WELCOME

TO

This is an Education Platform

We Provide PDF Notes for Pharmacy Students

Web Site http://www.fdspharmacy.in/

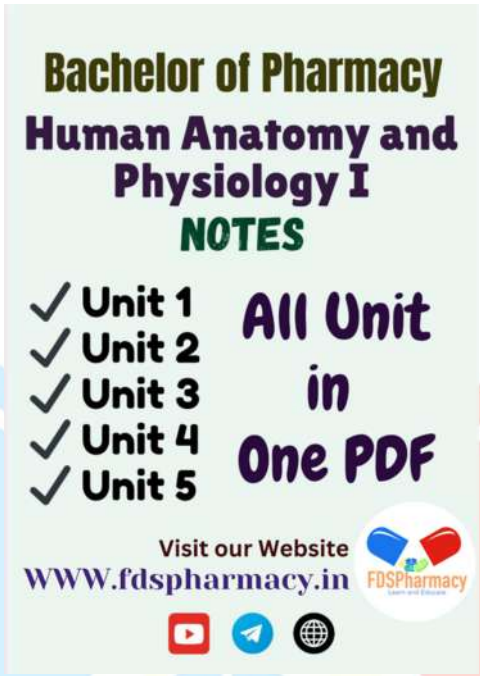
You tube https://www.youtube.com/c/FDSpharmacy

Telegram https://t.me/Fdspharmacy

App https://play.google.com/store/apps/details?id=com.FDSPharmacyMedia.FDSPharmacy

E-mail fdspharmacyinfo@gmail.com


Bachelor of Pharmacy
Communication skills
NOTES
Unit 1
Unit 2
Unit 3
Unit 4
Unit 5
All Unit in One PDF
Visit our Website
WWW.fdspharmacy.in
FDSPharmacy


Bachelor of Pharmacy
Human Anatomy and Physiology I
NOTES
Unit 1
Unit 2
Unit 3
Unit 4
Unit 5
All Unit in One PDF
Visit our Website
WWW.fdspharmacy.in
FDSPharmacy


Bachelor of Pharmacy
Pharmaceutical Analysis I
NOTES
Unit 1
Unit 2
Unit 3
Unit 4
Unit 5
All Unit in One PDF
Visit our Website
WWW.fdspharmacy.in
FDSPharmacy


Bachelor of Pharmacy
Pharmaceutical Inorganic Chemistry
NOTES
Unit 1
Unit 2
Unit 3
Unit 4
Unit 5
All Unit in One PDF
Visit our Website
WWW.fdspharmacy.in
FDSPharmacy


Bachelor of Pharmacy
Remedial Biology
NOTES
Unit 1
Unit 2
Unit 3
Unit 4
Unit 5
All Unit in One PDF
Visit our Website
WWW.fdspharmacy.in
FDSPharmacy


Bachelor of Pharmacy
Pharmaceutics I
NOTES
Unit 1
Unit 2
Unit 3
Unit 4
Unit 5
All Unit in One PDF
Visit our Website
WWW.fdspharmacy.in
FDSPharmacy

PHARMACEUTICAL INORGANIC CHEMISTRY

UNIT 3

TOPIC :

- **Antimicrobials :** Mechanism, classification, Potassium permanganate, Boric acid, Hydrogen peroxide, *Chlorinated lime*, Iodine and its preparations

Antimicrobial Agents

→ Antimicrobial agents are chemical substances or drugs that are used to kill or inhibit the growth of microorganisms, including bacteria, viruses, fungi, and protozoa.

They can act in two ways:

- **Microbicidal** – Kill the microorganisms
- **Microbistatic** – Inhibit or stop the growth of microorganisms

Type	Description	Examples
Antiseptics	Used on **living tissues** (skin, wounds) to kill/inhibit microbes	Hydrogen peroxide, Silver nitrate
Disinfectants	Used on **non-living surfaces** to kill microbes	Sulphur dioxide, Bleaching powder
Germicides	Kill microorganisms on **both living and non-living surfaces**	Phenol, Formaldehyde
Bacteriostatics	Inhibit growth of bacteria without killing them	Chloramphenicol
Sanitizers	Used for **cleaning purposes** to reduce microbial load	Alcohol-based hand rubs, Soaps
Sterilization	A **process**, not a substance, that kills **all forms** of microorganisms	Autoclaving, Dry heat

1. Antiseptics

- Used externally on living tissues (e.g., skin, mucous membranes).
- Prevent infection in cuts, wounds, burns.
- Should be non-toxic, non-irritant, and broad-spectrum.
- Examples: Hydrogen peroxide, Silver nitrate, Iodine

2. Disinfectants

- Used on non-living surfaces like surgical tools, floors, toilets.

- Kills bacteria, viruses, and fungi.
- Should not be used on human tissues.
- Examples: Sulphur dioxide, Formaldehyde, Bleach (NaOCl)

3. Germicides

- Kill microorganisms on both living and non-living surfaces.
- Classified further as:
  - Bactericides – Kill bacteria
  - Virucides – Kill viruses
  - Fungicides – Kill fungi
- Examples: Phenol, Glutaraldehyde

4. Bacteriostatics

- Prevent multiplication of bacteria but do not kill them.
- Can be used on both living and non-living surfaces.
- Useful in long-term bacterial control.
- Example: Chloramphenicol

5. Sanitizers

- Used for cleaning and maintaining hygiene in public areas.
- Lower the number of microorganisms to a safe level.
- Examples: Soap, Alcohol-based hand rubs, Sanitizing sprays

6. Sterilization

- It is a complete elimination of all forms of microbial life (including spores).
- Achieved by:
  - Physical methods: Heat (autoclave), UV radiation
  - Chemical methods: Ethylene oxide gas
- Used in surgical instruments, pharmaceutical preparations, lab media.

Mechanism of action of Antimicrobials

→ Microorganism mainly contains proteins (enzymes) to survive.

→ Anti-microbials act by changing their protein structure which results in death of microorganism.

→ Anti-microbials mainly act by 3 mechanism:

- Oxidation
- Halogenation
- Precipitation

Mechanism	Action	Examples
Oxidation	Oxidizing agents destroy proteins and enzymes by breaking functional groups	Hydrogen peroxide, Potassium permanganate
Halogenation	Halogen-releasing compounds (like chlorine, iodine) attach halide atoms to protein structures, making them inactive	Iodine, Chlorine compounds
Precipitation	Metallic salts bind to proteins, causing precipitation and inactivation	Silver nitrate, Zinc oxide

POTASSIUM PERMANGANATE

- Chemical Formula: $KMnO_4$
- Molecular Weight: 158 g/mol
- Synonym: Condy's Crystals

Preparation

Potassium permanganate is prepared from potassium manganate (K_2MnO_4) under acidic conditions.

$$2K2MnO4+4HCl \rightarrow 2KMnO4+MnO2\downarrow+2H2O+4KCl$$

Physical Properties

- Appears as dark purple or violet crystalline solid
- Odourless
- Has a sweet astringent taste (not consumed orally)
- Soluble in water and alcohol, forming a deep purple solution
- Acts as a strong oxidizing agent

Chemical Properties

- Acts as a strong oxidizer, especially in acidic or neutral medium
- Decomposes when heated, releasing oxygen
- Reacts with organic matter, bacteria, and toxins by oxidation
- In acidic medium:

$$2KMnO4+5H2O2+3H2SO4 \rightarrow 2MnSO4+K2SO4+5O2\uparrow+8H2$$

Uses

✓ Used as a topical antimicrobial agent
→ For cleaning wounds and infected skin.

✓ Used in the treatment of various skin conditions
→ Fungal infections (like athlete's foot), eczema, dermatitis.

✓ Acts as a mild antiseptic
→ In diluted form (0.01–0.1%) for bathing infected areas.

✓ Used as a strong oxidizing agent
→ In laboratory analysis and water purification.

BORIC ACID

- Chemical Formula: H_3BO_3
- Molecular Weight: 61.83 g/mol
- Synonym: Hydrogen Borate

Preparation

Boric acid is prepared by the reaction of hydrochloric acid (HCl) with borax ($Na_2B_4O_7 \cdot 10H_2O$) in the presence of water:

$$Na2B4O7 \cdot 10H2O + 2HCl \rightarrow 2NaCl + 4H3BO3$$

Physical Properties

- Appears as a white, crystalline solid
- Odourless
- Has a slightly sweet or pearly taste
- Soluble in water
- Slightly soluble in alcohol

Chemical Properties

- Weak monobasic acid
- In aqueous solution, acts as a Lewis acid by accepting hydroxyl ions (OH^-)
- Forms borate salts when reacted with alkalis
- Shows antiseptic and antifungal properties

Uses

- ✓ Used as a mild antimicrobial agent
  → For eye washes, wound cleansing, and burn treatment.
- ✓ Used as a preservative
  → In food products and pharmaceuticals (limited use today due to toxicity concerns with high doses).
- ✓ Used in cosmetics and personal care
  → Present in powders, creams, and lotions for skin protection.
- ✓ Used in buffer solutions
  → Helps in pH control in ophthalmic and cosmetic preparations.
- ✓ Sometimes used as an insecticide and wood preservative

HYDROGEN PEROXIDE

- Chemical Formula: H_2O_2
- Molecular Weight: 34.01 g/mol
- Synonym: Peroxide of Hydrogen

Preparation

Hydrogen peroxide is commercially prepared by the anthraquinone process, but it can also be prepared in the lab by reacting barium peroxide (BaO_2) with dilute sulfuric acid (H_2SO_4):

$$BaO2+H2SO4 \rightarrow BaSO4\downarrow+H2O2$$

Physical Properties

- Colorless, clear liquid
- Odourless
- Has a slightly bitter taste
- Miscible with water in all proportions

Chemical Properties

- Acts as a strong oxidizing agent
- Also shows mild reducing properties under certain conditions
- Releases nascent oxygen (O) which is responsible for its germicidal and bleaching action
- Reacts with oxidizable substances, e.g.:

$$H2O2+PbS \rightarrow PbSO4+H2O$$

Uses:

✓ Used as a topical antiseptic

→ For cleaning wounds, cuts, and mouth ulcers (in diluted form, usually 3%).

✓ Used as an antimicrobial agent

→ Kills bacteria by oxidizing their cell components.

✓ Used as a disinfectant

→ In household cleaners and hospital sterilization.

CHLORINATED LIME

- Chemical Formula: $Ca(OCl)Cl$ or $Ca(ClO)_2 \cdot CaCl_2 \cdot Ca(OH)_2 \cdot H_2O$ (complex composition)
- Molecular Weight: ~142.98 g/mol (approximate due to variable hydration)
- Synonym: Bleaching Powder

Preparation

Chlorinated lime is prepared by passing chlorine gas (Cl_2) over dry slaked lime ($Ca(OH)_2$):

$$Ca(OH)2+Cl2 \rightarrow Ca(OCl)Cl+H2O$$

Physical Properties

- Appears as a white or pale yellowish powder
- Strong chlorine-like odour
- Slightly soluble in water
- Unstable and decomposes on exposure to air, light, or moisture
- Releases nascent oxygen and chlorine, responsible for germicidal action

Chemical Properties

- Acts as a strong oxidizing agent
- Liberates nascent oxygen (O) and chlorine when in contact with water or acids:

$$Ca(OCl)Cl+H2O \rightarrow Ca(OH)2+Cl2\uparrow$$

Uses

- ✓ Used as a disinfectant and germicide
  → For water purification, sanitation, and hospital disinfection.
- ✓ Used as a bleaching agent
  → In paper, textile, and laundry industries.
- ✓ Used in disinfection of drinking water wells
  → Especially in rural and disaster-hit areas.
- ✓ Used in disinfection of floors, toilets, drains, and public places.
- ✓ Used for sterilizing instruments and surfaces in healthcare setups.

IODINE

- Chemical Formula: I_2
- Molecular Weight: 253.81 g/mol
- Synonym: Tincture of Iodine (when in alcohol solution)

Preparation

Iodine is usually obtained from:

- Natural brine (salt water) or
- Seaweed ash, from which iodine compounds are extracted and then treated with oxidizing agents to release free iodine (I_2).

$$2I^- + Cl_2 \rightarrow I_2 + 2Cl^-$$

Physical Properties

- Dark grey to violet-black crystalline solid
- Has a sharp, pungent odour
- Slightly soluble in water
- Soluble in alcohol, potassium iodide solution, and chloroform
- Sublimes (changes directly from solid to vapor) upon heating

Chemical Properties

- Acts as a strong oxidizing agent
- Reacts with starch to form a deep blue complex (used as a test for iodine)
- Releases free iodine which disrupts protein and enzyme functions of microorganisms

Uses

- ✓ Used as a topical antiseptic
  → Commonly used in wound cleaning and skin disinfection before surgeries.
- ✓ Used in the form of Tincture of Iodine
  → Iodine dissolved in alcohol (2–7%) and potassium iodide, applied externally as an antiseptic.
- ✓ Used in Lugol's solution (iodine + potassium iodide + water)
  → Used as a disinfectant and sometimes as an internal antiseptic in controlled doses.