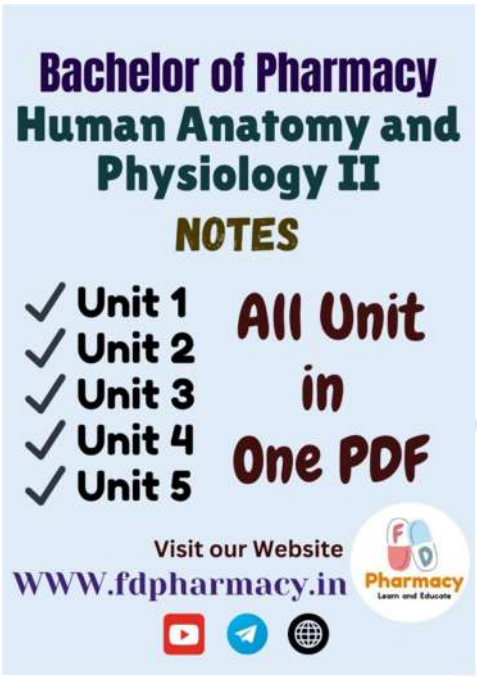
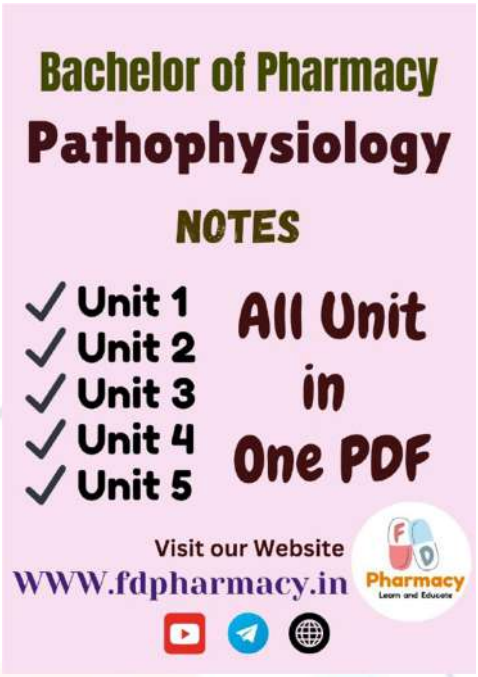
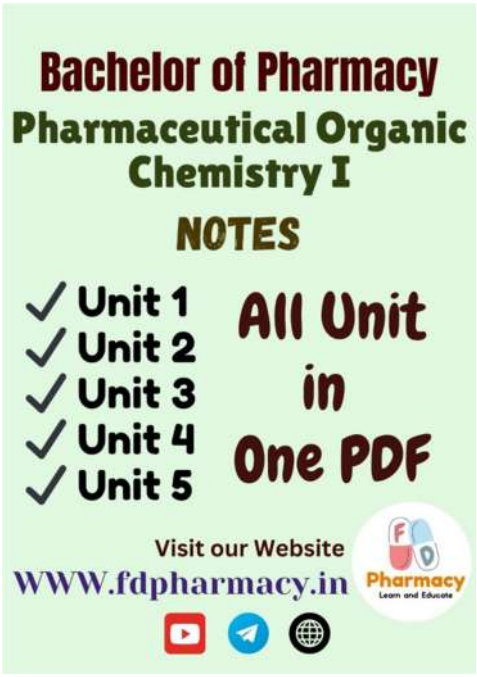
# WELCOME

# TO




Bachelor of Pharmacy
Human Anatomy and Physiology II
NOTES
Unit 1
Unit 2
Unit 3
Unit 4
Unit 5
All Unit in One PDF
Visit our Website
WWW.fdpharmacy.in
Pharmacy
Learn and Educate


Bachelor of Pharmacy
Pathophysiology
NOTES
Unit 1
Unit 2
Unit 3
Unit 4
Unit 5
All Unit in One PDF
Visit our Website
WWW.fdpharmacy.in
Pharmacy
Learn and Educate


Bachelor of Pharmacy
Pharmaceutical Organic Chemistry I
NOTES
Unit 1
Unit 2
Unit 3
Unit 4
Unit 5
All Unit in One PDF
Visit our Website
WWW.fdpharmacy.in
Pharmacy
Learn and Educate


Bachelor of Pharmacy
Biochemistry
NOTES
Unit 1
Unit 2
Unit 3
Unit 4
Unit 5
All Unit in One PDF
Visit our Website
WWW.fdpharmacy.in
Pharmacy
Learn and Educate


Bachelor of Pharmacy
Computer Applications in Pharmacy
NOTES
Unit 1
Unit 2
Unit 3
Unit 4
Unit 5
All Unit in One PDF
Visit our Website
WWW.fdpharmacy.in
Pharmacy
Learn and Educate


Bachelor of Pharmacy
Environmental Sciences
NOTES
Unit 1
Unit 2
Unit 3
Unit 4
Unit 5
All Unit in One PDF
Visit our Website
WWW.fdpharmacy.in
Pharmacy
Learn and Educate

# PHARMACEUTICAL ORGANIC CHEMISTRY – I

## UNIT 5

TOPIC :

- **Aliphatic amines*–** Basicity, effect of substituent on Basicity. Qualitative test, Structure and uses of Ethanolamine, Ethylenediamine, Amphetamine

# Aliphatic Amines

→ Amines are organic compounds derived from ammonia ($NH_3$) by replacing one or more hydrogen atoms with alkyl or aryl groups.

→ Aliphatic amines contain only alkyl groups attached to the nitrogen atom.

General Formula

- Primary (1°) amine: $R–NH_2$
- Secondary (2°) amine: $R_2–NH$
- Tertiary (3°) amine: $R_3–N$
  (where R = alkyl group)

Examples

- Methylamine: $CH_3NH_2$ (1°)
- Dimethylamine: $(CH_3)_2NH$ (2°)
- Trimethylamine: $(CH_3)_3N$ (3°)

## Basicity of Aliphatic Amines

Basicity

Basicity is the ability of a compound to **accept a proton ($H^+$).**

- In amines, the nitrogen atom has a **lone pair of electrons,** which can accept a proton.
- Thus, amines act as **Lewis bases.**

Aliphatic Amines

- The **lone pair on nitrogen** is readily available for protonation.
- In aqueous solution, they form **alkylammonium ions:**

$$R\text{–}NH_2 + H_2O \rightleftharpoons R\text{–}NH_3^+ + OH^-$$

# Effect of Substituents on Basicity

→ Substituents can affect basicity through inductive and solvation effects.

1. Inductive Effect (–I and +I effects)

- **Electron-donating groups (EDG)** like alkyl groups push electrons toward nitrogen via **+I effect**, increasing electron density and **increasing basicity**.
- More alkyl groups → greater +I effect → stronger base.

**Order in gas phase:**
3°amine>2°amine>1°amine>$NH_3$

2. Solvation Effect in Aqueous Solution

- In water, **hydrogen bonding** stabilizes the protonated amine.
- Primary amines are better solvated than tertiary, so:

**Order in water (aqueous phase):**
2°amine>1°amine>3°amine>$NH_3$

# Qualitative Tests for Aliphatic Amines

1. Litmus Test

- **Test**: Add a few drops of the amine to moist **red litmus paper**.
- **Observation**: The red litmus turns **blue.**
- **Inference**: Confirms **basic nature** of the amine.

2. Carbylamine Test **(for** Primary Amines **only)**

**Also called Isocyanide Test**

- **Reagents**: Chloroform ($CHCl_3$) + alcoholic KOH
- **Procedure**: Heat the primary amine with $CHCl_3$ and alcoholic KOH.
- **Reaction**:

$$R\text{-}NH_2 + CHCl_3 + 3KOH \rightarrow R\text{-}NC + 3KCl + 3H_2O$$

**Observation**: Formation of foul-smelling isocyanide (R–NC).

**Inference**: Positive test indicates presence of a primary aliphatic amine.

3. Reaction with Acyl Chlorides

Used for 1° and 2° amines

- **Reagent**: Acid chloride (e.g., acetyl chloride)
- **Reaction with 1° Amine**:

$$R\text{–}NH_2 + CH_3COCl \rightarrow R\text{–}NHCOCH_3 + HCl$$

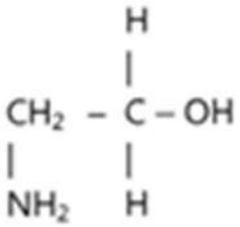
**Observation**: Formation of white precipitate of amide.

**Inference**: Confirms presence of primary or secondary amine

# Ethanolamine

→ Chemical Formula: $C_2H_7NO$
→ IUPAC Name: 2-Aminoethanol
→ Common Name: Ethanolamine
→ Other Names: Monoethanolamine (MEA)
→ Functional Groups:
- Hydroxyl group (–OH)
- Amino group ($–NH_2$)

## Structure of Ethanolamine




- It is a simple alkanolamine.
- Contains both:
  - Alcohol group (–OH)
  - Primary amine group ($–NH_2$)

## Uses of Ethanolamine:

✓ In Pharmaceutical Industry:
- Used as an alkalizing agent in creams, lotions, and ointments.
- Acts as a buffering agent in topical formulations.
- Used in the preparation of emulsifiers and soap bases.
- Found in some cough syrups and eye drops.

✓ As a Surfactant and Emulsifier:
- Common ingredient in:
  - Shampoos
  - Conditioners

    - Cleansers
  - Helps to stabilize emulsions and acts as a foam booster.

✓ In Gas Treatment:

  - Used in scrubbing acidic gases like $CO_2$ and $H_2S$ from natural gas and refinery streams.
  - Forms water-soluble salts with acidic gases.

✓ In Detergents and Soaps:

  - Improves cleaning power, solubility, and foam stability.
  - Used in industrial degreasers, floor cleaners, and surface disinfectants.

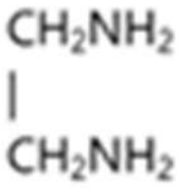
✓ In the Production of Other Chemicals:

  - Intermediate in the synthesis of:
    - Detergents
    - Textile additives
    - Cosmetics
    - Corrosion inhibitors
    - Herbicides (e.g., glyphosate)

# Ethylenediamine

→ Chemical Formula: $C_2H_8N_2$
→ IUPAC Name: 1,2-Diaminoethane
→ Common Name: Ethylenediamine (EDA)
→ Functional Group:
- Two primary amine groups ($-NH_2$) on adjacent carbon atoms

## Structure of Ethylenediamine



- Contains a two-carbon ethylene backbone with a $-NH_2$ group at each end.

## Uses of Ethylenediamine:

✓ In Pharmaceutical Industry:
- Used as an intermediate in the manufacture of:
  - Antihistamines (e.g., Tripelennamine)
  - Chelating agents like EDTA (Ethylenediaminetetraacetic acid)
- Used to stabilize some vaccine and injection solutions.

As a Chelating Agent:
- Binds to metal ions via both nitrogen atoms to form chelates.
- Forms stable complexes with:
  - Nickel ($Ni^{2+}$)
  - Copper ($Cu^{2+}$)

    - Cobalt ($Co^{2+}$)
  - Important in analytical and coordination chemistry.

✓ In Polymer and Resin Industry:
  - Used in the production of:
    - Polyamides
    - Epoxy resins
    - Urethane foams
  - Acts as a curing agent and hardener.

✓ In Detergents and Fabric Softeners:
  - Used to produce cationic surfactants and fabric softener bases.
  - Provides alkalinity and helps in dirt removal.

✓ In Agrochemical Industry:
  - Used in the synthesis of:
    - Herbicides
    - Fungicides
    - Pesticides

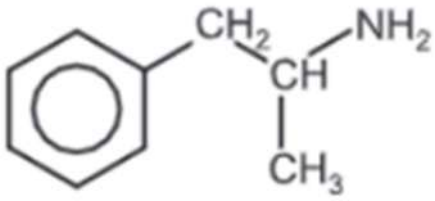
✓ In Corrosion Inhibitors and Coolants:
  - Acts as a corrosion inhibitor in boiler water treatments.
  - Added to coolants and antifreeze formulations.

✓ In Research and Coordination Chemistry:
  - Used as a ligand in inorganic synthesis.
  - Part of Werner complexes and coordination compound studies.

# Amphetamine

→ Chemical Formula: $C_9H_{13}N$
→ IUPAC Name: 1-Phenylpropan-2-amine
→ Common Name: Amphetamine
→ Drug Class: CNS stimulant, sympathomimetic amine

## Structure of Amphetamine




- Structure contains:
  - A phenyl ring ($C_6H_5$–)
  - A propyl chain with a methyl group (–$CH_3$) and a primary amine group (–$NH_2$)

## Uses of Amphetamine:

✓ Treatment of ADHD (Attention Deficit Hyperactivity Disorder):
- One of the primary drugs used for treating ADHD.
- Improves attention span, concentration, and behavior control.

✓ Treatment of Narcolepsy:
- Used to promote wakefulness in patients with narcolepsy (a sleep disorder).
- Reduces excessive daytime sleepiness.

✓ Appetite Suppressant:
- Historically used in the treatment of obesity (now limited due to abuse potential).

- Suppresses appetite by stimulating the hypothalamus.

✓ CNS Stimulant:

- Increases the release of dopamine and norepinephrine in the brain.
- Enhances alertness, focus, mood, and physical performance.

✓ Military and Aviation Use:

- Sometimes issued in military/aviation settings as "go pills" to maintain alertness during long missions (under strict supervision).

✓ For Depression (historical use):

- Used in the past to treat treatment-resistant depression, but replaced by safer drugs today.