Pharma Unit

Pharmaceutical Chemistry Top 10 Most Repeated Questions with Answers

According to New Syllabus ER 2020-21

1st Year D. Pharmacy

1) What is limit test? Explain the limit test of arsenic with diagram?

Ans.

Definition of Limit Test: A limit test is a quantitative or semi-quantitative test that identifies and controls small amounts of impurities in a substance.

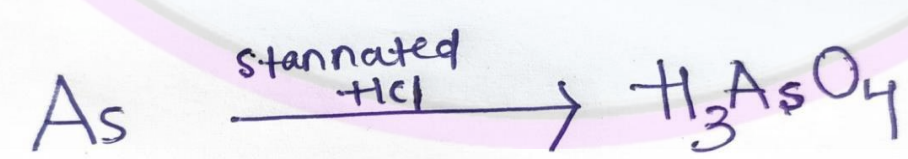
Limit test of arsenic

Principle: Limit test of arsenic is based on the reaction in which arsenic is converted into arsenic acid with the help of stanneted Hcl. This arsenic acid is further converted into arsenious acid with the help of potassium iodide, the arsenious acid is further reduced into arsine gas.

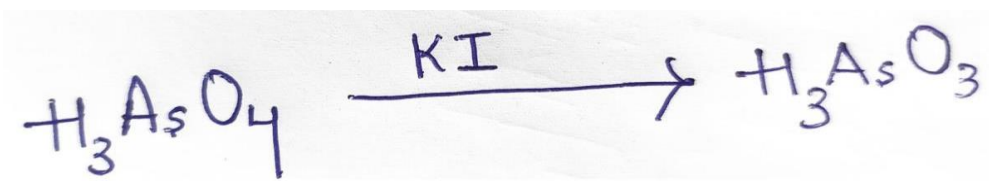
This arsine gas reacts with mercuric chloride paper to produce a yellowish-brown stain due to formation of mercuric arsenide. The depth of yellow color stain on mercuric chloride paper is based on the presence of arsenic in the sample.

Reaction

1. Arsenic to arsenic acid

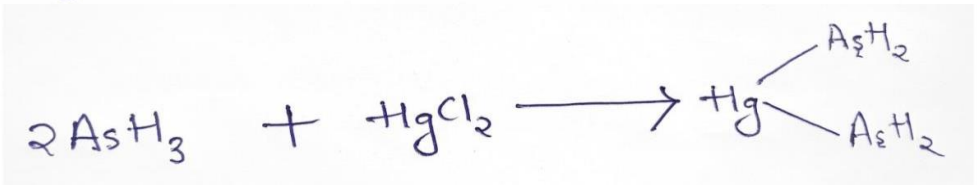


2. Arsenic acid to arsenious acid

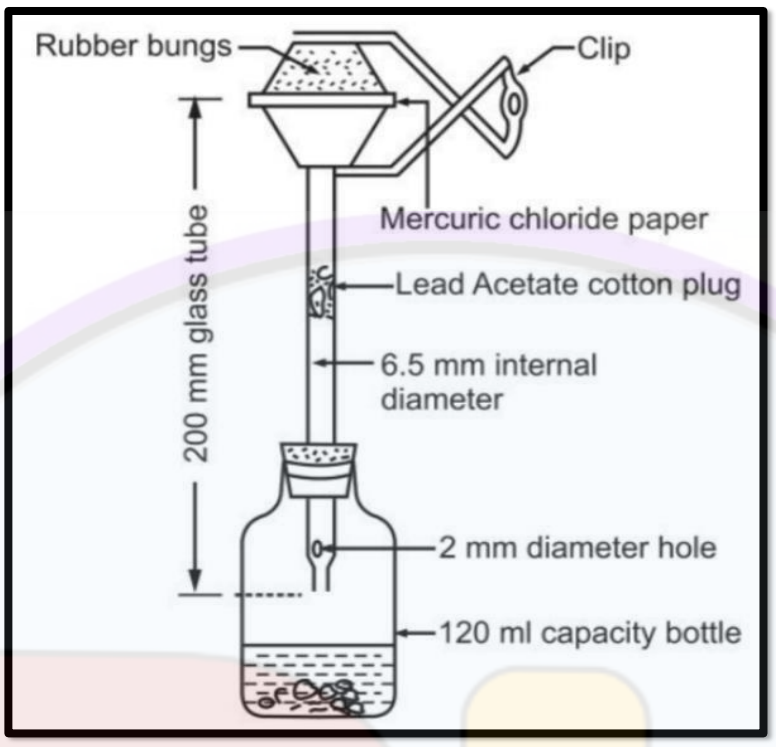


3. Arsenious acid to arsine gas

4. Arsine gas rec



Apparatus



It consists of a wide mouth bottle of 120 ml capacity with a rubber bung in which a glass tube is attached.
The glass tube has a length of 200mm and a diameter of 6.5mm to 8mm.
The part of the glass tube has a small hole.
One mercuric chloride paper is placed between the rubber bung and a clip is attached to hold together the rubber bung.
One cotton plug is also attached in between the glass tube.

Procedure

Sample preparation	Standard preparation
The sample solution is placed in the wide mouth bottle.	The standard solution is placed in the wide mouth bottle.
To this 1gm of potassium iodide is added	To this 1gm of potassium iodide is added
5ml of stannous chloride solution is added	5ml of stannous chloride solution is added
Then 10gm of zinc is also added.	Then 10gm of zinc is also added.
One cotton plug containing lead acetate is packed in glass tube.	One cotton plug containing lead acetate is packed in glass tube.
Keep the apparatus with the above mixture in the water bath for 40 minutes by maintaining the temperature 40 degree Celsius.	Keep the apparatus with the above mixture in the water bath for 40 minutes by maintaining the temperature 40 degree Celsius.
After 40 minutes the yellow color stain is produced on mercuric chloride paper.	After 40 minutes the yellow color stain is produced on mercuric chloride paper.

2) Explain the limit test of chloride and heavy metal?

Ans.

Limit test for chloride

Apparatus: Nessler's cylinder, pipette, stirring rod, beaker.

Chemicals: Dilute nitric acid (10%) Silver nitrate (5%), test sample, standard sample (Sodium chloride).

Principle: Limit test of chloride is based on the reaction of soluble chloride with silver nitrate in presence of dilute nitric acid to form silver chloride, which appears as solid particles in the solution (Opalescence)

Reaction

$$Cl^- + AgNO_3 \xrightarrow{\text{dil } HNO_3} AgCl\downarrow + NO_3^-$$

Procedure

Sample solution	Standard solution
Sample is dissolved in water and transfer the solution in Nessler's cylinder	Pipette out 1ml of chloride standard solution and transfer to Nessler's cylinder
Add 10 ml of dilute nitric acid	Add 10 ml of dilute nitric acid
Dilute to 50 ml with water	Dilute to 50 ml with water
Add 1ml of silver nitrate solution and stir immediately with the glass rod and keep aside for 5 minutes	Add 1ml of silver nitrate solution and stir immediately with the glass rod and keep aside for 5 minutes

Results

- The opalescence produce by the sample solution is compared with the standard solution.
- If the opalescence produce by the sample solution is less than the standard solution, the sample passes the limit test and vice versa.

Limit test for Heavy metals

Apparatus: Nessler's cylinder, pipette, stirring rod, beaker.

Chemicals: Test sample, standard sample, dilute acetic acid, dilute ammonia , dilute sodium hydroxide hydrogen sulphide solution.

Principle: Limit test of heavy metals is based on the reaction of metallic impurities with hydrogen sulphide in acidic medium to form metal sulphide which is in the form of brownish colour solution. Metals that response to this test are lead, mercury, bismuth, arsenic, antimony, tin, cadmium, silver, copper.

Reaction:

$$Pb + H_2S \longrightarrow PbS\downarrow$$

colour (brown)

Procedure:

sample solution	Standard solution
Take 1 gm of test sample	Take 1ml of lead standard solution in Nessler's cylinder
Add Dil acetic acid to adjust the pH of the mixture	Add Dil acetic acid to adjust the pH of the mixture

Add Hydrogen sulfide solution to the mixture	Add Hydrogen sulfide solution to the mixture
Dilute up to 50ml with distilled water and stir it well and keep aside for 5 minutes.	Dilute up to 50ml with distilled water and stir it well and keep aside for 5 minutes.

Result:

- The colour produce by the sample solution is compared with the standard solution.
- If the intensity of colour produce by the sample solution is less than the standard solution, the sample passes the limit test and vice versa.

3) Define Impurities and explain different sources of Impurities?

Ans.

Definition: Impurity is the undesirable foreign material which may be toxic or may not be toxic present in the pharmaceutical substances

Sources of impurities

1. **Raw material employed in manufacturing process**
   When any medicine is manufactured, the starting material used is raw material. If there are any impurities in raw material, then the final product will also have impurities.
   Example: if arsenic, heavy metal, lead is present in raw material then this will also be found in the final product which may cause harmful effects to human beings.
2. **Process used in manufacturing**
   There are a number of drugs and chemicals which are manufactured by different methods. Sometimes during manufacturing impurities are also incorporated and this will appear in final product
   If the manufacturing process is long, then the number of impurities will also increase in the final product.
3. **Plant material used in manufacturing process**
   During the manufacturing process, various chemicals are mixed in vessels, these vessels are made up of iron, copper, steel, aluminium. Sometime during mixing reaction takes place between chemicals and vessels which produce impurities in final product
   So, it is very necessary to use a proper vessel which does not react with any chemicals.
4. **Solvent used in manufacturing process**
   Water is the cheapest solvent and most commonly used in the manufacturing of chemicals.
   But water may act as a source of impurities if proper precaution is not taken. If a company is using tap water, then tap water contains lots of inorganic impurities. So, if a company is using distilled water then the number of impurities will reduce.
5. **Adulteration**
   It is a process in which high quality chemicals are mixed with low quality chemicals. Because of this impurity found in the final product.
   Examples: potassium bromide which is a costly chemical is mixed with sodium bromide which is a cheaper product.
6. **Improper storage area**
   Many substances may undergo changes if proper storage areas are not provided. Because of these impurities get involved in the final product.
7. **Atmospheric contamination**
   If the atmosphere is very polluted, then it may affect the purity of the product and impurities get involved in the final product.

4) Explain Gravimetric analysis?

Ans.

Definition: Gravimetric analysis or quantitative analysis by weight is the process of isolating and weighing an element or definite compound of the element in a pure form.

Principle of gravimetric analysis: In gravimetric analysis analytics quantitatively transformed into pure form which is then separated or isolated and accurately weighed.

Types of gravimetric analysis

a) **Precipitation method**
   This method involves conversion of analyte to a sparingly soluble precipitate with a known composition which is filtered and washed android or ignited and weight
b) **Electro analytical method**
   this method involves the electrical deposition of the analyte on a suitable pre-weighed electrode increase in weight of electrode indicate the amount of the analyte
c) **Volatilization method**
   In this method analyte or its decomposition product are volatilised at a suitable temperature. The amount of product is then collected and weight or alternatively the mass of the product is determined indirectly from the loss in mass of the sample
d) **Miscellaneous physical method**
   This method involves simple separation of an analyte in the form of gas or solid from a liquid without requiring chemical conversation of analyte

Advantages of gravimetric analysis

- Gravimetry is an accurate and precise method
- High accuracy can be obtained even in laboratory conditions
- This method requires no calibration and involve direct measurement
- This method is inexpensive

Disadvantages of gravimetric analysis

- This method is time consuming
- It is not applicable for qualitative analysis
- There is a possibility that the impurities may also get converted into insoluble components
- The drying process may result in loss of substances

5) Explain volumetric analysis?

Ans.

Volumetric Analysis

Volumetric analysis is a widely used quantitative analytical method. It is defined as the process of measuring the volume of a solution of known concentration (called the titrant) to determine the concentration of an unknown solution. This method is essential in analytical chemistry to assess the precise amount of a substance in a sample.

Definition

Volumetric analysis, or titration, involves the measurement of the volume of a reagent solution that reacts completely with the analyte, ensuring the reaction reaches its equivalence point.

Fundamentals of Volumetric Analysis

- Purpose: The solution under analysis contains an unknown quantity of a chemical substance to be measured.
- Indicators: In the presence of an indicator (e.g., phenolphthalein), the titrant of known concentration is added to the solution. The indicator changes color at the endpoint, signaling that the reaction is complete.
- Measurement: The reaction's completion is determined by measuring the precise volume of the titrant required to fully react with the analyte.
- Reagent and Solution Relationship: The volume and concentration of the reagent (titrant) are used to calculate the unknown concentration of the solution.
- Stoichiometry: The mole ratio or balanced chemical equation determines the relationship between the analyte and the titrant.

Important Points

- Volumetric analysis helps determine unknown concentrations through stoichiometric calculations.
- It is an accurate, reliable, and widely adopted method in fields like pharmaceuticals, environmental analysis, and food chemistry.
- Proper selection of the indicator is crucial for accuracy, as it signals the equivalence point where the reaction is complete.

Classification of Volumetric Analysis

A. Acid-Base Titration: Determines the concentration of acids or bases by neutralization.
B. Non-Aqueous Titration: Involves solvents other than water for titrations, often used for weak acids or bases.
C. Precipitation Titration: Based on the formation of an insoluble precipitate.
D. Complexometric Titration: Involves the formation of stable complexes, commonly used for metal ions.
E. Redox Titration: Relies on oxidation-reduction reactions to determine the analyte.

6) Explain in detail about NSAIDs?

Ans.

Definition:

These drugs produce relief of pain and elevated body temperature. As these drugs also produce anti-inflammatory effects they are known as NSAIDs. As these drugs act without interacting with opioid receptors they are also called as non-opioid analgesic

Classification

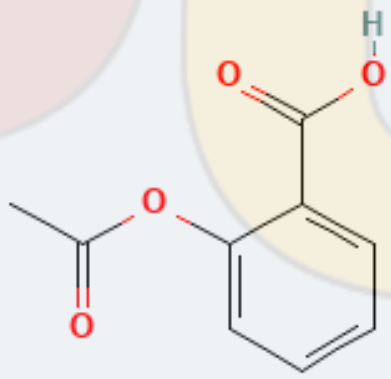
A. Non-selective cox-I inhibitors
   I. Salicylates and congeners: Examples - Salicylates, aspirin, salicylic acid, sodium salicylate
   II. Para-amino phenol derivatives: Examples - Paracetamol
   III. Pyrazolone derivatives: Examples - Aminopyrine, antipyrine, phenylbutazone
   IV. Miscellaneous: Examples - Indomethacin, ibuprofen, diclofenac, nimesulide

B. selective cox-ii inhibitors: Example - celecoxib, rofecoxib, valdecoxib

Uses:

1) It is used in the treatment of arthritis
2) It is used in the treatment of Rheumatism
3) It is used in the treatment of lupus erythematous
4) It is used in the treatment of ankylosing spondylitis
5) It is used in the treatment of Pain
6) It is used in the treatment if fever

Aspirin:



Properties:

1) White colour hygroscopic powder
2) Slightly soluble in water
3) Melting point is 142 Degree Celsius
4) Deep violet colour produces with ferric chloride solution after hydrolysis

Uses

- It is used as Antipyretics
- It is used as Antirheumatic
- It is used as Antithrombolytic

Storage: Well closed light resistant container

Formulation: Aspirin tablets and Aspirin dispersible tablets

7) Define and classify diuretics with examples and draw the chemical structure of furosemide with chemical name and uses?

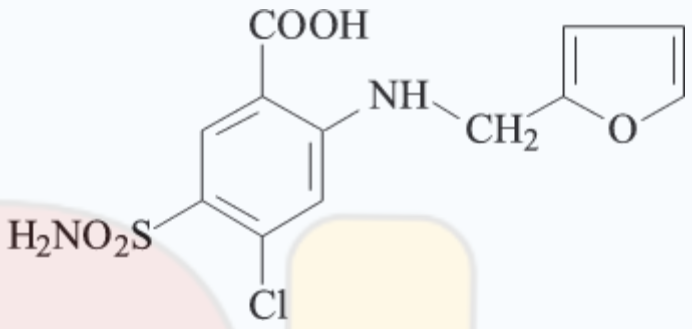
Ans.

Definition: Diuretics are the drugs which increase the rate of urine output. This drug increases the rate of urine formation.

Classification

a) Carbonic anhydrase inhibitors: for example, acetazolamide, methazolamide
b) Thiazide derivatives: for example, hydrochlorothiazide and chlorothiazide
c) Loop diuretics: for example, furosemide, bumetanide and ethacrynic acid
d) Potassium sparing diuretics: for example, spironolactone, amiloride
e) Osmotic diuretic: for example, urea mannitol isosorbide
f) Miscellaneous diuretics: for example, clopamide, chlorthalidone, metolazone

Structure of furosemide:



Chemical Name: 4-chloro-2-(furan-2-ylmethylamino)-5-sulfamoylbenzoic acid

Uses of furosemide:

- It is used for the treatment of oedema related to congestive heart failure, liver cirrhosis and renal disease
- It is also used either alone or with antihypertensive agent for the management of hypertension

8) Define and classify Antibiotics with examples? Draw the structure of basic nucleus of penicillin?

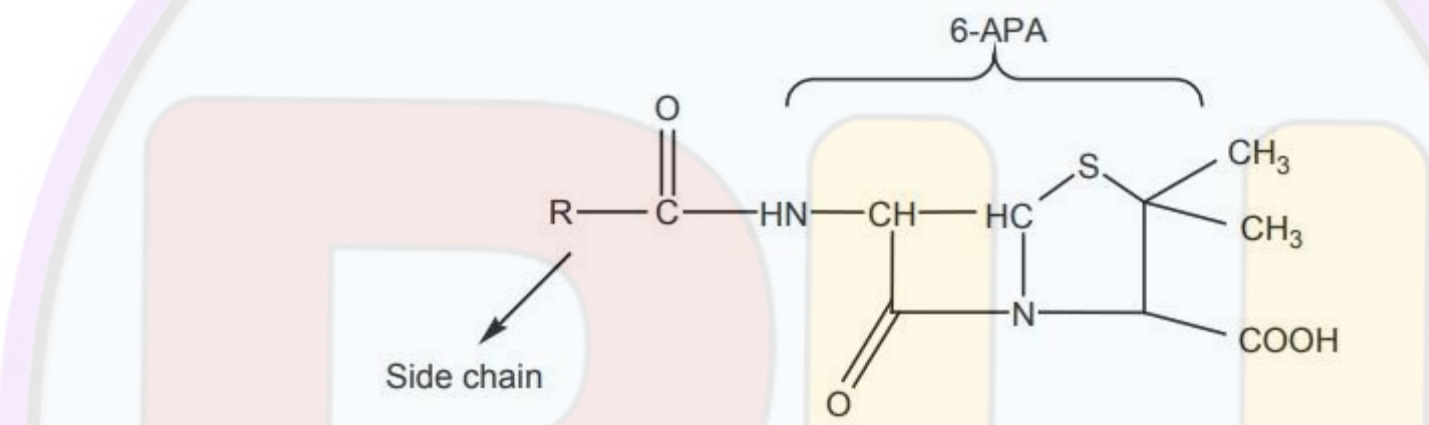
Ans.

Definition: These are the chemical substances produced by microorganisms having the property of inhibiting the growth or destroying other microorganisms.

Classification

1) Antibiotics effective against gram positive bacteria: for e.g., penicillin, erythromycin, cephalosporins
2) Antibiotics effective against gram negative bacteria: for e.g., streptomycin, gentamycin, kanamycin
3) Broad spectrum antibiotics (effective against both gram -ve and gram +ve bacteria): for e.g., tetracycline, chloramphenicol
4) Antibiotics effective against acid resistance bacilli: for e.g., rifampicin, streptomycin
5) Antibiotics effect against cancer: for e.g., actinomycin-d, mitomycin

Penicillin is the most important and oldest antibiotics. It was first extracted from penicillin notatum



The basic structure of all the penicillin consists of a thiazolidine ring fused with a beta-lactam ring, creating a fundamental nucleus (also known as 6-amino penicillanic acid) that is crucial for their antibacterial activity.

9) Define and classify Antihypertensive drugs? Draw the chemical structure of captopril?

Ans.

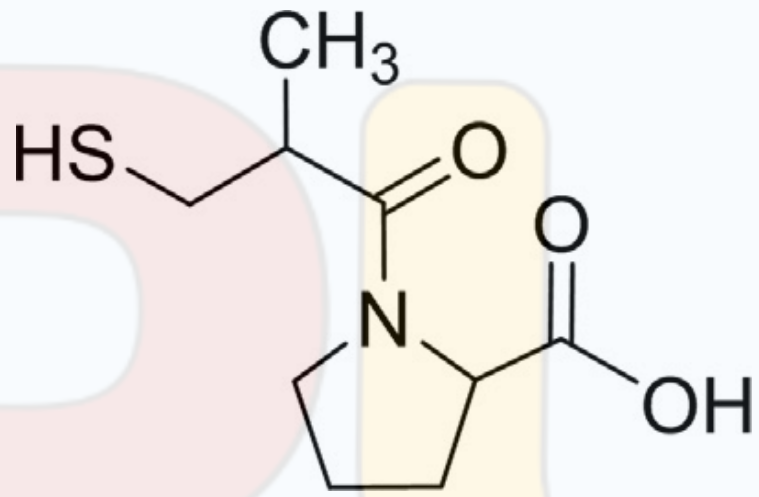
Definition:

The drug used for the treatment of hypertension is known as anti-hypertensive drugs.
These drugs lower the increased blood pressure in the body.

Classification of anti-hypertensive drugs

1. Ace inhibitors: Example - captopril, enalapril, lisinopril, ramipril
2. Angiotensin antagonist: Example - candesartan, losartan, telmisartan, valsartan
3. Calcium channel blockers: Example - diltiazem, verapamil, amlodipine, felodipine, nicardipine
4. Diuretics: Example - chlorothiazide, hydrochlorothiazide, frusemide, amiloride, spironolactone
5. Beta adrenergic blockers: Example - propranolol, metoprolol, atenolol
6. Alpha adrenergic blockers: Example - prazosin, terazosin, phentolamine
7. Central sympatholytic: Example - clonidine, methyldopa
8. Vasodilators: Example - diazoxide, hydralazine, minoxidil, nitroprusside

Chemical Structure of Captopril



10) Define and classify Anti-neoplastic agents?

Ans.

Definition: The drugs which are used in the treatment of cancer is known as antineoplastic agents
These drugs are also called as anticancer drugs

Classification:

A) Alkylating Agents
- Nitrogen Mustards: Examples: Melphalan, Cyclophosphamide, Chlorambucil
- Ethylenimines: Examples: Thiotepa, Altretamine (Diethylene melamine is an outdated term).
- Alkyl Sulfonates: Example: Busulfan

B) Antimetabolites
- Folic Acid Antagonists: Example: Methotrexate
- Purine Antagonists: Example: 6-Mercaptopurine, Azathioprine
- Pyrimidine Antagonists: Examples: 5-Fluorouracil, Cytarabine

C) Radioactive Isotopes
- Examples: Radioactive gold (Au-198), Radioactive iodine (I-131), Radioactive phosphorus (P-32)

D) Miscellaneous
- Natural Alkaloids (Plant Derivatives): Examples: Vincristine, Vinblastine, Paclitaxel
- Antibiotics (Cytotoxic): Examples: Actinomycin D (Dactinomycin), Mitomycin C, Doxorubicin
- Hormones and Hormone Antagonists: Examples: Androgens, Progestins, Corticosteroids, Tamoxifen (SERM)
- Others: Examples: Procarbazine, L-Asparaginase, Oxaliplatin

All The Best For Your Exam

Very Imp Note:

- Please Read All the chapters very carefully before Pharmaceutical Chemistry Exam.
- These questions are only for the reference purpose.