PHARMACY INDIA

PHARMACEUTICAL CHEMISTRY

A COMPETITIVE EXAMINATION BOOK

MODULE-2

START YOUR PREPARATION WITH US!

USEFUL FOR

AIIMS, DSSSB, ESIC, RAILWAY, CGHS
ISRO, NHM, SECL, NTPC, NCL, SEPOY,
STATE & CENTRAL GOVT.
PHARMACIST EXAMINATION

PHARMACY INDIA

PHARMACEUTICAL CHEMISTRY

Pharmacist Competitive Examination

Theory Book

ESIC | AIIMS | NHM | RRB | CGHS | ZILA PARISHAD | ISRO | DSSSB | RAJASTHAN | KERALA

Central Government Health Scheme

PHARMACY INDIA

DOWNLOAD OUR APP

Download PHARMACY INDIA App from Google Play Store

FOR PHARMA RELATED UPDATES

www.pharmacyindia.co.in

TABLE OF CONTENT

S.NO.	TOPIC	PAGE NO.
1.	Sources And Types Of Errors	1-4
2.	Volumetric analysis & Gravimetric analysis	5-16
3.	Inorganic Pharmaceuticals	17-28
4.	Heteroyclic Compound	29-31
5.	Drugs Acting on Central Nervous System	32-44
6.	Drugs Acting on Autonomic Nervous System	45-59
7.	Drugs Acting on Cardiovascular System	60-64
8.	Diuretics	65-67
9.	Hypoglycaemic Agents	68-70
10.	Analgesic And Anti-Inflammatory Agents & Nonsteroidal Anti-Inflammatory Agents (NSAIDs)	71-75
11.	Anti-Infective Agents	76-89
12.	Antibiotics, Tetracycline, Macrolide Antibiotics and Miscellaneous Agents	90-94
13.	Anti-Neoplastic Agents	95-98

Chapter 1

SOURCES AND TYPES OF ERRORS

Error

- Error is the difference between the true result (accepted true result) and the measured result.
- **Classification of errors**

✓ **Determinate (systematic) Errors:** they are those errors that are known and controllable errors e.g., instrument errors, personal errors.

✓ **Indeterminate (random) Errors:** these are random errors that are caused by uncontrollable or unknown fluctuations in variables that may affect experimental results.

Sources of Errors

1. **Personal errors:** They are exclusively caused due to 'personal equation' of an analyst and do not due to either on the prescribed procedure or methodology involved.
2. **Instrumental errors:** These are invariably caused due to faulty and uncalibrated instruments, such as: pH meters, UV-spectrophotometers, potentiometers etc.
3. **Reagent errors:**

- The errors that are solely introduced by virtue of the individual reagents, for examples.
- Impurities inherently present in reagents.
- High temperature volatilization of platinum (Pt).

4. **Constant Errors -**

- Multiple measurements show the same constant error
- E.g., if a scale of 15 cm actually measures 14.8 cm. Then it is measuring 0.2 cm more in every observation. This type of error will be same in all measurements done by the scale.

5. **Proportional Errors:** Proportional errors decrease or increase in proportion to the size of the sample taken for analysis. A common cause of proportional errors is the presence of interfering contaminants in the sample.
6. **Errors due to Methodology:** Both improper (incorrect) sampling and incompleteness of a reaction often lead to serious errors. A few typical examples are invariably encountered in titrimetric and gravimetric analysis.

Accuracy

- Accuracy is the degree of closeness of the measurements to the target or ref. value.
- Accuracy often referred as Bias error.
- Accuracy is measuring near the target or true or ref. value
- ISO defines accuracy as describing a combination of both types of observational error above (random and systematic), so high accuracy requires both high precision and high trueness.

- Formal solutions generally show changes in formality where volume changes associated with temperature.

7) Parts per million (ppm):

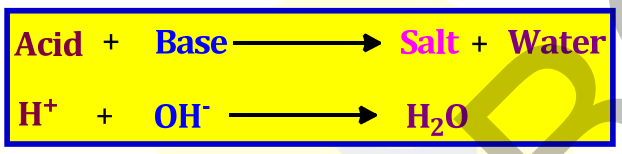
- Parts per million is frequently used to express the concentration of very dilute solutions and is expressed as 'ppm'.

Cppm = [(Mass of solute (in gm)/ mass of solution (in gm)] x 106 ppm

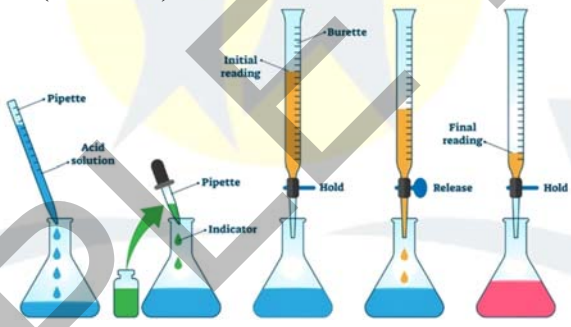
- These terms are also employed to express the concentration of impurities in pharmaceuticals.
- Parts per billion (ppb) is very rarely used.

ACID BASE TITRATION

- These titrations involve neutralisation reaction between acid and base. Titration of a base using standard solution of acid is termed as acidimetry. Example assay of sodium bicarbonate, sodium hydroxide.
- It involves the combination of H_3O^+ ions with OH ions to form water.



- During titration, one reagent(acid/base) is added progressively from the burette to the known volume of the other reagent (acid/base) in flask. An indicator is used to indicate end point.



- In acid-base titrations, when solutions of alkali are titrated against standard acid solutions and the estimation of concentration an alkali solution using a standard acid solution is called **Alkalimetry.**
- Similarly, the estimation of concentration an acid solution using a standard alkali solution is called **Acidimetry.**

Acid base theory

- Theories of acid and base There are three theories which explain the concept of acid and base

1. Arrhenius theory
2. Bronsted-Lowry theory
3. Lewis theory

- The **Arrhenius theory** of acids and bases states that "an acid generates H^+ ions in a solution whereas a base produces an OH^- ion in its solution".
- The **Bronsted-Lowry theory** defines "an acid as a proton donor and a base as a proton acceptor".
- Finally, the **Lewis definition** of acids and bases describes "acids as electron-pair acceptors and bases as electron-pair donors".

Summary of acid-base theories

THEORY	ACID	BASE

- Example: benzene, carbon tetrachloride

Assay of Non–aqueous Titration

- **Acidimetry**: It involves the quantitative determination of weak bases by non- aqueous titration.
- **Alkalimetry**: It involves the quantitative determination of weak acids by non-aqueous titration.

DETAILS	ACIDIMETRY	ALKALIMETRY
Samples	Basic drugs such as; ephedrine, adrenaline, caffeine, acyclovir	Acidic drugs such as nalidixic acid, fluorouracil
Solvents	Protogenic solvent – glacial acetic acid	Protophilic solvent – DMF (diethylformamide)
Titrant	Perchloric acid HClO3	Sodium methoxide
Indicator	Crystal violet – colour change from violet to yellowish green	Thymol blue – colour change from pink to blue

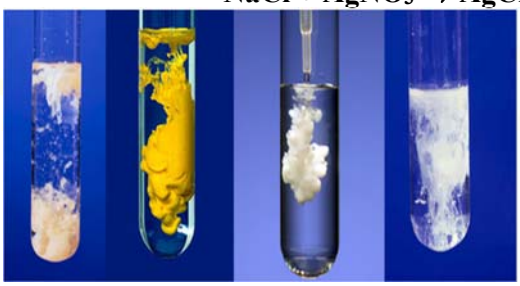
Indicators for Non-aqueous Titration

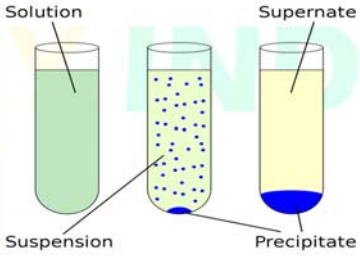
1. **Crystal violet:** It is used as a 0.5% (w/v) solution in glacial acetic acid. Its color change is from violet through blue, followed by green, then to greenish – yellow.
2. **Methyl red:** It is used as a 0.2% (w/v) solution in dioxane with a yellow to red colour change.
3. **I-naphthol benzene:** It is used as a 0.2% (w/v) solution in acetic acid gives a yellow to green colour. It gives sharp end points in nitromethane containing acetic anhydride for titrations of weak bases against perchloric acid.
4. **Oracet blue**: s used as a 0.5% (w/v) solution in acetic acid and is considered to be superior to crystal violet for titrations of bases in acetic acid with standard perchloric acid. The end point from blue to pink
5. **Thymol blue:** 0.5% (w/v) in methanol is used for titrations of substances acting as acids in dimethyformamide solution. The end point change from yellow to blue.
6. **Methyl violet:** 0.2% (w/v) in chlorobenzene, violet is blue.

PRECIPITATION TITRATION

- Precipitation is the process of conversion of a solution into solid by converting the substance into insoluble form.
- Precipitation titrations are most common types involve the reactions of metallic halides with silver nitrate.
- Such precipitation titration also known as Argentometric processes

$$NaCl + AgNO_3 \rightarrow AgCl\downarrow + NaNO_3$$





Classification of Hematinics

S.NO.	HEMATINICS DRUGS NAME
1.	Ferrous sulphate (FeSO4.7H2O)
2.	Ferrous fumarate (C4H2FeO4)
3.	Ferric ammonium citrate, (NH4)5[Fe(C6H4O7)2]
4.	Ferrous ascorbate, C12H14FeO12
5.	Carbonyl iron

FERROUS SULPHATE

- **Synonyms:** Iron vitriol, ferros Sulfas, Green vitriol
- **Chemical formula:** $FeSO_4.7H_2O$
- **Molecular Weight:** 278 g/mol

Market preparations	Storage condition	Uses
• FESATE TABLET • FERRON • HEMOVIT	Ferrous sulphate should therefore be kept in well closed containers.	• Iron supplements are indicated in patients with diseases caused by iron deficiency. • Iron deficiency anaemia, prophylaxis for iron deficiency in pregnancy.

FERROUS FUMARATE

- **Synonyms**: Iron (II) fumarate, Feostat
- **Chemical formula: ($C_4H_2FeO_4$)**
- **Molecular Weight: 169.9013 g/mol**

Market preparations	Storage condition	Uses
• Fersamal • Galfer • Cypress • Ecofer	• It should be stored in clean dry and well closed container. • It should be kept in cool place.	• Used to treat iron deficiency anaemia. • Used to treat pernicious anaemia.

FERRIC AMMONIUM CITRATE

- **Synonyms**: Ammonium iron (III) citrate, Iron ammonium citrate FerriSeltz
- **Chemical formula:** $(NH_4)_5[Fe(C_6H_4O_7)_2].2H_2O$
- **Molecular Weight:** 261.98 g/mol

Market preparations	Storage condition	Uses
• FERO-PLUS • L-RED • FEROGLO-HB	• It should be stored in well closed container protecting from light. • It should not be stored above 30 °C. • It should not be frozen.	• Used to treat iron deficiency.

• Vikram • Star brand • Vin shine	• It should be stored in a well closed container. • It should be keep in cool and dry place away from moisture and heat.	• It is also used in sugar industry for bleaching sugar cane. • It is used as an disinfectant. • It is used as an antiseptic

POTASSIUM PERMANGANATE

- **Chemical formula -** $KMnO_4$
- **Molecular weight –** 158.03 g/mol

Marketed Preparation	Storage Condition	Uses
• Potassium permanganate I.P	• It should be stored in well closed container. • Handle with care as it may explode if comes in touch with oxidizable substance.	• As disinfectant and deodorant • As an antiseptic • In treatment of urethritis • It oxidises protein and other bio – organic substance.

DENTAL PRODUCTS

- Products pertaining to teeth are known as dental products.
- Maintenance of oral hygiene that keeping mouth clean and free from disease is of immense importance.
- This is generally achieved by brushing of teeth and cleaning between the teeth on regular basis.

Types of dental products

Anticaries agent

- Dental caries or tooth decay is more or less a disease of the teeth caused by acids produced by the action of microorganisms on carbohydrates.
- **Example –** Sodium fluoride, Stannous fluoride

Dentifrices

- Dentifrices are the substances that are used along with the toothbrush for cleaning and polishing accessible surfaces of teeth.
- These are generally in the form of paste, powder, gel or liquid.
- **Examples –** calcium carbonate, dibasic calcium phosphate, calcium phosphate, sodium metaphosphate.

Desensitizing agent

- The desensitizers tend to decrease hypersensitivity of the teeth when applied to their outer surface, especially were erosion has occurred near the gum line.
- **Example –** Strontium chloride, Zinc chloride

Cement and fillers

- Dental cements are used to temporarily cover protection that had gone operation.

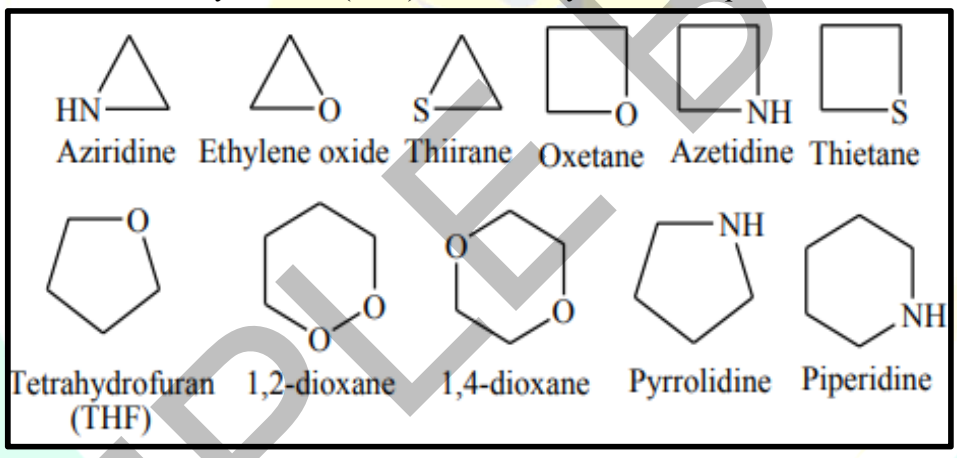
Chapter 4

HETEROYCLIC COMPOUND

- Heterocyclic compound is the class of cyclic organic compounds those having at least one hetero atom (i.e., atom other than carbon) in the cyclic ring system.
- The most common heteroatoms are nitrogen (N), oxygen (O) and sulphur (S).
- Based on the structural and electronic arrangement the heterocyclic compounds may be classified into two categories.

1. ALIPHATIC HETEROCYCLIC COMPOUNDS

- Cyclic heterocycles that do not contain any double bond.
- Examples of aliphatic heterocyclic compounds are Aziridine, Ethylene Oxide, Thiirane, Oxetane, Azetidine, Thietane, Tetrahydrofuran (THF), Dioxane, Pyrrolidine, Piperidine, etc.



2. AROMATIC HETEROCYCLIC COMPOUNDS

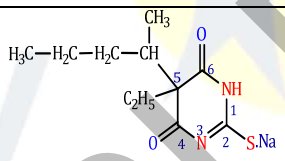
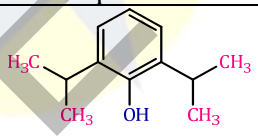
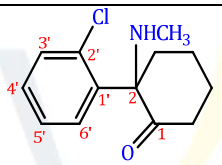
- Aromatic heterocyclic compounds, as the name suggests, are cyclic aromatic compounds.
- Aromatic Heterocyclic compounds obey Huckels Rule.
- It should be cyclic.
- It should be planar.
- It should not contain any sp3 hybridized atoms.
- It must have (4n+2) **π** electrons.
- Aromatic Heterocyclic compounds are analogous to Benzene.
- Examples: Furan, Pyrrole, Thiophene, Indole, Benzofuran, Carbazole, Quinoline, Isoquinoline, Imidazole, Oxazole, Pyrazole, Pyridazine, Pyrimidine, Purine, etc.

Stage III	Stage IV
Surgical Anesthesia	Respiratory paralysis
• Unconsciousness • Regular respiration	• No eye movement • Respiratory and cardiac arrest

Classification of General Anesthetics

Inhalational	Nitrous oxide, Ether, Halothane, Enflurane, Isoflurane, Desflurane, Sevoflurane
Parenteral	Diazepam, Lorazepam, Midazolam, Thiopental Ketamine, Fentanyl, Propofol

Individual Drugs

Drugs	Thiopental Sodium	Propofol	Ketamine HCl
Description	• It is the thiobarbiturate analog of pentobarbital, and an analog of thialbarbital.	• To induce general anesthesia, propofol is the drug used almost exclusively, having largely replaced sodium thiopental.	• Ketamine is structural analogue of phencyclidine. • A dissociative anesthetic. • Safe for childrens.
Structure		 2,6-diisopropyl phenol	
Brand Names	Thiowell 1000, Thiotone, Thipen	Diprivan, Neorof, Propowell	Ketaset, Ketalar, Ketamine HCl
Uses	• Anticonvulsants. • It also induces hypnosis. • For induction of anesthesia before the administration of inhalational anesthetics.	• It is an anaesthetic agent used for maintenance of general anesthesia. • In small doses it is used in carsciaus sedation.	• Induction of anaesthesia • Maintenance of anaesthesia • Conscious sedation • Can be used as convulsant

SEDATIVE AND HYPNOTICS

- Sedatives are central nervous system (CNS) depressant drugs that reduce excitement, tension, and produce relaxation.
- Hypnotics are drugs that depress the CNS and produce sleep similar to that of natural sleep.
- Both sedative and hypnotic action may reside in the same drug.
- At lower dose, the drug may act as sedative, while at a higher dose the same drug may act as hypnotic.

STAGES OF SLEEP

- **Stage 0 (awake):** From lying down to falling asleep. Eye movements are irregular or slowly rolling.

- By inhibiting sodium channels (phenytoin).
- By inhibiting gamma amino butyric acid (GABA) transaminase enzyme (Vigabatrin).
- By inhibition of T-type calcium currents (Ethosuximide, valproate).
- By GABA agonistic activity (benzodiazepine).

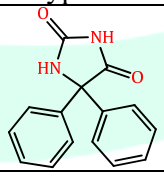
Types of epilepsy

1. **Grandmal:** In which the seizures last from 2 to 5 min, being characterized by a sudden loss of consciousness.
2. **Petitmal:** The seizures last from 5 to 30 sec, being characterized by brief attacks of unconsciousness, usually occur in children at the age of 4 to 8 years.
3. **Psychomotor seizures:** Characterized by attacks without convulsions and lasts from 2 to 3 min.

Classification of Anticonvulsants

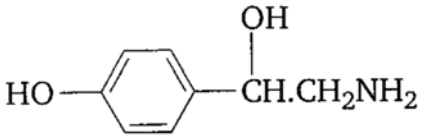
Classes	Drugs
Hydantoins	Phenytoin, Fosphenytoin
Iminostilbenes	Carbamazepine, Oxcarbazepine
Phenyltraiziness	Lamotrigine
Aliphatic carboxylic acid	Valproate, Divalproex
Aliphatic carboxylic acid	Valproate, divalproex
Barbiturate	Diazepam, Lorazepam, Clobazam, Clonazepam
Benzodiazepines	Phenobarbitone, Pentobarbitone
Cyclic GABA analogue	Gabapentin, Pregabaline
Succinimides	Ethosuximide
Newer Drugs	Levetiractam
	Topiramide
	Zonisamide
	Lacosamide
	Vigabatrin
	Topiramate

PHENYTOIN

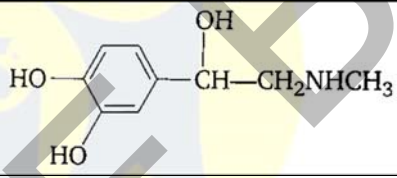
Description	• Phenytoin is the first anticonvulsant in which it was clearly demonstrated that anticonvulsant activity could definitely be separated from sedative-hypnotic activity.
Structure	
Brand Names	Dilantin, Epsolin, Eptoin
Uses	Generalised tonic-clonic seizures, Status epilepticus, Trigeminal neuralgia, Cardiac arrhythmias.

CARBAMAZEPINE

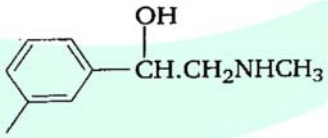
Description	• Carbamazepine inhibits voltage-dependent sodium channels. Carbamazepine, a urea derivative, is a broad spectrum

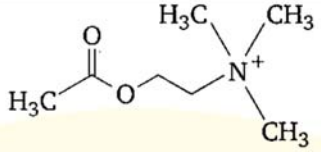
Structure	
Brand Name	Levophed, Norepinephrine, Levarterenol.
Uses	
➢ Treatment of peripheral vasomotor collapse. ➢ Acute cardiac infarction. ➢ Maintain blood pressure acute hypotension.	

EPINEPHRINE (ADRENALINE)

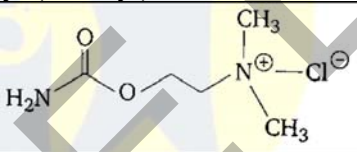
Description	➢ Adrenaline is the active hormone produced by the adrenal medulla. ➢ It may be prepared from catechol.
Chemical Name	4-[1-Hydroxy-2-(methylamino) ethyl]-1, 2 benzenediol 3, 4-dihydoxy-a [(methylamino) methyl] benzyl alcohol.
Structure	
Brand Name	Isuprel, Epinephrine, Adrenaline, Suprarenin, Levorenin.
Uses	
➢ Treatment of asthma. ➢ Cardiac arrest. ➢ Administered with local anesthetics to prolong the duration of action.	

PHENYLEPHRINE

Description	Phenylephrine is a synthetic compound of adrenaline like properties.
Chemical Name	1-(3-hydroxyphenyl)-2-methylamino ethanol.
Structure	
Brand Name	Drosyn, Adrianol, Lexatol, Meta sympatol, Mezaton, Mydfrin, Offalfrine.
Uses	
It is a sympathomimetic agent used in the treatment of hypotensive states such as: ➢ Circulatory failure. ➢ Spinal anesthesia. ➢ Drug induced hypotension. ➢ As a nasal decongestant in rhinitis and sinusitis.	

	➢ It has a role as a vasodilator agent.
Chemical Name	2-Acetyloxyethyl (trimethyl) azanium.
Structure	
Brand Name	Acetylcholine ophthalmic, Miochol, Miocholphes
Uses	➢ Cataract surgery ➢ Keratoplasty ➢ Myasthenia gravis ➢ Alzheimer's disease.

CARBACHOL

Description	➢ Carbachol is chemically a carboamate. ➢ It possesses a very high potency.
Chemical Name	2-Carbamoyloxyethyl (trimthyl) azanium chloride.
Structure	
Brand Name	Dichol, Miostat, Isopto, Carbastat, Carbopotic.
Uses	➢ It is used in the treatment of glaucoma. ➢ It is also used in opthalmic surgery. ➢ Carbachol eye drops are used to decrease the pressure in the eye for people with glaucoma. ➢ It is also used to stimulate micturition by contraction of depressor muscles.

PILOCARPINE

Description	It is an alkaloid obtained from the dried leaflets of Pilocarpus jaborandi.
Brand Name	Myostigmine, Chibropilocarpine, Ocusert pilo.
Uses	➢ Parasympathomimtic agent. ➢ It is an antidote for insect poisoning. ➢ Used in the treatment of glaucoma of the eye.

CHOLINESTERASE INHIBITORS

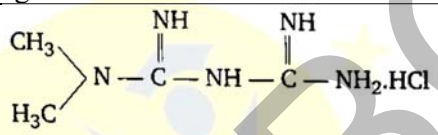
- Cholinesterase inhibitors (also called acetyl cholinesterase inhibitors) are a group of medicines that block the normal breakdown of acetyl choline.
- Acetyl choline is the main neurotransmitter found in the body. It has functions in both the peripheral nervous system (PNS) and the central nervous system (CNS).

2. **Insoluble insulin:** Prepared by combination of insulin with globin or protamine. There are absorbed slowly and are long acting.
3. **Biphasic insulin injection:** Prepared by mixing suspension of crystalline insulin with solution of crystalline insulin. Onset of action is quick and prolonged.

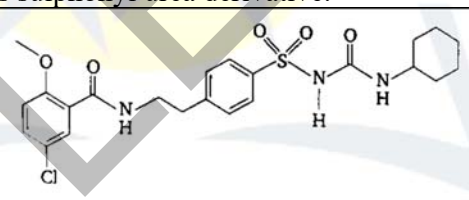
Insulin can be classified according to their duration of action as follows:

Short acting Insulin	**Insulin injection (I.P.)** (plain insulin injection): It is a sterile solution of insulin.
	Insulin injection (I.P.) (plain insulin injection): It is a sterile solution of insulin.
Intermediate acting insulin	Insulin zinc suspension (I.Z.S. Insuliun lente), Isophane insulin injection [Isophane insulin (NPH)]
Long-acting insulins	Protamine zine insulin injection, Insulin zinc suspension (crystalline) (Cryst I.Z.S.)

METFORMIN HYDROCHLORIDE

Description	Metformin is a biguanide derivative.
Structure	
Chemical Name	1, 1-Dimethyl biguanide hydrochloride.
Brand Name	Gluformin, DMCG, Diabex, Fluamine, Gliguanid
Uses	It is used in the treatment of diabetes mellitus.

GLIBENCLAMIDE

Description	Glibenclamide is sulphonyl urea derivative.
Structure	
Chemical Name	1-[4-(2-(5-chloro-2-methoxybenzamido)-ethyl) benzenesulphonyl]-3-cyclohexylurea.
Brand Name	Daonil, Glybenclamide, Glyburide, Diabeta, Euglucon
Uses	➢ It is used in the treatment of diabetes mellitus. ➢ It is also used in controlling high blood sugar. ➢ Prevent kidney damage, blindness, nerve problems, loss of limbs and sexual function problem.

GLIMEPIRIDE

Description	It is less preferred than metformin.
Brand Name	Amaryl
Uses	➢ It is used to treat diabetes mellitus type 2. ➢ Its use is recommended together with diet and exercise.

PIOGLITAZONE

Description	Pioglitazone is a diabetic drug (thiazolidinedione-Type), also called glitazones.
Brand Name	Actos, Dioglit, Diavista, G-tase, Geoglit

Uses	➢ Treatment of acute lymphoblastic leukemias. ➢ Choriocarcinoma. ➢ Immunosuppressant.

DACTINOMYCIN

Description	Dactinomycin is a high molecular weight antineoplastic antibiotic. It is isolated from a liquid culture of microorganisms streptomyces parvulus.
Brand Name	Cosmegen, Damozen, Dactino, Dactinoget
Uses	It is used as a part of combination chemotherapy for treating: ➢ Wilms tumor, ➢ Childhood rhabdomyosarcoma ➢ Ewing's sarcoma and metastatic ➢ Non-seminomas testicular cancer

DOXORUBICIN HYDROCHLORIDE

Description	Doxorubicin Hydrochloride is the hydrochloride salt of doxorubicin, an anthracycline antibiotic with antineoplastic activity.
Brand Name	Adrim, Cadria, Dobixin, Doxolem, Doxomed, Rubinat.
Uses	➢ It is used in combination with other medications to treat certain types of bladders, breast, lung, stomach and ovarian cancer. ➢ It is also used to treat Hodgkin's lymphoma and non-Hodgkin's lymphoma. ➢ It is used to treat certain types of leukemias (cancer of white blood cells).

VINBLASTINE SULPHATE

Description	➢ Vinblastine sulphate is the sulphate salt of Vinblastine. ➢ Vinblastine is a natural alkaloid, obtained from Catharanthus roseus (Madagascar Periwinkle). ➢ This plant possesses antineoplastic properties.
Brand Name	Velban
Uses	It is used in the treatment of: ➢ Breast cancer ➢ Testicular cancer ➢ Lymphomas ➢ Neuroblastoma ➢ Hodgkin's and non-Hodgkin's lymphomas ➢ Kaposi's sarcoma.

AIIMS

RRB

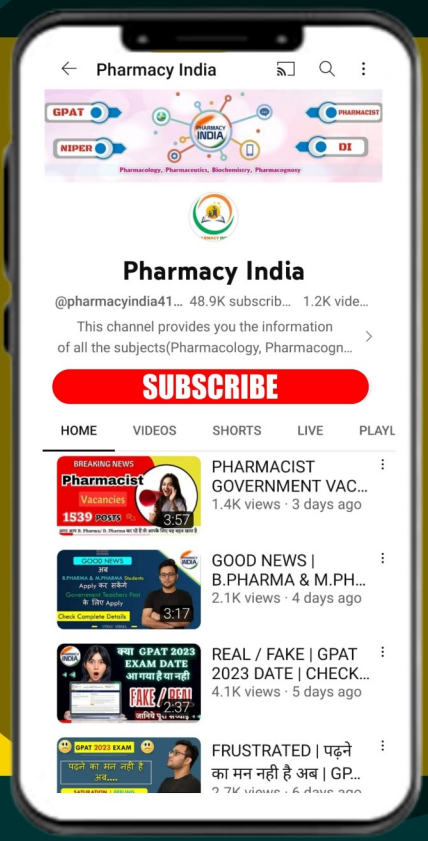
CGHS,
HPPSC, BTSC, ISRO,
KERALA PSC,
MP PHARMACIST,
SECL, DSSSB,
BCCL

ESIC

UP NHM

ABOUT PHARMACY INDIA

Our classes set up with an aim to provide coaching to the aspiring students who are dedicated and want to achieve excellence in their career. we nurture aspirants and facilitated achievement and we specialized in providing correct and relevant information related to Pharma institute admission for higher education.



PHARMACY INDIA

Dayalpuram, Street-4, Khatauli Muzaffarnagar, 251201

8171313561, 8006781759

pharmacyindia24@gmail.com