D.PHARMA 1ST YEAR

PHARMACEUTICAL CHEMISTRY

MODEL PAPER

ER20-12T

PHARMACY INDIA

PHARMACY COUNCIL OF INDIA

A. Each question carries equal marks (Any 6) 6×5 = 30 marks

1. **Describe the principle and chemical reactions involved in the limit test for the following: (any one)**

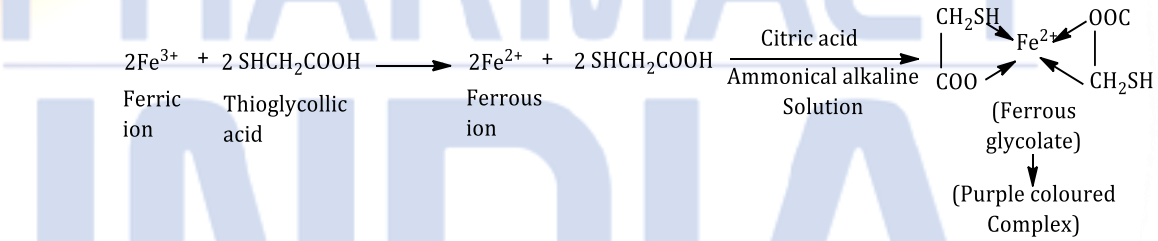
a. Iron

Answer

Principle

- Limit test of Iron is based on the reaction of iron in ammonical solution with thioglycollic acid in presence of citric acid to form iron thioglycolate which is pale pink to deep reddish purple in color.
- Ferric iron is reduced to ferrous iron by the thioglycollic acid and the compound produced is ferrous thioglycolate.
- Citric acid forms a soluble complex with iron and prevents its precipitation by ammonia as ferrous hydroxide.
- The colour develops only in the presence of alkali.
- The colour is due to the formation co-ordination compound, ferrous thioglycollate which is stable in the absence of air bud fades in air due to oxidation.
- Therefore, the colour should be compared immediately after the time allowed for full development of colour is over.

Chemical Reaction



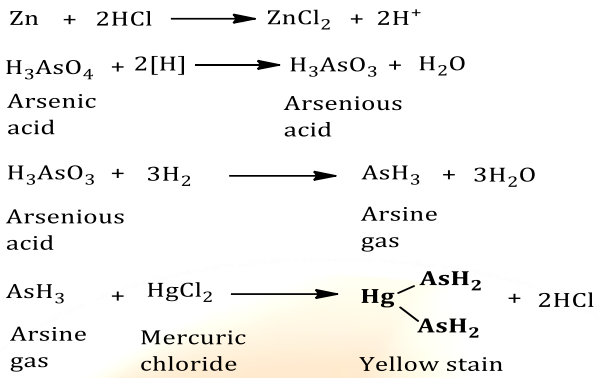
- The purple color produce in sample solution should not be greater than standard solution.
- If purple color produces in sample solution is less than the standard solution, the sample will pass the limit test of iron and vice versa.

b. Arsenic

Principle

- The principle is based on Gutzeit Test wherein, all arsenic present is duly converted into arsine gas (AsH_3) by subjecting it to reduction with zinc and hydrochloric acid.
- Limit test of Arsenic is based on the reaction of arsenic gas with hydrogen ion to form yellow stain on mercuric chloride paper in presence of reducing agents like potassium iodide.
- The intensity of the stain is proportional to the amount of arsenic present
- The stain is compared with that produced from a known amount of arsenic
- The IP prescribes the limits for the presence of arsenic (NMT 2 ppm) as an impurity in various pharmaceutical substances
- Apparatus used for arsenic limit test is called Gutzeit apparatus.

Chemical Reaction



2. What is redox titration? Discuss about the standardization of potassium permanganate against oxalic acid.

Answer

- Redox reactions consist of both oxidation and reduction reactions
- **Oxidizing agent**
  - ✓ Oxidizing agent is a substance that oxidizes something else.
  - ✓ Oxidizing agents give oxygen to another substance.
  - ✓ Example – cupreous, O_3
- **Reducing agent**
  - ✓ A reducing agent reduces something else.
  - ✓ A reducing agent is an element or compound that loses an electron .
  - ✓ Reducing agents remove oxygen from another substance.
  - ✓ Example – carbon monoxide

Standardization of Potassium Permanganate against Oxalic acid

Principle:

- The principle of standardization of potassium permanganate is based upon redox titration in which strength of an oxidizing agent is estimated by titrating it with a reducing agent and viceversa.
- Potassium permanganate acts as an strong oxidizing agent in acidic medium that oxidizers oxalic acid in to carbondioxide.
- Known strength of oxalic acid is titrated directly with potassium permanganate.
- End point can be detected with appearance of permanent pink colour potassium permanganate acts as self indicator.
  2KMnO4+5H2C2O4+3H2SO4→K2SO4+2MnSO4+8H2O +10CO2

Procedure:

- **Preparation of 0.1 N Potassium permanganate solution:** Dissolve 3.2g of potassium permanganate in 1000ml of water, heat on a water bath for 1 hour, allow to stand for 2 days. Filter the solution through glass wool.
- **Preparation of 0.1 N Oxalic acid:** 6.3 gm of oxalic acid dissolve in 1000 ml of distilled water.
- **Standardisation of 0.1N Potassium permanganate:**
  - Take 20 ml of Oxalic acid solution.
  - Add 5 ml of 1m sulphuric acid. warm the mixture to about 70°C.

- Titrate with potassium permanganate solution taken in the burette.
- Endpoint is the appearance of pink colour that persist for 30sec.

$$N_1V_1=N_2V_2$$

3. Define any two of the following:

a. Haematinics.

Answer

- A hematinic is a nutrient required for the formation of blood cells in the process of hematopoiesis.

b. Topical Agents

Answer

- Topical agents which are applied on skin or mucous membrane or in the body cavities and give their local effect.

c. Gastro-intestinal Agents.

Answer

- Gastrointestinal agents are used in the treatment of Gastric Acidity, Peptic Ulcers, and Gastro Esophageal Reflux Disease (GERD), Bowel Motility Disorders, Constipation, and Diarrhea, and for the treatment of Nausea and Vomiting.

Write a note on saline cathartics.

Answer

- Saline cathartics are water soluble and are taken with large quantities of water. This prevents excessive loss of water from body fluids and reduces nausea vomiting if a too hypertonic solution should reach the stomach.

4. What are heterocyclic compounds that classify heterocyclic compounds giving one structure from each class.

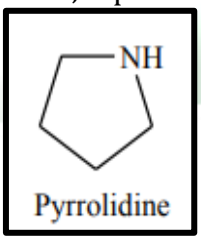
Answer

- 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).

Classification of Heterocyclic Compounds

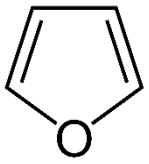
1. ALIPHATIC HETEROCYCLIC COMPOUNDS

- Cyclic heterocycles that do not contain any double bond.
- Examples - Aziridine, , Pyrrolidine, Piperidine, etc.



2. AROMATIC HETEROCYCLIC COMPOUNDS

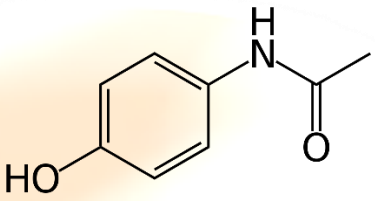
- Aromatic heterocyclic compounds, as the name suggests, are cyclic aromatic compounds.
- Examples: Furan, Pyrrole, Pyrimidine, Purine, etc.



5. **Write the chemical structure of any five of the following:**

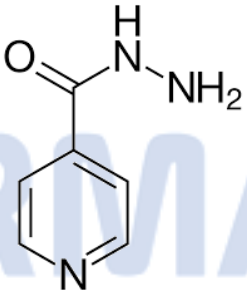
   a. **Paracetamol**

   Answer



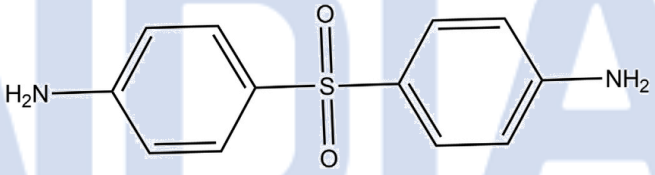
   b. **INH**

   Answer



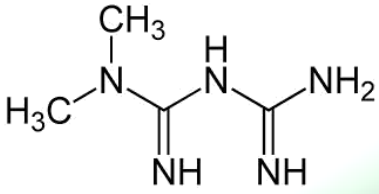
   c. **Dapsone**

   Answer



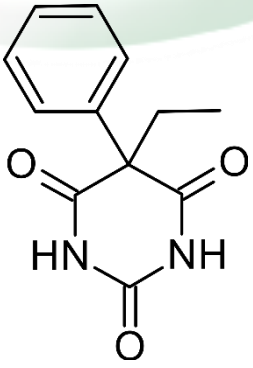
   d. **Metformin**

   Answer



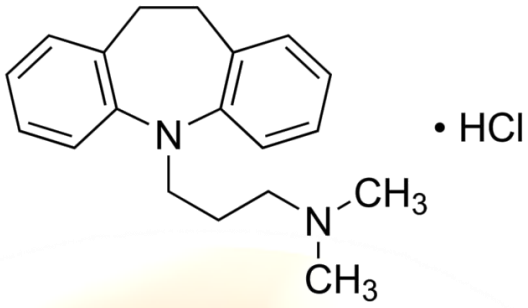
   e. **Phenobarbital**

   Answer



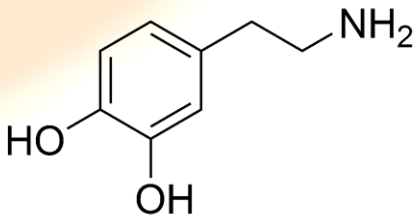
f. Imipramine Hydrochloride

Answer



g. Dopamine

Answer



6. Write the stability and storage conditions of any five of the following:

a. Chloramphenicol

Answer

Stability:

- Neutral and acid solutions are stable on heating.
- In solution, chloramphenicol undergoes a number of degradative changes related to pH, temperature and photolysis.

Storage: Air-tight and light-resistant container.

b. Insulin

Answer

Stability: Insulin is inactivated by alkali, reducing agents and proteolytic enzymes. It cannot be administered orally.

Storage

- **Insulin (Raw material):** Stored in air-tight, light-resistant container at a temperature of 20. When removal from cold storage it should be kept at a temperature 2 to 8°C and formulated immediately.
- **Insulin formulations:** Stored at 2 to 8°C. Should not be allowed to freeze.

c. Aspirin

Answer

Stability: Stable in dry air but in moist air it is gradually hydrolyzed into salicylic and acetic acid. When heated to decomposition it releases acrid smoke and fumes.

Storage: Store in a room temperature and away from excess heat and moisture.

d. Sulphacetamide

Answer

Stability: Photolytic degradation occurs and hydrolyzed in the presence of air.

Storage: Stored in tightly-closed and light-resistant containers.

e. Cyclophosphamide

Answer

Stability: Unstable at room temperature. Colour changes on exposure to light at temperature above 30°C.

Storage: Well closed light-resistant container at a temperature below 30°C.

f. Diazepam

Answer

Stability: Stable at room temperature. Colour changes on exposure to light at temperature above 30°C.

Storage:

- Should be stored at 20-25˚ C.
- Protect from direct sunlight.
- Keep out of the reach of children.

g. Acyclovir

Stability:

- Stable at room temperature.
- Colour changes on exposure to light at temperature above 30°C.
- Hydrolysis occurs in the presence of moisture.

Storage:

- Suspension stored at 15°C to 25°C.
- Capsules stored at room temperature away from light.
- Kept away form moisture.

7. Write the popular brand name and uses of any five of the following:

a. Isosorbide dinitrate.

Answer

Brand name: Hordil, Sorbitrate

Uses

- used in the management of patients with ischaemic heart disease.
- used in acute myocardial infarction in control of ischaemic pain.
- also useful in the treatment of severe hypertension.

b. Sulfacetamide.

Answer

Use: Treatment of infection of eye, ear and urinary tract.

Brand name: Albucid.

c. Propranolol.

Use:

- To treat hypertension.
- Cardiac arrhythmias.
- Myocardial infarction.

Brand name: Hemangiol, Innopran

d. Diclofenac.

Answer

Use:

- It is used in the treatment of rheumatoid and osteoarthritis, bursitis, ankylosing spondylitis, dysmenorrhea, Post-traumatic and Post-operative inflammatory conditions.
- It affords quick relief to pain and wound edema.

Brand name: Voltaflam, Zobid D.

e. Ofloxacin.

Answer

Use:

- Bronchitis
- Infection of Urinary bladder, Urinary tract, reproductive organs and prostate gland

Brand name: Floxin, Floxin I.V

f. Rifampicin.

Answer

Use: Treatment of tuberculosis, leprosy and meningitis.

Brand name: Rifampin.

g. Remdesivir.

Answer

Uses: Remdesivir was approved or authorized by W.H.O for emergency use to treat Covid-19 in more than 50 countries.

Brand names: Veklury, Cipremi, Covifor

h. Chlorpromazine

Answer

Brand names: Largactil, Megatil, Emetil, Thorazine

Uses:

- It is used as an antipsychotic agent.
- It is used as an antiemetic agent.

B. Each question carries equal marks (Any 10) 10×3 = 30 marks

1. **Discuss any three different sources of impurities in pharmaceuticals.**

Answer

- Impurities in pharmaceuticals are the unwanted chemicals that remain with the active pharmaceutical ingredients (APL), or develop during formulation.

Sources of impurities

- ✓ Materials employed in manufacture.
- ✓ Method or the process used in manufacture.
- ✓ Chemical processes and the plant materials employed in the processes.
- ✓ Storage conditions.
- ✓ Decomposition.

- **Raw materials employed in manufacture**
  - Impurities known to be associated with these chemicals may be carried through the manufacturing process and contaminate the final product.
  - Example Rock salt → Calcium Sulphate ($CaSO_4$) + Magnesium Chloride ($MgCl_2$)= NaCl prepared.

- **Reagents used in the manufacturing process**
  - If reagents used in the manufacturing process are not completely removed by washing, these may find entry into the final products.

- Example: Ammoniated mercury may be prepared by adding a solution of Mercuric chloride to dilute ammonia solution.

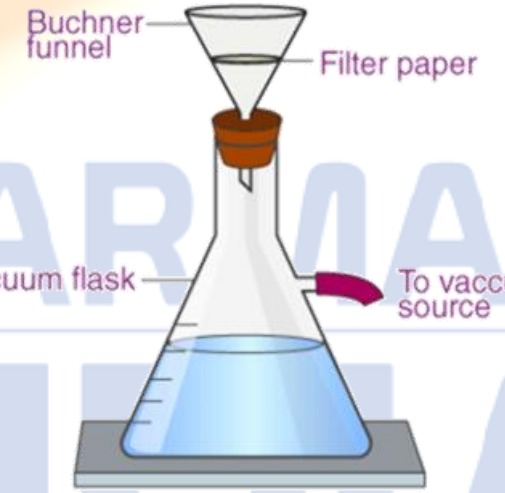
$$HgCl_2 + 2NH_4OH \rightarrow NH_2HgCl + NH_4Cl + 2H_2O$$

- **Method or the process used in the manufacture**
  - Many drugs and chemicals (usually organic) are manufactured from different raw materials, by using different methods or processes.
  - Some impurities are incorporated into the materials during the manufacturing process.

2. **Write in short about gravimetric analysis.**

Answer

- Gravimetric analysis is a group of analytical methods in which the amount of analyte is determined by the measurement of the mass of a pure substances containing the analyte.



Gravimetric Analysis Apparatus

Principle

- A general principle of gravimetric method of analysis is based on a chemical reaction between analyte and reagent.

$$aA + rR \longrightarrow Aa\ Rr$$

- The analyte (A) of molecules 'a' react with the reagent (R) of molecule 'r'. After drying, the product formed by igniting AaRr can either be weighed or ignited to create another compound of known chemical components.

3. **Discuss the combination of antacids.**

Answer

- Antacids (anti - against; acidus - acid) are weak alkaline compounds used to neutralize hydrochloric acid in the stomach.
- Antacids are the substances which reduce gastric acidity resulting in an increase in the pH of stomach and duodenum.

Classification of Antacids

Non-systemic antacids	Systemic antacids
• Non-systemic antacids are compounds that are not absorbed into the systemic circulation • Their anionic group neutralizes the H+ ions in gastric acid. • This releases their cationic group which combines with HCO3– from the pancreas to form an insoluble basic compound that is excreted in feces.	• Systemic antacids are absorbed into the systemic circulation • They have a cationic group that does not form insoluble basic compounds with HCO3–.
➢ Aluminum Hydroxide ➢ Magnesium Hydroxide	➢ Sodium bicarbonate

4. **Write a note on narcotic antagonists.**

Answer

- A narcotic antagonist reverses the opioid actions. Respiratory depression is the most severe adverse reaction of opioid treatment. Specific antagonists are developed which revereses the respiratory depression related to opioids.
- **Naltrexone** is the most promising narcotic antagonist. It is used for treating alcohol dependence and for blocking the effects of opioids used by a person being treated for alcohol dependence.
- **Naloxone hydrochloride** is used for completely or partially reversing respiratory depression by opioids, natural or synthelic narcotics.

5. **Discuss in short about Anti-hypertensive drugs with suitable examples.**

Answer

- The arterial blood pressure of a normal healthy adult is 100-120 mm Hg systolic and 70-80 mm Hg diastolic. A condition where presistant raise in blood pressure above 140/90 mm Hg is known as hypertension. There are two types of hypertension:
    - Primary or essential hypertension.
    - Secondary hypertension.
- Antihypertensives are a class of drugs that are used to treat hypertension (high blood pressure). Antihypertensive therapy seeks to prevent the complications of high blood pressure, such as stroke and myocardial infarction.
- Examples -

Class and Sub-class	Drugs
ACE enzyme inhibitor	Captopril, Enalapril, Lisinopril, Fosinopril, Perindopril
Angiotensin receptor antagonist	Losartan, Candesartan, Valsartan, Telmisartan, Irbesartan
Direct renin inhibitor	Aliskiren

6. **Write the storage conditions of any three of the following.**

a. Oxygen

Answer

Storage condition

- Store under compression in metal cylinders.
- The cylinder of oxygen are painted black with a white shoulder.

b. Silver Nitrate

Answer

Storage Condition

- Silver nitrate should be stored in sealed containers or packages and not exposed to light.

c. Ferrous Sulphate

Answer

Storage Condition

- Ferrous sulphate should therefore be kept in well closed containers.

d. Sodium Fluoride

Answer

Storage Condition

- Aqueous solution of sodium fluoride corrodes ordinary glass bottles and hence the solution should be prepared in distilled water and stored in dark, pyrex bottles.
- It should be stored in well closed container.

e. Aluminium Hydroxide Gel

Answer

Storage Condition

- Store in air-tight containers and avoid freezing

7. **What are Anti-neoplastic agents? Give some examples.**

Answer

- Cancer is a disease where there is a rapid proliferation of abnormal cells of any tissue leading to the derangement of normal body functions.
- Cancers may be malignant (harmful) or benign (harmless). Drugs used in the treatment of cancer are known as anti-cancer drugs or anti- neoplastic drugs.

Examples

Classes	Drug
Alkylating agent	**Nitrogen mustard:** Mechlorethamine cyclophosphamide **Ethylnimine:** thiotepa **Alkyl sulfonate:** Busulphan **Nitrosourea:** Carmustine, Lomustine **Triazine:** Dacarbazine
Platinum coordination complex	Cisplatin, carboplatin, oxaliplatin
Antimetabolites	**Folate antagonist:** methotrexate
	Purine antagonist: mercaptopurine, thioguanine azathioprine
	Pyrimidine antagonist: fluorouracil, capecitabine, Cytarabine

8. **Write in brief about Non-Steroidal Anti-inflammatory Agents.**

Answer

- **Non-steroidal anti-inflammatory agents (NSAIDs)** are used to reduce inflammation and reduce pain. They have no adverse effects like steroid therapy. These drugs are used in inflammatory conditions in:
  - arthritis
  - rheumatism
  - lupus erythematosus, and
  - ankylosing spondylitis.

Examples

Class	Examples
Nonselective COX inhibitors (traditional NSAIDs)	
• **Salicylates**	Aspirin
• **Propionic acid derivatives**	Ibuprofen, Naproxen, Ketoprofen, Flurbiprofen

9. **What are hypoglycemic agents? Give examples of oral hypoglycemic agents.**

Answer

- Hypoglycemic agents are used in treatment of diabetes or increased blood sugar generally caused by the deficiency of insulin.
- **Examples**

Class	Sub class	Drugs
Enhance Insulin secretion	**Sulfonylureas (K_{ATP} Channel blockers)**	**First generation:** Tolbutamide **Second generation:** Glibenclamide (Glyburide), Glipizide, Gliclazide, Glimepiride
	Meglitinide/phenylalanine analogues	Repaglinide, Nateglinide
	Glucagon-like peptide-1 (GLP-1) receptor agonists (Injectable drugs)	Exenatide, Liraglutide
	Dipeptidyl peptidase-4 (DPP-4) inhibitors	Sitagliptin, Vildagliptin, Saxagliptin, Alogliptin, Linagliptin

10. **Define any three of the following:**

a. Diuretics.

Answer

- Diuretics is a drug which accelerates the secretion of urine from kidney.

b. Anaesthetics.

Answer

- Anesthesia is the use of medicines to prevent pain during surgery and other procedures.

c. Anticonvulsants.

Answer

- Anticonvulsants are drugs that are used to treat convulsions or seizures caused in epilepsy.

d. Dental products.

Answer

- 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.

11. **Write about Anti-tubercular Drugs.**

Answer

- Tuberculosis is a chronic infectious disease caused by the organism Mycobacterium *tuberculosis*. Drugs used in the treatment of tuberculosis are called as antitubercular drugs.

C. MCQs/ Fill in the blanks (Answer all questions) 20×1 = 20 marks

1. A chemical that changes its colour in acidic and basic medium during titration is called.
   a) Indicator b) Titrant
   c) Analyte d) None of these
2. Which of the following is antacid?
   a) Hydrogen peroxide b) Ferrous Fumarate
   c) Aluminium Hydroxide Gel d) Silver Nitrate
3. General Formula for alkene is:
   a) Cn H2n+2 b) CnH2n
   c) Cn H2n+2 d) None of these
4. Ferrous sulphate is used in the treatment of:
   a) Scurvy b) Diabetes
   c) Anaemia d) Marasmus
5. Which of the following is heteroatom?
   a) B b) K
   c) N d) P
6. Which of the following is Anti-Neoplastic Drug?
   a) Methotrexate b) Chloroquine phosphate
   c) Spironolactone d) Epinephrine
7. Calpol is the brand name of which of the following?
   a) Terbutaline b) Fluconazole
   c) Ethambutol d) Paracetamol
8. 5,5-diphenylimidazolidine -2,4-dione is the chemical name of.
   a) Atenolol b) Phenytoin
   c) Furosemide d) Haloperidal
9. Which of the following drugs is second generation hypoglycemic agent of sulfonylureas class
   a) Metformin b) Glibenclamide
   c) Pioglitazone d) Repaglinide
10. Griseofulvin is
    a) Anaesthetic b)Hypoglycemic
    c) Antifungal d) Laxative Fill in the blank
11. Chemical formula of sodium bicarbonate is _____.

Answer – $NaHCO_3$

12. Nitrous oxide is also know as _____ gas.
    Answer – Laughing gas
13. Calmpose valium is brand name of _____.
    Answer - Diazepam
14. Chlorphenicol is the drug of choice for the treatment of _____.
    Answer – Bacterial Conjunctivitis
15. Hydrogen peroxide is used as an antidote in _____and _____ poisoning.
    Answer – Cyanide and Phosphorous poisoning
16. Thiopental sodium has _____odour with taste.
    Answer – disagreeable
17. Pilocarpine is used in the treatment of ____.
    Answer - Glaucoma
18. Amphotericin B is the most effective drug against _____ infections.
    Answer - Fungal
19. Glibenclamide possesses a _____group in its chemical structure.
    Answer – Sulphonyl Urea
20. The full form of EDTA is_____.
    Answer – Ethylene diamine tetra acetic acid