometer : Pressure :: Thermometre : Temperature	Ammeter : Current, Hygrometre : Humidity, Stopwatch : Time
Product and Raw Material	Mason : Wall :: Butter : Milk	Fabric : Yarn, Shoes : Leather, Furniture : Wood, Book : Paper
Male and Female Counterparts	Horse : Mare :: Lion : Lioness	Gentleman : Lady, Nephew : Niece, Dog : Bitch, Tiger : Tigress

❑ NUMBER ANALOGY [MP DI - 2022], [MP DI – 2012], [AP DI – 2012]

❖ INTRODUCTION

- Symbolic and number analogy test is a procedure to check the knowledge of a student with reference to number system and alphabetic series.

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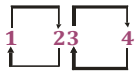
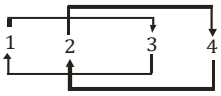
❖ Concepts of Symbolic/Number Analogy

✓ Rule I Basic rule



Through, this operation/rule. We can say that here 1 is related to 2, in same manner 2 is related to 1 and as 3 is related to 4, in same manner 4 is related to 3.

✓ Rule II Develop rule



Through, this operation/rule. We can say that here 1 is related to 3, in same manner 3 is related to 1 and as 2 is related to 4, in same manner 4 is related to 2.

➢ The relationship is number analogy can be of following types.

- ✓ Square and square roots of digits
- ✓ Even and odd numbers
- ✓ Number Analogy
- ✓ Multiplication and division of numbers
- ✓ Total number of digits
- ✓ Cube and cube roots of

Eg.- Choose the correct alternative, which represent the same relationship as first two bears 684: 462:: 795: ?

(a) 573 (b) 583 (c) 671 (d) 581

(a) As, 6 → **4** (6 - 2) 8 → **6** (8 - 2) 4 → **2** (4 - 2) = **462**

Similarly, 7 → **5** (7 - 2) 9 → **7** (9 - 2) 5 → **3** (5 - 2) = **573**

So, 573 is the correct answer.

❑ ALPHABET ANALOGY [MAHARASHTRA DI – 2014]

Relationships between letters based on position or type.

❖ Types:

- ✓ **Position Change: Increment/Decrement (e.g., A → C: +2).**
- ✓ **Reverse Order: Alphabet flipp7ed (e.g., A → Z).**
- ✓ **Vowel/Consonant: Categorization by type.**

Before dealing with the problems, candidates are advised to remember the following.

➢ Ascending/forward order letter position

A	B	C	D	E	F	G	H	I	J	K	L	M
1	2	3	4	5	6	7	8	9	10	11	12	13
N	O	P	Q	R	S	T	U	V	W	X	Y	Z
14	15	16	17	18	19	20	21	22	23	24	25	26

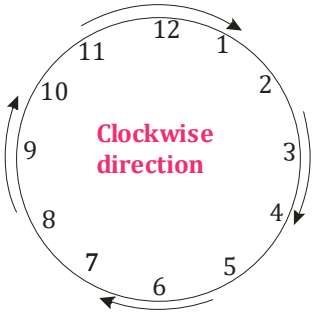
➢ Descending/forward order letter position

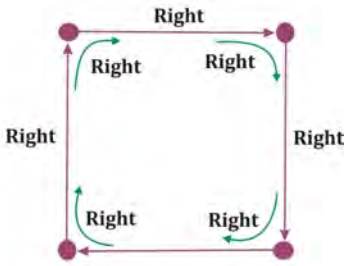
A	B	C	D	E	F	G	H	I	J	K	L	M
26	25	24	23	22	21	20	19	18	17	16	15	14
N	O	P	Q	R	S	T	U	V	W	X	Y	Z
13	12	11	10	9	8	7	6	5	4	3	2	1

➢ Opposite letter

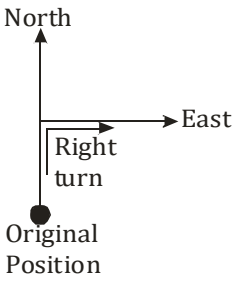
A	B	C	D	E	F	G	H	I	J	K	L	M
Z	Y	X	W	V	U	T	S	R	Q	P	O	N

❖ **Right Turn** (Clockwise Turn) When a person takes turn in **the direction of motion of clock, then this turn is called right turn or clockwise turn.**



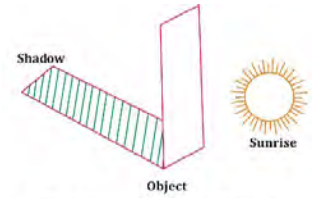


- When a person goes **towards North and turns clockwise, then it is his right.**

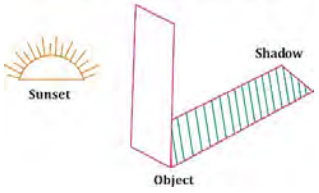


❑ CONCEPT OF SHADOW

- In the morning, when the **Sun rises in the East, the shadow** of any person or object is in the West direction. Similarly, in the evening, **when the Sunsets in the West, the shadow of a person or an object is towards the East.**
- Note At 12:00 noon, there will be no shadow as the rays of the Sun are vertically downwards at that time.
- Different types of questions covered in this chapter are as follows
- Finding both the Distance and Direction.



Shadow at the time of Sunset



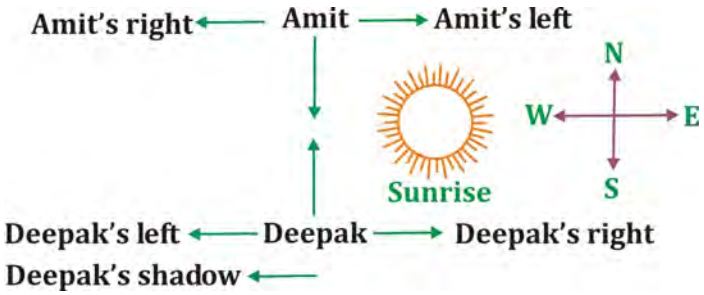
❑ FIND THE DIRECTION

- In this type, problems are based on the **final direction of an object** with respect to its starting point. It requires the knowledge of main as well as **sub-directions and the angle between them.**

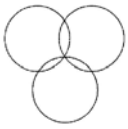
Eg- At Sunrise, Amit and Deepak are having a conversation standing in front of each other. The shadow of Deepak is formed towards the right hand of Amit. What direction is Deepak facing

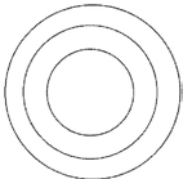
(a) North-East (b) South (c) East (d) North

Ans -(d) North

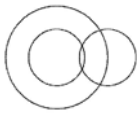


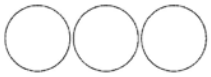
Clearly, Deepak is facing North

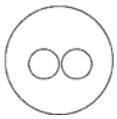
(c) 

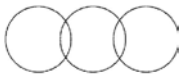
(d) 

4. Which one of the following figures represents the relationship among Males, Fathers, Advocates? [GDC PRACTICE MCQ]

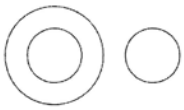
(a) 

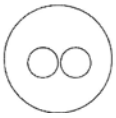
(b) 

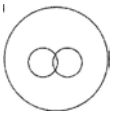
(c) 

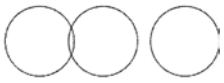
(d) 

5. Which one of the following figures represents the relationship among Dog, Animal, Snake? [GDC PRACTICE MCQ]

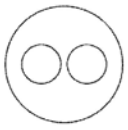
(a) 

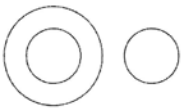
(b) 

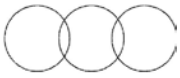
(c) 

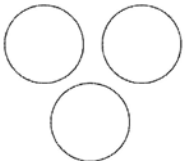
(d) 

6. Which of the following figure indicates relation between Aeroplane, Train, Travel? [GDC PRACTICE MCQ]

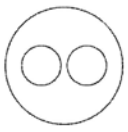
(a) 

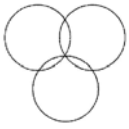
(b) 

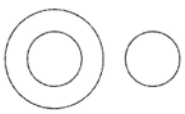
(c) 

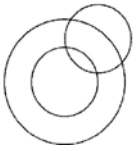
(d) 

7. Which of the following diagram best depicts the relationship between authors, teacher, men. [GDC PRACTICE MCQ]

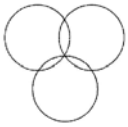
(a) 

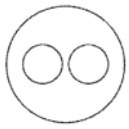
(b) 

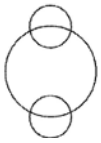
(c) 

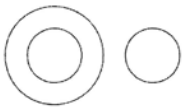
(d) 

8. For the given set of elements: Keyboard, Function keys, letter-keys. [GDC PRACTICE MCQ]
Which figure given below will best represent the relationship among these three elements?

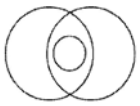
(a) 

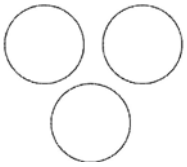
(b) 

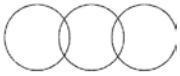
(c) 

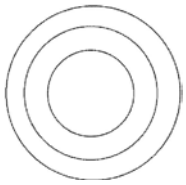
(d) 

9. Which Venn diagram represents the inter-relationship among Reptiles, Water living creatures and Frog? [GDC PRACTICE MCQ]

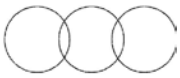
(a) 

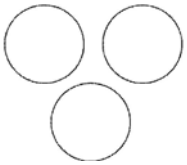
(b) 

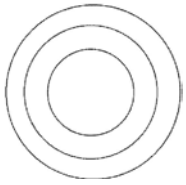
(c) 

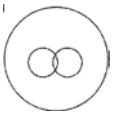
(d) 

10. Which of the following diagrams best depicts the relationship between Book, Pen and Pencil? [GDC PRACTICE MCQ]

(a) 

(b) 

(c) 

(d) 

Direction (11-15): Read the following information carefully and answer the questions based on them.
In the Venn-diagram given below the triangle represents infants, the square represents Boys, the circle represents villagers and the rectangle represents school going populations. Your task is to study the diagram and answer the questions that follow.

MATHEMATICS

Average

❑ INTRODUCTION [MP DI - 2022], [GUJARAT DI - 2024]

- An average or an arithmetic mean of given data is obtained when the sum of the given observations divided by number of observations.

  e.g. If we have to find out the average of 10, 15, 25 and 30, then the required average

$$\frac{10+15+25+30}{4}=\frac{80}{4}=20$$

Therefore, we can write the formula

$$\textbf{Average(A)}=\frac{\textbf{Sum of given observtions(S)}}{\textbf{Number of observations(N)}}\Rightarrow \textbf{A}=\frac{\textbf{S}}{\textbf{N}}$$

❑ PROPERTIES OF AVERAGE

• Average of a given data is less than the greatest observation and greater than the smallest observation of the given data.	
Example :- Average of 3,7,9 and 13 =	$\frac{3+7+9+13}{4}=\frac{32}{4}=8$
• If the observations of given data are equal, then the average will also be the same as observations.	
Example :- Average of 6, 6, 6 and 6 will be 6 because	$\frac{6+6+6+6}{4}=\frac{24}{4}=6$
• If 0 (zero) is one of the observations of a given data then that 0 (zero) will also be included while calculating average	
Example :- Average of 3, 6 and 0 is 3 because	$\frac{3+6+0}{3}=\frac{9}{3}=3$

PRACTICE MCQs

1. The average age of 5 men is 40. The average age of 5 women is 39. The average age of their 4 children is 15. What is the average age of a family [GDC PRACTICE MCQ]

(a) 45 (b) 30.33
(c) 90.5 (d) 91

2. The average age of 20 men is 50. The average age of their wives is 44. 3 couples among them have two children, the rest have one child. The average age of each child is 19 years. Find the average age of a family. [GDC PRACTICE MCQ]

(a) 11.575 (b) 115.85
(c) 115.75 (d) 11.585

3. The total age of 5 men is 440. The total age of their wives is 385. The average age of their children is 22. What is the average age of each member of the family (each couple has 3 children) [GDC PRACTICE MCQ]

(a) 44.5 (b) 56.2
(c) 46.2 (d) 50.2

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Interest (Simple and Compound)

❑ INTRODUCTION [TN DI - 2019], [CG DI - 2009], [GUJARAT DI - 2024]

If someone borrows some money for a particular time period from some other person or firm, then he pays back some additional amount of money with the borrowed money. The additional amount of money paid is called interest

❑ FUNDAMENTAL DEFINITION

- Some important definitions related to simple interest are as given below

Principal	The some of money which we borrow from banks or institutions is termed as principal
Rate of interest	This is the rate on which the extra money what we pay for keeping or using of money is calculated. It is in percent form. e.g. 20% rate of interest means for every hundred rupees, we have to pay ₹ 20 each year.
Amount	Total money what we return to the bank after end of period is called amount. In other words, amount is the sum of principal and interest accrued on principal. **i.e. Amount = Principal + Interest**
Time	The period for which the money is lent or deposited or borrowed, is called time. There are two ways of calculating interest **1. Simple interest 2. Compound interest**

❑ SIMPLE INTEREST

- If the interest in calculated on the original principal at any rate of interest for any period of time, then it is called simple interest

$$\text{Simple interest} = \frac{\text{Principal} \times \text{Rate of interest} \times \text{Time}}{100}$$

$$\Rightarrow SI = \frac{P \times R \times T}{100}, A = P\left(1 + \frac{RT}{100}\right)$$

- **Example :- A person invests ? 12000 as fixed deposit at a bank at the rate of 10% per annum simple interest. But due to some pressing needs he has to withdraw the entire money after 3 yr for which the bank allowed him a lower rate of interest. If he gets ₹3320 less than what he would have got at the end of 5 yr, the rate of interest allowed by the bank is**

(a) $7\frac{8}{9}\%$ **(b)** $8\frac{7}{9}\%$ **(c)** $7\frac{5}{9}\%$ **(d)** $7\frac{4}{9}\%$

Solution – (d)

If person had not withdrawn money then he must have interest = $\frac{P \times R \times T}{100}$

Here, P = ₹ 12000, R = 10%, T = 5yr

$= \frac{12000 \times 10 \times 5}{100} =$ ₹ 6000

By given, conditions

He actually receives interest = (6000-3320) =₹2680

Now, let the interest rate at which he receives interest = R %

Then, interest = $\frac{P \times R \times T}{100}$ (Here, T = 3 yrs)

$\Rightarrow 2680 = \frac{12000 \times R \times 3}{100} \Rightarrow R\% = \frac{2680 \times 100}{12000 \times 3} = 7\frac{4}{9}\%$

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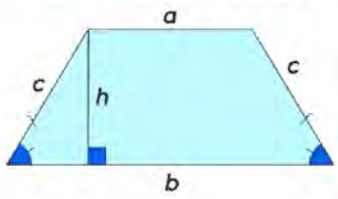
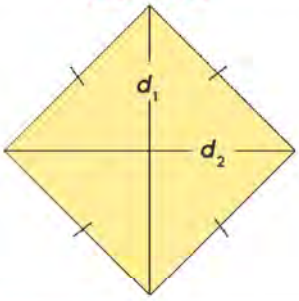
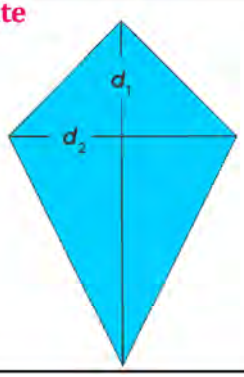
Isosceles Trapezoid 	**An isosceles trapezoid (or isosceles trapezium) is a quadrilateral with:** • One pair of opposite sides parallel (called bases) • The non-parallel sides (legs) are equal in length • Base angles are equal **Key Properties:** • **Area = 1/2×(base1+base2) × height** • **Perimeter = sum of all sides** Where: • $base_1$ and $base_2$ = lengths of the two parallel sides • height = perpendicular distance between the bases
Rhombus 	**A rhombus is a quadrilateral in which:** • All four sides are equal in length • Opposite sides are parallel • Opposite angles are equal • Diagonals bisect each other at 90° and are not equal **Key Properties:** • **Area =1/2×$Diagonal_1$×$Diagonal_2$** • **Perimeter = 4 × side** • **Where $Diagonal_1$ and $Diagonal_2$ are the lengths of the diagonals.**
kite 	**A kite is a quadrilateral with:** • Two pairs of adjacent sides that are equal • One pair of opposite angles (between unequal sides) is equal • Diagonals intersect at 90° (right angle) • One diagonal bisects the other **Key Properties:** • **Area =1/2×d_1×d_2** • **Where $d_1$and d_2 are the lengths of the diagonals.** • **No opposite sides are parallel.**

❑ EXAMPLES

Example: Find the area of a square with a side of 7 cm.
Solution:
Area of a square = side × side. Here, side = 7 cm
Substituting the values, 7 × 7= 49.
Therefore, the area of the square = 49 square cm.

Example: The dimensions of a rectangle are 15 cm and 8 cm. Find its area.
Solution:
The area of a rectangle is the product of its length and width, which can be represented by the formula: **Area = l × w.**
Substituting the given values, we get area of the rectangle = 15 × 8 = 120 cm^2

Example: Can you find the area of a circle with a radius of 14 cm?
Solution:
The radius of the circle = 14 cm
Area of a circle is calculated by the **formula π r^2**
Substituting the values in the formula, area = 227 × 14 × 14 = 616 square cm.

GENERAL SCIENCE

Physics

"Physics is the branch of science that studies the nature and properties of matter, energy, and their interactions. It seeks to understand the fundamental principles governing the universe, from the smallest particles to the largest cosmic structures."

UNITS AND MEASUREMENTS

Quantity: A measurable property of a physical system, such as length, mass, or time.
Unit: A standard reference used for measuring quantities, e.g., meter (m) for length, kilogram (kg) for mass.
Measurement: The process of comparing a physical quantity with a standard unit to express its magnitude.

❖ System of Units

- ✓ **CGS:** Centimeter, Gram, Second (small-scale measurements).
- ✓ **MKS:** Meter, Kilogram, Second (large-scale measurements).
- ✓ **FPS:** Foot, Pound, Second (old British system).
- ✓ **SI:** International System; includes base and derived units.

❖ Base Units and Derived Units in SI System

Physical Quantity	S.I. Unit	Symbol
Length	Metre	m
Mass	Kilogram	kg
Time	Second	s
Electric Current	Ampere	A
Thermodynamic Temperature	Kelvin	K
Amount of Substance	Mole	mol
Luminous Intensity	Candela	cd
Density	Kilogram per cubic metre	Kg/m^3
Velocity	Metre per second	m/s
Acceleration	Metre per second square	m/s^2
Force	Newton	N
Work, Energy	Joule	J
Power	Watt	W
Pressure	Pascal	N/m^2
Surface Tension	Newton per metre	N/m
Torque	Newton-metre	Nm
Electric Charge	Coulomb	C
Electric Potential	Volt	V
Electric Resistance	Ohm	Ω
Magnetic Induction	Tesla	T
Luminous Flux	Lumen	lm

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❖ **Applications:**
- ✓ **Medicine:** Cancer treatment (radiotherapy), medical imaging (tracers, PET scan).
- ✓ **Industry:** Sterilization of medical equipment, food preservation, thickness control.
- ✓ **Dating:** Carbon-14 dating for archaeological artifacts.
- ✓ **Energy:** Nuclear power generation.

❖ **Hazards:** Ionizing radiation can cause cell damage, genetic mutations, and cancer. Proper shielding and waste disposal are crucial.

Chemistry

MATTER, ATOMS AND MOLECULES

❖ **Matter:** Anything that has mass and occupies space.
- ▪ **Physical Classification (States of Matter):**
  - ✓ **Solids:** Fixed shape & volume; strong intermolecular forces; particles vibrate; incompressible.
  - ✓ **Liquids:** Fixed volume, no fixed shape; weaker intermolecular forces; particles slide; slightly compressible.
  - ✓ **Gases:** No fixed shape or volume; very weak intermolecular forces; particles random; highly compressible.
  - ✓ **Plasma:** Ionized gas (free electrons & ions); occurs at high temperatures (e.g., stars).
  - ✓ **Bose-Einstein Condensate (BEC):** Supercooled bosons behave as one quantum entity.
  - ✓ **Phase Changes:** Melting (S to L), Freezing (L to S), Boiling (L to G), Condensation (G to L), Sublimation (S to G), Deposition (G to S).
- ▪ **Chemical Classification:**
  - ✓ **Pure Substances:** Fixed composition, distinct properties.
    - ➢ **Elements:** Simplest form; cannot be broken down (e.g., O, Fe).
    - ➢ **Compounds:** Two+ elements chemically combined in fixed ratio; new properties (e.g., H_2O, CO_2).
  - ✓ **Mixtures:** Two+ substances physically mixed; components retain properties.
    - ➢ **Homogeneous (Solutions):** Uniform composition (e.g., Saltwater, Air).
    - ➢ **Heterogeneous:** Non-uniform composition; visibly separate components (e.g., Sand & water, Oil & water).

❖ **Atoms:** Smallest particle of an element retaining its chemical properties.
- ▪ **Atomic Structure:**
  - ✓ **Nucleus:** Central, dense.
    - ➢ **Protons (p+):** Positive charge, mass H≈1 amu.
    - ➢ **Neutrons (n):** Neutral, mass H≈1 amu.
  - ✓ **Electrons (e-):** Negative charge, orbit nucleus in shells, negligible mass.

▪ **Key Terms:**
- ✓ **Atomic Number (Z):** Number of protons; defines element; Z = electrons in neutral atom.
- ✓ **Mass Number (A):** Protons + Neutrons.

GENERAL ENGLISH

Noun

This part of speech refers to words that are used to name persons, things, animals, places, ideas or events.

Types of Nouns

TYPE	DESCRIPTION	EXAMPLES
Common Noun	General names of people, places, or things	girl, city, car
Proper Noun	Specific names; always capitalized	John, Paris, Monday
Concrete Noun	Things you can see, touch, hear, taste, or smell	apple, music, perfume
Abstract Noun	Ideas, emotions, or qualities – cannot be sensed directly	love, honesty, bravery
Collective Noun	Refers to a group of people or things	team, class, army
Countable Noun	Can be counted (singular/plural forms)	book/books, pen/pens
Uncountable Noun	Cannot be counted individually	water, sugar, knowledge

PRACTICE MCQs

1. Which of the following is a proper noun [GDC PRACTICE MCQ]
(a) City (b) Country
(c) New York (d) River

2. Which word is a collective noun [GDC PRACTICE MCQ]
(a) Apple (b) Family
(c) Beauty (d) Pencil

3. Identify the abstract noun in the sentence: [GDC PRACTICE MCQ]
"She was filled with happiness."
(a) She (b) Was
(c) Filled (d) Happiness

4. Which of the following is a countable noun [GDC PRACTICE MCQ]
(a) Water (b) Milk
(c) Chair (d) Rice

5. "Children" is the plural form of which noun [GDC PRACTICE MCQ]
(a) Child (b) Children
(c) Childhood (d) Childs

6. What type of noun is the word "team" [GDC PRACTICE MCQ]
(a) Abstract (b) Proper
(c) Collective (d) Compound

7. Identify the compound noun in the list. [GDC PRACTICE MCQ]
(a) Teacher (b) Classroom
(c) Dog (d) Country

8. Which of these is not a noun [GDC PRACTICE MCQ]
(a) Honesty (b) Quickly
(c) River (d) Man

9. What kind of noun is "India" [GDC PRACTICE MCQ]
(a) Common (b) Abstract
(c) Collective (d) Proper

10. Choose the correct plural form of "tomato." [GDC PRACTICE MCQ]
(a) Tomato (b) Tomatos
(c) Tomatoes (d) Tomatoe

Answer Key

1-c	2-b	3-d	4-c	5-a	6-c	7-b	8-b	9-d	10-c

GENERAL HINDI

वर्ण

वर्ण की परिभाषा:

वर्ण भाषा की सबसे छोटी और मूल इकाई होती है, जिसे बोला और लिखा जा सकता है।

हिंदी वर्णमाला में कुल वर्ण: लगभग 52

वर्णों के प्रकार:

हिंदी में वर्णों को दो मुख्य वर्गों में बाँटा गया है:

1. स्वर:

जिनका उच्चारण स्वतं= :प से किया जा सकता है।

कुल स्वर = 13

अ, आ, इ, ई, उ, ऊ, ऋ, ए, ऐ, ओ, औ, अं, अः

2. व्यंजन:

जो स्वर की सहायता से बोले जाते हैं, अकेले नहीं बोले जा सकते।

कुल व्यंजन = 33

मानक हिंदी वर्णमाला:

क, ख, ग, घ, ङ च, छ, ज, झ, ञ ट, ठ, ड, ढ, ण त, थ, द, ध, न प, फ, ब, भ, म य, र, ल, व

श, ष, स, ह **क्ष, त्र, ज्ञ (संयुक्त व्यंजन)**

शब्द

शब्द विचार की परिभाषा

दो या दो से अधिक वर्णो से बने, समूह को शब्द कहते है, जिसका कोई न कोई अर्थ अवश्य हो।

दूसरे शब्दों में- ध्वनियों के मेल से बने सार्थक वर्ण समुदाय को 'शब्द' कहते है।

उत्पति की दृष्टि से शब्द-भेद

(i) तत्सम शब्द (ii) तद्भव शब्द (iii) देशज शब्द (iv) विदेशी शब्द

(i) तत्सम शब्द :. संस्कृत भाषा के वे शब्द जो हिन्दी में अपने वास्तविक रूप में प्रयुक्त होते है, उन्हें तत्सम शब्द कहते है।

तत्सम	हिंदी	तत्सम	हिंदी
आम्र	आम	गोमल ,गोमय	गोबर
उष्ट्र	ऊँट	घोटक	घोड़ा
चंचु	चोंच	पर्यक	पलंग
त्वरित	तुरंत	भक्त	भात
शलाका	सलाई	हरिद्रा	हल्दी, हरदी
चतुष्पदिका	चौकी	सपत्री	सौत
उद्वर्तन	उबटन	सूचि	सुई

(ii) तद्भव शब्द :– ऐसे शब्द, जो संस्कृत और प्राकृत से विकृत होकर हिंदी में आये है, 'तदभव' कहलाते है।

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COMPUTER

Introduction

- **Definition:** An electronic device that processes data, converting it into information. It takes input, stores it, processes it, and produces output.
- **COMPUTER - Commonly Operated Machine Particularly Used for Trade, Technology, Education, and Research** [MP DI - 2022]
- **Characteristics:** Speed, Accuracy, Diligence, Versatility, Storage Capacity.
- **Instruction Pointer -** (also known as the Program Counter) is a register in the CPU that holds the memory address of the next instruction to be executed in a program. [MP DI - 2022]
- **Types of Computers (by Size/Power):** Supercomputers, Mainframes, Minicomputers, Microcomputers (Desktop, Laptop, Palmtop), and Workstations.
- **Development of Computer**
  - **Abacus**: First known calculating tool.
  - **Napier's Bones (1617)**: John Napier's rods for multiplication.
  - **Pascaline (1642)**: Blaise Pascal's mechanical calculator.
  - **Leibniz Calculator (1673)**: Enhanced Pascaline for multiplication/division.
  - **Analytical Engine (1830s)**: Babbage's conceptual computer, algorithms by Ada Lovelace.
  - **Tabulating Machine (1890s)**: Hollerith's punched card system, led to IBM.
- **Generations of Computers:**
  - **First Gen (1940s-1950s):** Vacuum Tubes, Machine Language, ENIAC, UNIVAC I.
  - **Second Gen (1950s-1960s):** Transistors, Assembly Language, Fortran, COBOL.
  - **Third Gen (1960s-1970s):** Integrated Circuits (ICs), High-level Languages, OS introduced.
  - **Fourth Gen (1970s-Present):** Microprocessors, VLSI, Personal Computers, GUI, Networking.
  - **Fifth Gen (Present-Future):** AI, Parallel Processing, Quantum Computing.

Input and Output Device

- **An input device:** is used by the user to give instructions or data to the computer for processing. [MP DI - 2017]
- **Output Device:** A device that receives data from a computer and converts it into a human-readable form, such as text, images, or sound (e.g., monitor, printer, or speakers).

INPUT DEVICES [UPSC DI – 2019, MP DI - 2017]	OUTPUT DEVICES
Keyboard	Monitor/Display [MP DI - 2017]
Mouse	Printer
Scanner	Speakers/Headphones
Microphone	Projector

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GENERAL AWARENESS

International and national organizations

International Organizations

Organization	Established	Headquarters	Primary Purpose / Focus
United Nations (UN)	1945	New York, USA	Promote international peace, security, and cooperation.
World Health Organization (WHO) [TELANGANA DI - 2023]	1948	Geneva, Switzerland	Global health issues.
International Monetary Fund (IMF)	1944	Washington, D.C., USA	Financial assistance; foster global monetary cooperation.
World Bank	1944	Washington, D.C., USA	Financial/technical assistance for economic development.
World Trade Organization (WTO)	1995	Geneva, Switzerland	Regulate international trade.
North Atlantic Treaty Organization (NATO)	1949	Brussels, Belgium	Military alliance for collective defense.
ASEAN	1967	Jakarta, Indonesia	Regional economic and political cooperation (Southeast Asia).
G20	1999	- (Forum)	Discuss global economic policies (19 countries + EU).
BRICS	-	- (Group)	Economic cooperation and development (Brazil, Russia, India, China, South Africa).
SAARC	1985	Kathmandu, Nepal	Economic and regional integration (South Asia).

National Organizations (India)

Organization	Established	Headquarters	Primary Purpose / Focus
Reserve Bank of India (RBI) [TELANGANA DI - 2023]	1935	Mumbai	Central banking institution regulating monetary policy.
Election Commission of India (ECI)	1950	New Delhi	Constitutional body for conducting free and fair elections.
NITI Aayog	2015	New Delhi	Policy think tank for strategic planning & cooperative federalism.
Indian Space Research Organisation (ISRO)	1969	Bengaluru	Space research and exploration.

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Government policies and schemes

CATEGORY	SCHEME NAME	KEY OBJECTIVE/DESCRIPTION
Rural Development	MGNREGA	Provides 100 days of guaranteed wage employment annually to rural households.
	Pradhan Mantri Awas Yojana – Gramin (PMAY-G)	Aims to provide pucca houses with basic amenities to rural poor.
	Sansad Adarsh Gram Yojana (SAGY)	Focuses on developing model villages through MPs' initiatives.
	National Rural Livelihood Mission (NRLM)	Empowers rural poor by promoting self-employment and Self-Help Groups (SHGs).
	Deen Dayal Upadhyaya Grameen Kaushalya Yojana (DDU-GKY)	Provides skill development and job opportunities to rural youth.
	Pradhan Mantri Gram Sadak Yojana (PMGSY)	Rural road connectivity.
	Smart Cities Mission	Urban infrastructure improvement.
	AMRUT [TELANGANA DI - 2023]	Urban infrastructure and sanitation.
Agriculture	Pradhan Mantri Fasal Bima Yojana (PMFBY)	Provides crop insurance against natural calamities, pests, and diseases.
	Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)	Ensures irrigation water for every farm and promotes water-use efficiency.
	Kisan Credit Card (KCC)	Provides affordable credit to farmers for crop production and other expenses.
	Soil Health Card Scheme	Provides soil health cards for balanced fertilizer use and better crop productivity.
	e-NAM (National Agriculture Market)	Digital platform for trading agricultural commodities across India.
	Rashtriya Krishi Vikas Yojana (RKVY)	Supports agricultural development.
	Paramparagat Krishi Vikas Yojana (PKVY)	Promotes organic farming.
Social Welfare for Farmers	Pradhan Mantri Kisan Samman Nidhi (PM-KISAN)	Provides annual income support of ₹6,000 to small and marginal farmers.
	Atmanirbhar Bharat Abhiyan – Agriculture Package	Strengthens infrastructure, logistics, and capacity building in agriculture.
	National Agriculture Market (eNAM)	Promotes online trading for better prices for farmers.
Livestock & Fisheries	National Livestock Mission	Focuses on sustainable development of the livestock sector.
	Pradhan Mantri Matsya Sampada Yojana (PMMSY)	Aims for the sustainable development of the fisheries sector.

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CURRENT AFFAIRS

SSC Protest 2025

- Massive disruptions during the Staff Selection Commission's (SSC) Selection Post Phase 13 examination have triggered a wave of protests across Delhi this week, bringing thousands of aspirants to the streets and also resulting in a strong backlash on social media.
- They have sought a complete review of the examination process, a rollback or reassessment of the vendor contract, and an independent investigation into the failures.
- Held between July 24 and August 1, the computer-based Phase 13 examination process was allegedly marred by abrupt cancellations, software crashes, biometric verification failures, and incorrect exam center allotments.

PM Modi Gets Namibia's Top Civilian Honour

- Prime Minister Narendra Modi was given Namibia's highest civilian award during his one-day state visit to the African nation on Wednesday. The award, called 'The Order of the Most Ancient Welwitschia Mirabilis', was presented by Namibia's President Netumbo Nandi-Ndaitwah.

PM Modi Honoured in Ghana with 'Order of the Star'

- PM Modi Honoured in Ghana with 'Order of the Star' In a historic diplomatic gesture, Prime Minister Narendra Modi has been conferred with Ghana's highest civilian award, the "Officer of the Order of the Star of Ghana", during his landmark visit to the country. The honour, bestowed by President John Dramani Mahama, recognizes PM Modi's global statesmanship, commitment to South-South cooperation, and hisrole in elevating India-Ghana bilateral ties.

Prime Minister Narendra Modi Honoured with Brazil's Highest Civilian Award

- Prime Minister Narendra Modi has been honoured with Brazil's highest civilian award, the Grand Collar of the National Order of the Southern Cross. This recognition was presented by Brazilian President Luiz Inácio Lula da Silva as a mark of respect for the growing diplomatic, economic, and cultural ties between India and Brazil.

India's Maratha Forts Added to UNESCO World Heritage List

- Maratha Military Landscapes of India were added to the UNESCO World Heritage List during the 47th session of the World Heritage Committee in Paris. This important recognition covers 12 historic forts built by the Maratha rulers between the 17th and 19th centuries. The listing highlights their unique military design and the rich history of India's fort architecture.

1st Indian to set foot on the International Space Station

- **IAF Group Captain Subhanshu Shukla**
- Part of Axiom 4 mission
- Axiom Mission 4 (Ax 4) is a private spaceflight to the International Space Station (ISS) operated by Axiom Space in partnership with SpaceX and NASA.
- **Crew members of the mission :** Peggy Whitson , Shubhanshu Shukla , S^{3}awosz Uznañski-Wiœniewski , Tibor Kapu.
- **Mission commander:** Peggy Whitson (USA)
- **Spacecraft used:** SpaceX Dragon spacecraft
- The Ax-4 astronauts will spend about 14 days aboard the orbiting lab, completing a record number of science investigations and STEM (science, technology, engineering and math) outreach events.

Inauguration of the highest railway arch bridge in the world

- Built over the Chenab River
- Marks the completion of the Udhampur-Srinagar-Baramulla Rail Link (USBRL).
- Aim: To integrate the Kashmir Valley with the national railway network.
- **Height of the bridge:** 359m
- **Length of the bridge:** 1315m
- Falls under the Northern Railways, which is headquartered in Baroda House(New Delhi).

G7 Summit 2025

- **Edition:** 51st
- **Host:** Canada
- **Member countries of the G7 :**
- Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States.
- Several non-G7 nations were invited as outreach partners, including India, Australia, Brazil, Mexico, South Africa, South Korea, and Ukraine.

3rd state in India to achieve 100% literacy

- Tripura (capital : Agartala)
- 1st state to achieve full literacy: Mizoram

Indian Navy inducts INS Arnala

- It's the first of the Anti-Submarine Warfare Shallow Water Craft.
- Equipped to conduct Sub-Surface Surveillance and Interdiction, Search and Rescue Missions, and Low-Intensity Maritime Operations (LIMO).

IPL 2025

- **Edition:** 18th
- **Winner:** Royal Challengers Bangalore
- **Runners-up:** Punjab Kings
- Number of Teams: 10
- Total Matches: 74
- Key Players: Sai Sudharsan (Most Runs), Prasidh Krishna (Most Wickets), both from Gujarat Titans.

Champions Trophy 2025

- **Edition:** 9th
- **Host:** Pakistan & UAE
- **Winners:** India
- **Runners-Up:** New Zealand
- **Player of the Series:** Rachin Ravindra

Oscars 2025

- **Edition:** 97th
- **Host:** Conan O'Brien
- Important Oscar Awardees 2025 Oscars

Category	Winner
Best Picture	Anora
Best Actor (Male)	Adrian Broody (The Brutalist)
Best Actor (Female)	Mikey Madison (Anora)
Best Director	Sean Baker (Anora)

Indians who have won Oscars

Winner	Movie
Kartiki Gonsalves, Guneet Monga	The Elephant Whisperers
M. M. Keeravani (Music), Chandrabose (Lyrics)	RRR (2022)
Bhanu Athaiya	Gandhi (1982)
Gulzar, Resul Pookutty, A.R. Rahman	Slumdog Millionaire (2008)

IIFA Awards 2025

Winners:

1. Best Picture: Laapataa Ladies
2. Best Direction: Kiran Rao (Laapataa Ladies)
3. Best Performance in a Leading Role (Male): Kartik Aaryan (Bhool Bhulaiyaa 3)
4. Best Performance in a Leading Role (Female): Nitanshi Goel (Laapataa Ladies)

Jnanpith Award 2025

- India's highest literary honour
- **Edition:** 59th
- **Awarded to:** Vinod Kumar Shukla
- Recognised for his outstanding contribution to Hindi literature.

Union Budget 2025

- **Theme:** Sabka Vikas
- **Presented by:** Finance Minister Nirmala Sitharaman
- **Aim:** To stimulate balanced growth across all regions.

Major highlights:

- No Income Tax for annual incomes up to ₹12 lakh, extended to ₹12.75 lakh for salaried taxpayers with deductions.
- TDS on Rent increased from ₹ 2.4 lakh to ₹ 6 lakh
- The time limit for updated tax returns is extended from 2 to 4 years.

categorized into **national parks**, **wildlife sanctuaries**, and **biosphere reserves**.

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