

BOARD SOLVED QUESTION
WITH ANSWER

Year : 2022

Subject : Pharmaceutical chemistry

Subject Code : ER20-12T

Subject In-Charge : Kiranmayee Bhatra
Jyotiprasanna Nanda



DO NOT WRITE ANYTHING ON YOUR QUESTION PAPER EXCEPT YOUR ROLL NO.
QUESTION PAPER CONTAINING ANYTHING WOULD BE TREATED AS MALPRACTICE

Full Mark -80

PHARMACEUTICAL CHEMISTRY

1. Answer any six .

Time -3 hrs
[6x05=30]

- Define Acid-Base Indicators & describe in details about the indicator theory with suitable Examples?
- Describe the principles involved, procedure & application of Mohr's Method?
- Mention the chemical structure, chemical name, uses and brand names of followings –
 - Glibenclamide
 - Chloroquine Phosphate.
- What is quality control? Describe the importance of quality control?
- Write the detail about chemistry of aluminium hydroxide gel?
- Classify anti-neoplastic agents with suitable examples. Write the structure, chemical name, popular brand name of Cyclophosphamide and Fluorouracil.
- Classify nonsteroidal anti-inflammatory agents (NSAIDs). Write the structure, chemical name and popular brand name of i) Ibuprofen ii) Paracetamol

2. Answer any ten questions.

[10x03=30]

- Write a short note on Mouth Washes?
- Define Dental Fluorosis and Briefly discuss the role of Fluorides as an anti-carries agent?
- Define Haematinics, mention some official compounds and discuss the role of ferrous fumarate as an ideal compound?
- Define Sedative & Hypnotics. Mention the Chemical Structure & Chemical Name of Diazepam and Phenobarbital
- Write about the uses, storage & incompatibility of light kaolin?
- Write the structure of Metformin, Verapamil and Alprazolam?
- How raw materials contribute impurities to the finished product. Explain.
- What are the advantages of BaSo₄ reagent over BaCl₂ in the limit test for sulphate.
- Write the principle of limit test for chloride.
- Write a note on DOT therapy in tuberculosis.
- What are anti-hypertensive agents? Write the structure and chemical name of Propranolol.

3. Answer all questions in the following sections. Each carries ONE mark [20x1=20]

A) Define the followings:

- Normality
- Conjugate Acid and Conjugate Base with Suitable Examples
- Hemosiderosis
- Oxidant and Reductant with examples
- Cathartics
- Astringent
- Complexometric Titration
- Impurity
- Self indicator with example
- Antidepressant

B) Write the chemical formula & Uses of followings

- Dapsone
- Magaldrate
- Potassium Permanganate
- Bleaching powder
- Green Vitriol

C) Write down the structure & numbering.

- Purine
- Phenothiazine
- Imidazole
- Pyrimidine
- Indole

(1)(a) Define Acid Base indicators and describe in details about the indicator theory with suitable examples?

Ans:- Acid base indicators are chemical substances that change color in response to changes in pH, allowing us to visually determine the acidity or basicity of a solution.

Indicator theory -

The indicator theory is based on the principle that acid-base indicators are weak acid or bases that exist in two forms -

(1) Acidic form (HIn): colored

(2) Basic form (In^-): colored differently

(1) At low pH (acidic), the equilibrium shifts to the left, favoring the acidic form (HIn).

(2) At high pH (basic) the equilibrium shifts to the right, favoring the basic form (In^-).

(3) The color change occurs when the concentration of one form becomes significant enough to dominate the other.

Type of indicators:-

- (1) strong acid indicators
- (2) weak acid indicators
- (3) strong base indicators
- (4) weak base indicators.

Ex - (1) Phenolphthalein -

$\text{pH} < 8.3$: colorless (HIn)

$\text{pH} 8.3 - 10.0$: pink (In⁻)

$\text{pH} > 10.0$: pink (In⁻)

(1) Methyl orange

$\text{pH} < 3.1$: red (HIn)

$\text{pH} 3.1 - 4.4$: yellow (In⁻)

$\text{pH} > 4.4$: yellow (In⁻)

(1) Litmus -

$\text{pH} < 4.5$: red (HIn)

$\text{pH} 4.5 - 8.3$: purple (In⁻)

$\text{pH} > 8.3$: blue (In⁻)

(b) Describe the principles involved, procedure and application of Mohr's method?

Ans - Principles involved

- (1) precipitation titration - Mohr's method involves the precipitation of silver chloride (AgCl) from the reaction between silver nitrate (AgNO₃) and chloride ions.

(2) Equivalence point - The endpoint is determined when the precipitation of silver chromate Ag_2CrO_4 indicates the excess of silver ions.

(3) Stoichiometry: - The reaction follows the 1:1 stoichiometry between silver and chloride ions.

Procedure -

Apparatus -

① Burette, conical flask, pipette, silver nitrate solⁿ, potassium chromate solⁿ, sample solⁿ containing Cl⁻ ion.

procedure -

(1) Prepare the sample solⁿ by dissolving the Cl⁻ containing compound in water.

(2) Add 1-2 ml of potassium chromate solⁿ to the sample solⁿ as an indicator.

(3) Titrate the sample solⁿ with silver nitrate solⁿ from the burette.

(4) Continue titration until a reddish-brown precipitate of silver chromate forms, indicating the endpoint.

(5) Record the volume of silver nitrate solution added.

(6) Calculate the concentration of chloride ions using formula - $\text{Cl}^- (\text{mg/L}) = \frac{\text{Vol of AgNO}_3 \times \text{molarity of AgNO}_3 \times 35.45}{\text{Vol of Sample}}$

Application -

- ① water quality analysis -
- ② Food industry
- ③ Pharmaceutical industry
- ④ Industrial processes.
- ⑤ Environmental monitoring

(c) Mention the chemical structure, chemical name, uses and brand names of followings?

(i) Glibenclamide (ii) chloroquine phosphate.

Ans - Glibenclamide -

- chemical name - 5-chloro-N-(4-[[N-(Cyclohexylcarbamoyl)Sulfamoyl]cyclohexylcarbamoyl]-2-methoxybenzamide

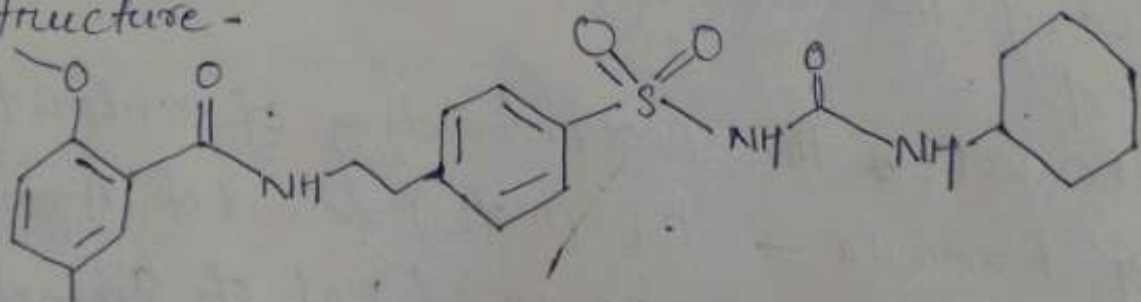
- molecular formula - $C_{23}H_{28}ClN_3O_3S$

- uses - Oral hypoglycemic agent for type 2 diabetes mellitus.

- Reduces blood sugar levels by stimulating insulin release from pancreas.

- Brand names, Diabeta, Micronase, Glynase, Daonil, Euglucon.

- structure -



(ii) Chloroquine phosphate -

- Chemical name - N_4 (7-chloro-4-quinoliny) - N_1, N_1 - diethyl - 1,4 - pentanediamine phosphate.

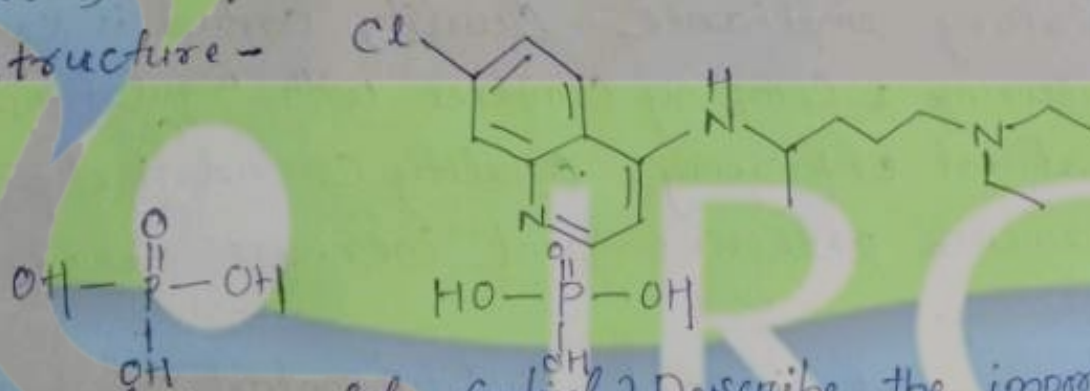
- uses - Antimalarial agent for prophylaxis and treatment of malaria

- Treatment of rheumatoid arthritis and Lupus erythematosus.

- Anti-inflammatory and immunosuppressive properties.

- Brand name - Aqualen, Avloclor, chlorquin, Malari von, Nivaquine

structure -



(d) what is quality control? Describe the importance of quality control?

Ans - Quality Control is a process that ensures a product or service meets a set of quality criteria or customer requirements. It involves testing and inspecting products to ensure they meet specifications and are free of defects.

Importance -

- product safety - Quality Control ensures products are made to specifications, which can make them safer to use. This is especially important in industries like aerospace, automotive, and pharmaceuticals.
- Brand reputation - High quality products can enhance a company's reputation and increase customer loyalty.
- Cost - Quality Control can help reduce costs by preventing lost materials and higher waste disposal costs.
- Regulatory Compliance - Quality Control is key to ensuring a company complies with regulations.
- Operational efficiency - Quality Control can streamline processes and increase operational efficiency.
- Environmental impact - Quality Control can help minimize the environmental impact of production.
- Employee attitudes - Quality Control can create a sense of ownership and improve employee attitudes about the workplace.

(e) write the detail about chemistry of aluminium hydroxide gel?

Ans - chemical formula - $Al(OH)_3$

formation - $Al_3 + (\text{aluminium ions}) + 3 OH^- (\text{hydroxide ions})$
→ $Al(OH)_3$ (aluminium hydroxide gel)

properties - (1) Amphoteric (2) Insoluble in water
(3) white, gel like precipitate

Reactions - (1) Neutralization: $Al(OH)_3 + 3HCl \rightarrow AlCl_3 + 3H_2O$
(2) Hydrolysis: $Al(OH)_3 + NaOH \rightarrow NaAlO_2 + 2H_2O$

uses: - (1) Antacid (neutralizes stomach acid)
(2) pharmaceutical application
(3) Cosmetics.

stability: - Aluminium hydroxide gel is stable at pH 5-9, but decomposes at high temperatures or extreme pH.

Storage - Store in cool, dry place
- Avoid inhalation or ingestion
- Handle with gloves and protective eyewear

Safety and precautions -

(1) Ingestion - may cause constipation or aluminium toxicity.

(2) Skin Contact - may cause irritation or allergic reactions.

(3) Eye Contacts - may cause irritation or vision -

(F) classify anti-neoplastic agents with suitable examples. Write the structure, chemical name, popular brand name of cyclophosphamide and Fluorouracil.

Ans - Classification -

- (1) Alkylating agents.
- (2) Antimetabolites
- (3) Anthracyclines
- (4) Taxanes
- (5) Vinca alkaloids
- (6) Hormonal Agents
- (7) Targeted Therapies

Examples - (1) Alkylating agents - cyclophosphamide (8)
Busulfan (NS)

(2) Antimetabolites - Fluorouracil, methotrexate POP

(3) Anthracyclines - Doxorubicin, Daunorubicin Ans-

(4) Taxanes - paclitaxel, Docetaxel (1)

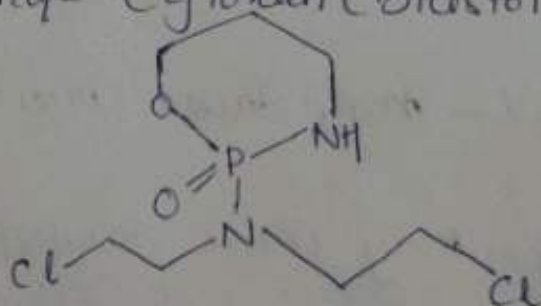
(5) Vinca alkaloids - vincristine, vinblastine (2)

Cyclophosphamide - (3)

Chemical name - 2-[Bis(2-chloroethyl)amino] - tetrahydro-2H (4)

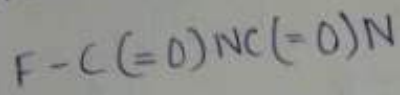
popular brand - Cytosan (Bristol-Myers Squibb) (5)

Structure - (6)



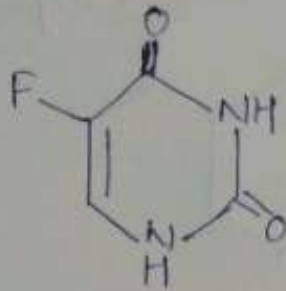
Fluorouracil (5-FU):

- Chemical Name: 5-Fluoro-1H-pyrimidine-2,4-dione
- Molecular Formula: $C_4H_3FN_2O_2$



popular brand name - Adrucil (Teva pharmaceutical-Industries)

Structure -



(8) Classify nonsteroidal anti-inflammatory agents - (NSAIDs). Write the structure, chemical name and popular brand name of (i) Ibuprofen (ii) paracetamol

Ans - According to the chemical structure & selectivity

(1) Acetylated Salicylates.

(2) Non-acetylated Salicylates.

(3) Propionic acid

(4) Acetic acid

(5) Enolic acid

(6) Anthranilic acid

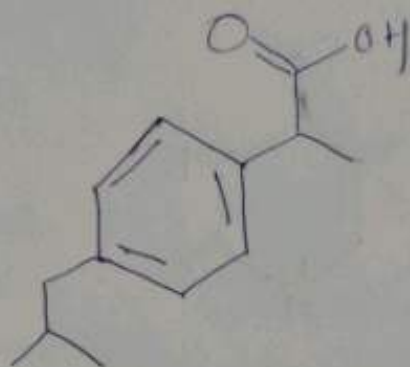
(7) Naphthylalanine

(8) Selective COX-2 inhibitors.

- According to their preferential Cyclooxygenase (COX) selectively - COX-1 preferential inhibitors:
 - Nonselective NSAIDs
 - Lower COX-2 Selectively NSAIDs
 - Higher COX-2

(i) Ibuprofen -

Structure -

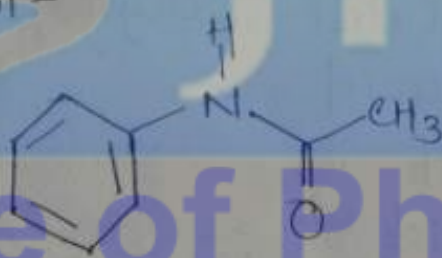


Chemical name - 2-(4-isobutyl-phenyl)propionic acid

Brand name - Advil, motrin, Nurofen, Brufen, Calprofen.

(ii) paracetamol -

Structure -



Chemical name -

N-(4-hydroxyphenyl)acetamide

Brand name - Tylenol, Excedrin, Calpol, Panadol.

(2)

(a) Write a short note on Mouthwashes?

Ans:- Mouthwashes are liquid preparations used to:-

- (I) Reduce Oral bacteria and plaque
- (II) Freshen breath
- (III) Prevent gum diseases

Type:-

- (I) Antibacterial (Chlorhexidine)
- (II) Anti-plaque (Fluoride)
- (III) Astringent (alcohol-based)
- (IV) Medicated (For specific oral condition)

Benefit:-

- (I) Improved oral hygiene
- (II) Reduced risk of oral diseases
- (III) Fresh breath and confidence

(b) Define Dental Fluorosis and Briefly discuss the role of Fluorides as an anti-Caries agent?

Ans:- Dental Fluorosis:-

Dental Fluorosis is a condition caused by excessive fluoride intake during tooth development resulting in:-

- (I) white or brown spots on teeth
- (II) Enamel discoloration
- (III) Pitting or mottling

Role of Fluoride as Anti-Caries Agent:-

Fluoride prevents tooth decay by:-

- (I) Inhibiting acid production by bacteria
- (II) Enhancing tooth enamel remineralization
- (III) Reduce tooth sensitivity.

- Optimal Fluoride levels (0.7-1.2 ppm) in drinking water and toothpaste help prevent dental caries.

(c) Define Haematinics, mention some official compounds and discuss the role of ferrous fumarate as an ideal compound?

Ans:- Haematinics:-

- Haematinics are medicinal agents that stimulate the formation of red blood cells and hemoglobin, treating anemia and iron deficiency.

- Official Compounds:-

(1) Ferrous Sulfate

(2) Ferrous Fumarate

(3) Ferrous gluconate

(4) Iron polysaccharide complex

- Role of Ferrous Fumarate:-

(i) High iron content (33%)

(ii) Good bioavailability

(iii) Minimal gastrointestinal side effects

As an ideal compound ferrous fumarate:

- Corrects iron deficiency anemia

- Enhances hemoglobin synthesis

- Supports red blood cell production.

(d) Define sedative and Hypnotics. Mention the chemical structure and chemical name of Diazepam and phenobarbital.

Ans:- Sedative - Substances that calm nervousness, reduce anxiety and promote relaxation.

Hypnotics - Substances that reduce sleep or ~~consciousness~~

- Diazepam (Sedative) :-

chemical name - 7-chloro-1,3-dihydro-5-phenyl-2H-1,4-benzodiazepin-2-one.

chemical structure - $C_{16}H_{13}ClN_2O$

- phenobarbital (Hypnotic/Sedative) :-

chemical name :- 5-ethyl-5-phenylbarbituric acid

chemical structure :- $C_{12}H_{13}N_2O_3$

(e) Write about the uses, storage and incompatibility of Light Kaolin?

Ans: - Light Kaolin -

uses - Light Kaolin, also known as china clay is a soft, white, powdery mineral used in various applications.

(1) Pharmaceutical - Excipient in tablets, capsules and suspensions, anti-diarrheal agent.

(2) Cosmetics - Absorbing agent in powders, creams & lotions.

(3) Food - Anti-caking agent, filler and carrier in food products.

(4) Paper - Coating and filling agent.

Storage -

(1) Store in dry, well-ventilated areas.

(ii) Keep away from moisture and humidity.

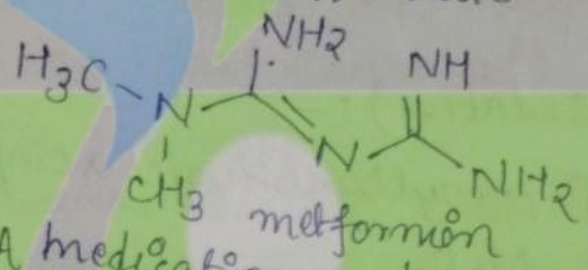
(iii) protect from direct sunlight.

- Incompatible with strong acid, strong bases, oxidizing agents, Reducing agents, Alkaline substances, moisture - Sensitive materials.

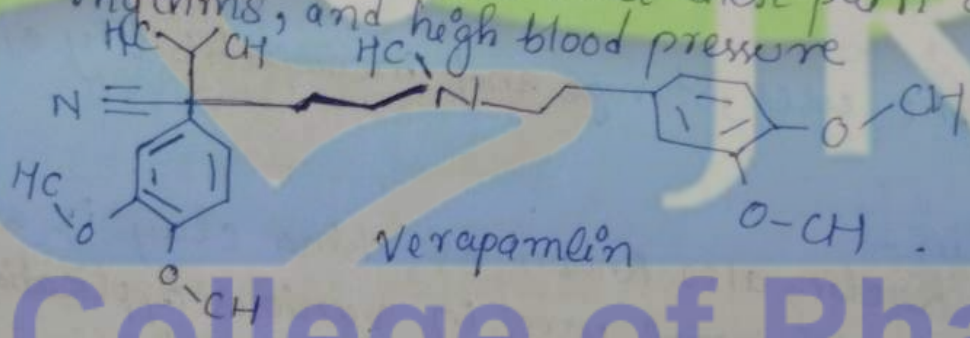
VIVO Y20

(A) write the structure of metformin, verapamil and Alprazolam?

Ans:- Metformin is a white, hygroscopic crystalline powder with a bitter taste.



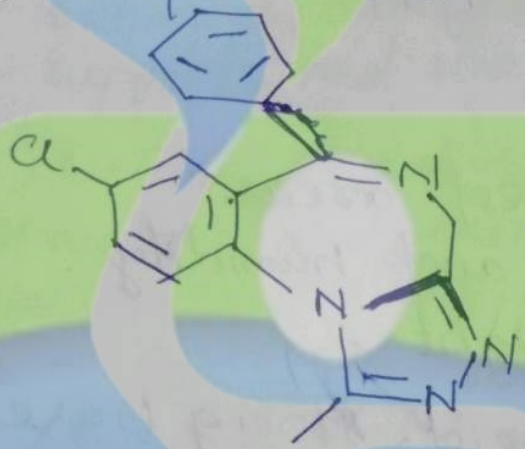
A medication used to treat chest pain, abnormal heart rhythms, and high blood pressure



College of Pharmacy

VIVO Y20

It is a medicine used to treat anxiety disorders and panic disorder



Alprazolam.

College of Pharmacy

g) How raw materials contribute impurities to the finished product. Explain.

Ans: - Raw materials can contribute impurities to a finished product in several ways.

i) Natural Contaminants - Raw materials may contain natural contaminants that can introduce inorganic elements like - iron, zinc or copper.

Example - heavy metals may be present in trace amounts in mineral based ingredients like pigments or clays.

ii) Reagents - If reagents used in the manufacturing process aren't completely removed by washing, they can enter the final product.

iii) Solvents - Solvents used in the synthesis may contain impurities that can react with other chemicals and produce impurities.

iv) Manufacturing equipment - Wear and tear on equipment can cause metals like chromium or nickel to leach into the final product.

v) Environmental Contamination - Dust air, and water used in the manufacturing process can introduce inorganic elements.

h) What are the advantages of BaSO_4 reagent over BaCl_2 in limit test for sulphate?

Ans: - Barium sulphate (BaSO_4) is the precipitate that forms when Barium chloride (BaCl_2) is used in the limit test for sulphate.

→ In the limit test for sulfate, Barium chloride and Hydrochloric acid (HCl) are used to identify sulfate ions.

The HCl is added first, followed by the BaCl₂ which causes a white precipitate of barium sulfate to form.

The turbidity of the test solution is then compared to standard sulfate solution. In the test solution is less turbid than the standard, the sample passes the test.

i) Write the principle for limit test for chloride?

Ans:- The precipitation reaction is the limit test for chloride. In the presence of dilute nitric acid chloride precipitate from soluble chloride when silver nitrate reacts with soluble chloride to produce the form of which appears as solid particles in the solution.

j) Write a note on dot therapy in tuberculosis?

Ans:- Directly observed therapy short course is a program to help cure TB.

→ A DOT lay worker meets with clients to help with TB medication and provide support and education.

→ The client is supported to successfully complete the full course of medication.

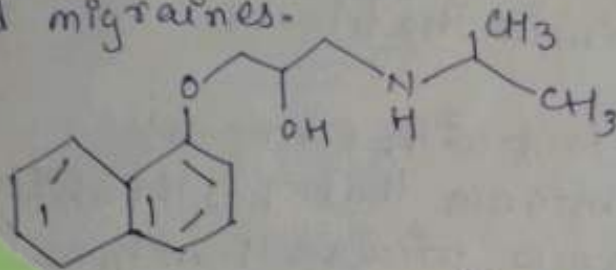
→ The client is monitored closely for side effects of medications and supported to work through the side effects appropriately.

k) What are antihypertensive agents write the structure and chemical name propranolol?

Ans:- Antihypertensive agents, or blood pressure medications are used to treat high blood

pressure or hypertension. They work to keep the heart strong and prevent heart failure, heart attack, kidney failure or strokes.

Propranolol is a medication used to treat high blood pressure, chest pain, irregular heart-beat, heart attacks, and migraines.



Chemical name - 1-(isopropyl amino)-3-(1-naphthoxy) propan-2-ol.

3. A \Rightarrow Normality:- Normality is equal to molarity multiplied by the no. of equivalents in the formula unit of the solute.

$$N = \frac{\text{Gram eq. of solute}}{\text{Volume of sol. in litre}}$$

$$= \frac{\text{Wt}}{\text{Eq. Wt}} \times \frac{1000}{\text{Vml}}$$

$$\text{Equivalent wt} = \frac{\text{Molar mass}}{n}$$

i) Conjugate acid and conjugate base with suitable examples

* A conjugate acid contains one more H atom and one more positive charge than the base that formed it -

A conjugate base contains one less H atoms and

one more - charge than the acid that formed it
Examples:- Bicarbonate ions reacting with water to create carbonic acid and Hydroxonium ions.

iii) Hemosiderosis:- Hemosiderosis is a term used for excessive accumulation of iron deposits called hemosiderin in the tissues.

iv) Oxidant and Reductant with examples:
Oxidant:- It is a substance that has the ability to oxidize other substances, to cause them to lose electrons.

Ex - O_2 , H_2O_2 and the Halogens

Reductant:- It is an element or compound that loses an electron to another chemical species in a redox chemical reaction

Ex - Ca , CO , SO_2 .

v) Cathartics:- Drugs that relieve constipation and promote defecation.

→ It is otherwise called as laxatives or purgatives

vi) Astringent:- It is a drug that reacts chemically with cellular proteins producing limited coagulation which is accompanied by shrinkage of body tissues

vii) Complexometric Titration:- It is a form of volumetric titration in which the formation of a colored complex is used to indicate the end

point of titration.

→ The complexes are formed by the reaction of a metal ion with an anion, a neutral molecule or a very rarely a positive ion.

viii) Impurity :- Any component of the new drug substance that is not the chemical entity defined as the new drug substance.

ix) Self indicator with example :- Self indicator is actually a chemically substance which can mark the end point of a titration or any other reaction along with self participation in the reaction.

ex - potassium permanganate.

x) Antidepressant :- Drug which enhance alertness and may result in an increased output of behavior.

B) i) Dapsone :- $C_{12}H_{12}N_2O_2S$
It used to treat leprosy.

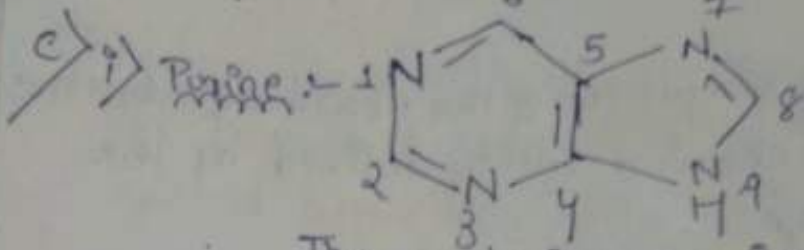
ii) Magnaldrate :- It act as a antacid, to relieve heart burn, sour stomach.

iii) Chemical Name - Hydroxy magnesium aluminate

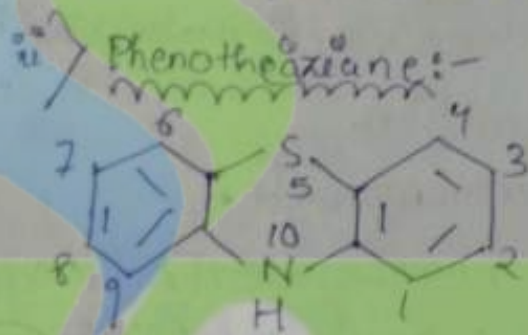
iii) Potassium Permanganate :- It is a strong oxidizing agent.

iv) Bleaching powder :- It is used as a disinfectant, sanitizing, oxidizing agent - Calcium hypochlorite.

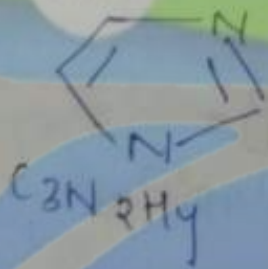
✓ Green Vitriol:- It is used in sewage and water treatment and as a pigment and fertilizer.
(FeSO₄)



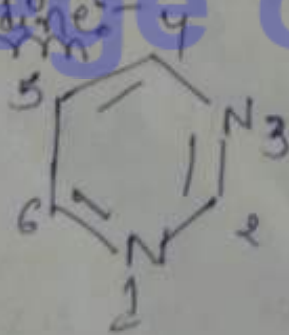
The numbering of pyrimidine starts with the first nitrogen of six membered ring and then proceeds in an anticlockwise direction.



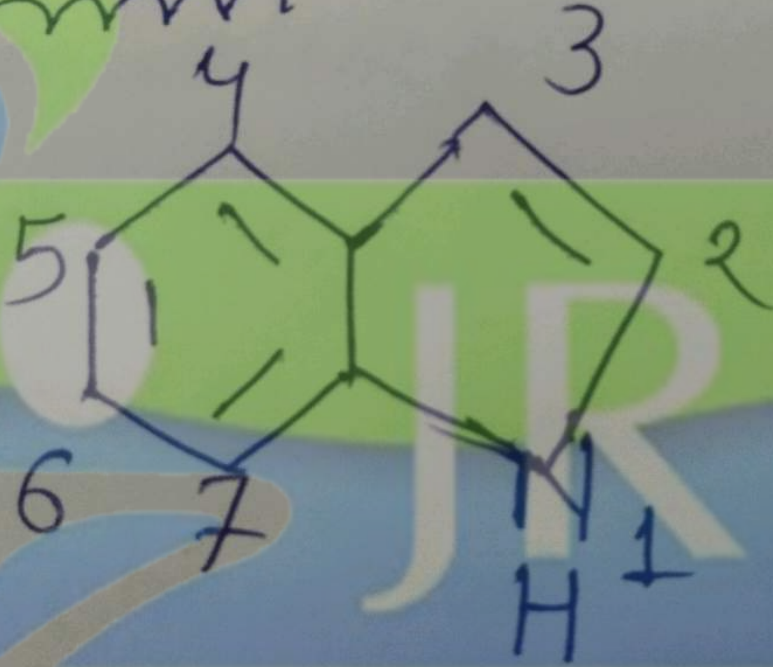
iii) Imidazole:-



iv) Pyrimidine:-



iv) Indole :-



College of Pharmacy