Top Important Questions for D. pharma 1st year

Pharmaceutical Chemistry

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Q 1. Define accuracy and Precision in Pharmaceutical Chemistry.

Answer: - Accuracy and precision are important concepts used to assess the reliability and quality of analytical measurements.

Here's how accuracy and precision are defined: -

1. Accuracy: Accuracy refers to how close a measured value is to the true or accepted value. It indicates the degree of correctness of a measurement. In pharmaceutical chemistry, accuracy is determined by comparing the experimental results to a known standard or reference material. An accurate measurement is one that has minimal systematic errors and provides results that are close to the true value.

2. Precision: Precision refers to the degree of agreement or reproducibility between individual measurements of the same quantity. It assesses the consistency and reliability of repeated measurements under similar conditions. Precision indicates the scatter or spread of data points around the mean value. In pharmaceutical chemistry, precision is evaluated by performing replicate measurements and calculating statistical parameters such as standard deviation or relative standard deviation (RSD). A precise measurement exhibits minimal random errors and provides consistent and reproducible results.

Q 2. Define Impurities and explain different source of impurities.

Answer: - Certainly! In pharmaceutical chemistry, impurities can originate from various sources.

Here are the different sources of impurities:

1. Raw materials: The raw materials used in the synthesis of pharmaceuticals can contain impurities. These impurities can be inherent to the starting materials themselves or introduced during their production, handling, or storage. Raw material impurities may include residual solvents, heavy metals, organic impurities, or other contaminants.

2. Manufacturing process: The manufacturing process itself can generate impurities. These impurities may arise from incomplete reactions, side reactions, or degradation of the drug substance or intermediates. By-products, reagents, catalysts, and residual solvents used in the manufacturing process can also contribute to impurities.

3. Intermediates: Pharmaceutical synthesis often involves several intermediate steps before obtaining the final drug substance. Impurities can be formed at each stage of these intermediates due to incomplete reactions, side reactions, or other process-related factors.

4. Degradation products: Pharmaceuticals can degrade over time due to various factors such as heat, light, moisture, or chemical instability. Degradation products can be formed during storage, transportation, or handling of the drug substance or drug product. These degradation products can be impurities and may have different chemical structures and potentially harmful effects.

5. Environmental factors: Impurities can originate from the environment in which the pharmaceuticals are manufactured. Contaminants can enter the production area through air, water, or surfaces, and subsequently contaminate the drug substance or drug product. Environmental impurities can include dust particles, microbial contaminants, or volatile organic compounds.

6. Human factors: Human interactions and activities can contribute to impurities in pharmaceutical chemistry. Poor manufacturing practices, inadequate training, or improper handling of raw materials and equipment can lead to contamination or the introduction of impurities.

Q 3. Explain Limit test of arsenic with diagram principle and procedure.

Answer: -Principle:

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. It is also called as **Gutzeit test** and requires special apparatus.

Arsenic, present as arsenic acid in the sample is reduced to arsenious acid by reducing agents like potassium iodide, stannous acid, zinc, hydrochloric acid, etc. Arsenious acid is further reduced to arsine (gas) by hydrogen and reacts with mercuric chloride paper to give a yellow stain.

$H_3AsO_4 + H_2SnO_2 \rightarrow H_3AsO_3 + H_2SnO_3$
Arsenic acid Arsenious acid

$H_3AsO_3 + 3H_2 \rightarrow AsH_3 + 3H_2O$
Arsenious acid Arsine

The depth of yellow stain on mercuric chloride paper will depend upon the quality of arsenic present in the sample.

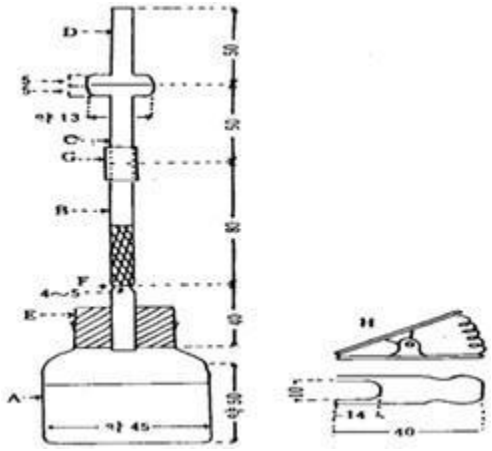
Procedure:
Test solution: -

The test solution is prepared by dissolving specific amount in water and stagnated HCl (arsenic free) and kept in a wide mouthed bottle.
To this solution 1 gm of KI, 5 ml of stannous chloride acid solution and 10 gm of zinc is added (all this reagents must be arsenic free)

Keep the solution aside for 40 min and stain obtained on mercuric chloride paper is compared with standard solution.

Standard solution: -

A known quantity of dilute arsenic solution is kept in wide mouthed bottle and rest procedure is followed as described in test solution.



A : approximately 60 ml generator bottle with 40 ml indicating line.

B : glass tube with 6.5 mm inner diameter

C and D : a ground joint glass tube with 6.5 mm inner diameter and 18 mm outer diameter at the joint. Inner joint and the outer joint form a concentric circle.

E : rubber stopper

F : narrow part of the glass tube B. Glass wool is inserted up to this part.

G : rubber board (Lead acetate cotton plug)

H : clamp

Reasons:

Stannous chloride is used for complete evolution of arsine

Zinc, potassium iodide and stannous chloride is used as a reducing agent

Hydrochloride acid is used to make the solution acidic

Lead acetate pledger or papers are used to trap any hydrogen sulphide which may be evolved along with arsine.

Q 4. Explain the gravimetric analysis.

Answer: - Gravimetric analysis is a quantitative analytical technique used to determine the amount of a substance present in a sample based on the measurement of its mass. It relies on the principle that the mass of a substance is directly proportional to its quantity.

The process typically involves several steps: -

1. Sample Preparation: - The sample under analysis is collected and prepared in a way that ensures it is representative of the whole. It may involve crushing, grinding, drying, or other techniques to achieve a homogeneous and easily measurable sample.

2. Precipitation: -In gravimetric analysis, the substance of interest is often separated from the sample matrix by precipitation, forming a solid compound. This can be achieved by adding a reagent that reacts specifically with the analyte to produce an insoluble product. The precipitate formed should have known stoichiometry.

3. Filtration: - The precipitate is then separated from the liquid phase by filtration. This is typically done using filter paper or other porous materials. The filtrate, which contains the unwanted species, is discarded, while the solid precipitate is collected on the filter paper.

4. Washing: - The collected precipitate is washed with a suitable solvent to remove any impurities or unwanted ions that may be adsorbed on the surface. This is done to ensure the purity of the precipitate.

5. Drying: - After washing, the filter paper with the precipitate is dried to remove any remaining moisture. This can be done by heating the filter paper and precipitate to a constant weight.

6. Weighing: - The dried precipitate is carefully weighed using an analytical balance with high precision. The difference in mass before and after precipitation and drying represents the mass of the analyte.

7. Calculation: - The mass of the analyte is used to calculate the amount or concentration of the substance in the original sample. This calculation involves stoichiometry and may require additional information, such as the molecular weight of the compound or other factors.

Q 5. Discuss Arrhenius acid base theory with example and limitations.

Answer: - Arrhenius gave a definite concept about acids and bases. According to Arrhenius, an acid is a substance containing hydrogen which produces hydrogen ion (H+) in its aqueous solution,

$$HNO3\ (I)\ H2OH{+}{+}NO3{-}\ (aq)$$

A base is a substance containing hydroxide which produces hydroxide ion (OH^-) in its aqueous solution.

$$KOH(s)H2OK^+ + OH^-(aq)$$

For example, hydrogen nitrate (nitric acid) produces hydrogen ion in its aqueous solution, and sodium hydroxide produces hydroxide ion in its aqueous solution. This hydrogen nitrate is an acid and sodium hydroxide are a base.

Limitations of Arrhenius theory: -

1. It is applicable to aqueous solutions only.
2. It could not explain the basic nature of ammonia in its aqueous solution, as ammonia (NH_3) does not have the hydroxide ion.
3. An Arrhenius acid is based on the formation of the H^+ ion. However, it is highly unstable and does not exist independently. It combines immediately with the solvent and forms hydronium ions, i.e. H_3O^+.

Q 6. Define general anesthetic agent explain different stages of general anesthetics.

Answer: - A general anesthetic agent is a medication that induces a reversible loss of consciousness, allowing for painless medical procedures and surgeries. These agents act on the central nervous system, producing a state of general anesthesia characterized by unconsciousness, amnesia, analgesia (pain relief), and muscle relaxation.

The stages of general anesthesia can be classified into four distinct phases, each with specific characteristics: -

1. Induction: - This stage begins with the administration of the anesthetic agent and ends when the patient becomes unconscious. The agent is typically administered intravenously or inhaled through a mask or breathing tube. During induction, the patient may experience a sense of euphoria or disorientation before losing consciousness. Vital signs, such as heart rate and blood pressure, may fluctuate during this phase.

2. Maintenance: - Once the patient is unconscious, the maintenance stage begins. The anesthetic agent is continuously administered to sustain the state of anesthesia throughout the procedure. Inhaled gases like sevoflurane or intravenous medications such as propofol are commonly used during this stage. The dosage is adjusted based on the patient's needs, ensuring adequate depth of anesthesia while minimizing side effects. Vital signs are closely monitored and controlled to maintain stability.

3. Surgical Anesthesia: - This stage refers to the desired level of anesthesia where the patient is adequately anesthetized and immobilized, allowing the surgical procedure to take place. The depth of anesthesia should be sufficient to prevent awareness and pain perception, and muscle relaxation is achieved. Vital signs remain stable, and the anesthetic is adjusted as needed.

4. Emergence: - The emergence phase occurs when the administration of the anesthetic agent is stopped, and the patient begins to regain consciousness. The anesthetic is gradually eliminated from the body, and the patient wakes up. During this stage, the patient may experience confusion, disorientation, or temporary memory loss. Vital signs are carefully monitored, and pain management is initiated as needed.

Q 7. Define and classify diuretics with example draw the chemical structure of furosemide with chemical name and uses

Answer: - Diuretics are the drugs which increase the rate of urine output.

Classification: -

1. Carbonic anhydrase inhibitors: - for example acetazolamide, methazolamide

2. Thiazide derivatives: - for example hydrochlorothiazide and chlorothiazide

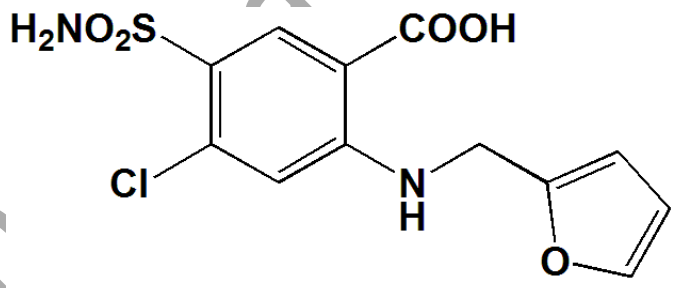
3. Loop diuretics: - for example furosemide, bumetanide and ethacrynic acid

4. Potassium sparing diuretics: - for example spironolactone, Amilonde

5. Osmotic diuretic: - for example urea mannitol isosorbide

6. Miscellaneous diuretics: - for example clorpromide, chlorthalidone, metolazone-

Structure of furosemide: -



Furosemide

Chemical name: - 4-chloro-2-(furan-2-ylmethylamino)-5-sulfamoyibenzoic acid

Uses of furosemide

1. It is used for the treatment of oedema related to congestive heart failure, laser cirrhosis and renal disease

2. It is also used either alone or with ant hypertensive agent for the management of Hypertension.

Q 8. Define and classify antibiotic with example draw and explain the structure of basic nucleus of penicillin.

Answer: - Ans. 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

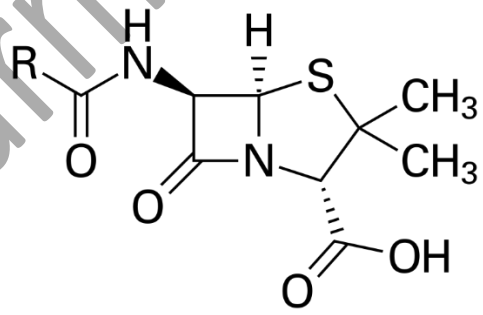
3. Broad spectrum antibiotics (effective against both gram -ve and gram +ve bacteria): for e.g. tetracycline, chloramphenicol

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 penicillins consists of a thiazolidine ring fused with a beta-lactam ring, creating a fundamental nudeus (also known as G-amino penicillanic acid) that is crucial for their antibacterial activity.



Q 9. Explain diabetes mellitus classify hypoglycemic agent with example.

Answer: - Diabetes mellitus is a chronic metabolic disorder characterized by high blood sugar levels (hyperglycemia) due to insufficient production or utilization of insulin, a hormone responsible for regulating glucose metabolism. Hypoglycemic agents, also known as antidiabetic drugs, are medications used to treat diabetes by lowering blood sugar levels.

They can be classified into several categories based on their mechanism of action:

1. Insulin: Insulin is a hormone naturally produced by the pancreas. In individuals with type 1 diabetes or advanced type 2 diabetes, insulin replacement therapy is necessary because their pancreas cannot produce enough insulin.

2. Sulfonylureas: They are primarily used to treat type 2 diabetes. Examples include glibenclamide, glimepiride, and glipizide.

3. Biguanides: Biguanides, such as metformin, work by reducing glucose production in the liver and improving insulin sensitivity in peripheral tissues.

4. Thiazolidinediones: Thiazolidinediones, also known as glitazones, enhance insulin sensitivity in target tissues. They primarily act on the peroxisome proliferator-activated receptor gamma (PPARγ), which regulates glucose and lipid metabolism. Examples include pioglitazone and rosiglitazone.

5. Alpha-glucosidase inhibitors: They reduce the postprandial rise in blood glucose levels. **Acarbose** and **miglitol** are common examples.

6. Dipeptidyl peptidase-4 (DPP-4) inhibitors: By prolonging the action of incretin hormones, they help regulate blood sugar levels. Examples include **sitagliptin, saxagliptin, and linagliptin**.

Q 10. Define and classify antihypertensive agent draw the chemical structure of captopril.

Answer: -

Antihypertensive agents, also known as antihypertensives, are drugs used to treat high blood pressure (hypertension). They work by lowering blood pressure, reducing the strain on the heart and blood vessels, and helping to prevent complications associated with hypertension.

There are several classes of antihypertensive agents, including: -

1. Angiotensin-Converting Enzyme (ACE) Inhibitors: - ex-captopril, enalapril, lisinopril, ramipril

2. Angiotensin II Receptor Blockers (ARBs): - ARBs work by blocking the action of angiotensin II at the receptor level, preventing its vasoconstrictive effects and promoting vasodilation. E.g.: - candesartan, losartan, telmisartan, valsartan

3. Calcium Channel Blockers (CCBs): - These drugs block the entry of calcium into the smooth muscle cells of blood vessels and the heart. By doing so, they relax and widen the blood vessels, reducing blood pressure.

E.g.: - diltiazem, verapamil, amlodipine, felodipine, nicardpine

4. Diuretics: - Diuretics increase the excretion of water and salts from the body, leading to a decrease in blood volume and, consequently, blood pressure.

Ex-chlorothiazide, hydrochlorothiazide, frusemide, amiloride, spironolactone

5. Beta Blockers: - Beta blockers block the effects of adrenaline and noradrenaline on the beta-adrenergic receptors, resulting in decreased heart rate and reduced force of contraction. This leads to a decrease in cardiac output and blood pressure.

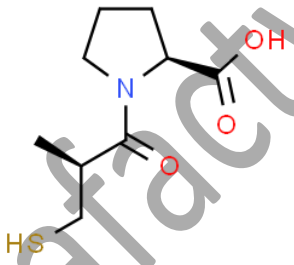
E.g.: - propranolol, metoprolol, atenolol

6. Alpha Blockers: -Alpha blockers block the action of alpha-adrenergic receptors, causing relaxation of smooth muscle in blood vessels and leading to vasodilation and lowered blood pressure.

E.g.: - prazosin, terazosin, phentolamine

7. Direct Renin Inhibitors: -These drugs inhibit the enzyme renin, which is involved in the production of angiotensin II, leading to reduced blood pressure.

Chemical Structure: -



Q 11. Define and classify antineoplastic agent with example.

Answer: -The drugs which are used in the treatment of cancer is known as antineoplastic agents

Classification:

A) Alkylating agents: -

- Nitrogen mustards: ex melphalan, cyclophosphamide, chlorambucil
- Ethylenimines: ex diethylene melamine, diethylene triphosphamide
- Alkyl sulfonates: ex: busulfan

B) antimetabolite:

- Folic acid antagonist :-ex: methotrexate
- Purine antagonist: ex: 6-mercaptopurine
- Pyrimidine antagonist: ex: 5-fluorouracil

C) **Radioactive isotopes:** ex: radio gold, radio iodine, radio phosphorus

D) miscellaneous

- **Natural alkaloids:** ex: vincristine, vinblastine

- **Antibiotics: ex** actinomycin-d, mitomycin-c
- **Hormones: ex:** androgens, progestins, corticosteroids
- **Others: ex:** procarbazine, l-asparaginase, oxplatins

Q 12. Define sedative and hypnotic and classify it with example

Answer: - A sedative is a substance that induces a calming or relaxing effect on the body and mind. It is commonly used to reduce anxiety, promote sleep, and relieve tension. Sedatives can have varying levels of potency, ranging from mild relaxation to deep sedation. These substances work by depressing the central nervous system (CNS), slowing down brain activity and reducing excitability. They are commonly used in medical and clinical settings to aid in surgical procedures, manage anxiety disorders, or treat insomnia.

Classification: -

1) Barbiturates:

A Long acting barbiturates (duration of action in 8hrs or more):- ex: barbitone, phenobarbitone

B. Intermediate acting barbitone (4 hrs or more):- ex: amylobarbitone, cyclobarbitione

C. Short acting barbitone (less than 4 hrs)-ex: hexobarbitone, secobarbitone.

D. Ultra-short acting barbiturates. (Less than 1 hrs)- ex thiopentone, methohexitone

2) Non-barbiturates

A. Benzodiazepines - ex: diazepam, nitrazepam, alprazolam

B. Alcohol-ex: chlorhydrate

C. Aldehydes :- ex paraldehyde

Q 13. Write a short Note on Sulphonamide.

Answer: - Sulfonamides, also known as Sulphonamide, are a class of synthetic antimicrobial drugs that were among the first effective treatments for bacterial infections. They were discovered in the mid-20th century and have played a significant role in the history of antibiotic therapy.

Sulfonamides work by inhibiting the growth and reproduction of bacteria by targeting an enzyme called dihydropteroate synthase, which is involved in the production of folate, an essential nutrient for bacteria. By blocking this enzyme, sulfonamides prevent the synthesis of folate, leading to impaired bacterial growth and eventually their elimination.

These drugs have a broad spectrum of activity, meaning they are effective against a wide range of bacteria. However, their use has decreased over time due to the emergence of bacterial resistance

and the availability of more advanced antibiotics. Nonetheless, sulfonamides still find application in certain clinical situations.

Here are some key points about sulfonamides:

1. Uses: Sulfonamides can be used to treat various bacterial infections, including urinary tract infections, respiratory tract infections, middle ear infections, and certain gastrointestinal infections. They are also employed in the treatment of certain protozoal infections, such as toxoplasmosis.

2. Combination Therapy: Sulfonamides are sometimes used in combination with other antibiotics to enhance their effectiveness. One such combination is trimethoprim-sulfamethoxazole, which is commonly used to treat urinary tract infections, respiratory tract infections, and certain types of pneumonia.

3. Adverse Effects: Sulfonamides can cause side effects, including allergic reactions, skin rashes, gastrointestinal disturbances, and, in rare cases, more severe reactions like Stevens-Johnson syndrome or toxic epidermal necrolysis. They can also cause hypersensitivity reactions in some individuals.

4. Resistance: Over time, bacteria have developed resistance to sulfonamides through various mechanisms, such as altered drug targets, reduced drug uptake, or increased drug efflux. This has limited their effectiveness, and they are no longer considered first-line agents for many infections.

Q 14. Define (NSAIDs) Non-steroidal anti- inflammatory drugs any classify it with example.

Answer: - These drugs produce relief of pain and elevated body temperature. As these drugs also produce anti-inflammatory affects, 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-l inhibitors

1. Salicylates and congeners-ex salicylates, aspirin, salicylic acid, sodium salicylate

2 Para-amino phenol derivatives -ex paracetamol

3 Pyrazolone derivativesex aminopyrine, antipyrine, phenylbutazone

4 Miscellaneous-ex indomethacin, ibuprofen, diclofenac, nimesulide,

B) Selective Cox-2 inhibitors: -
Excelecom, rofecob, valdecomb

Q 15. What is tuberculosis defining anti-tubercular drugs and classify with example.

Answer: - Ans. Tuberculosis is an infectious disease most commonly affecting the lungs and caused by mycobacterium tuberculosis it is an air borne disease it spread va air in the form of small droplets tuberculosis can be treated in a long term lie., 8 months to 3 years

The drug used for the treatment of tuberculosis is called anti-tubercular drugs

Classification

1. First line drugs

Example: - isoniazid, rifampicin, pyrazinamide, ethambutol and streptomycin

2. Second line drugs

Fluoroquinolones: - for example, ofloxacin, levofloxacin moxifloxacin, aprofloxacin

Other oral drugs: - for example, ethionamide prothionamide, cycloserine, para-amino salicylic acid, rifabutin

Injectable drugs: - for example kanamycin, amikacin, capreomycin

Q 16. Enlist the Properties for ideal Antacids.

Answer: -

Ideal antacids possess several properties that make them effective in relieving symptoms of acid indigestion, heartburn, and related conditions. Here are some properties of ideal antacids:

1. Neutralizing capacity: Ideal antacids should have a high neutralizing capacity to effectively counteract excessive stomach acid. They should be able to neutralize acid quickly to provide rapid relief.

2. Acid-soluble: Antacids should be able to dissolve easily in the acidic environment of the stomach to ensure efficient neutralization of acid.

3. Fast-acting: Effective antacids act quickly to provide relief from symptoms. They should start working within a short time after ingestion, typically within a few minutes.

4. Long-lasting effect: Ideal antacids provide sustained relief and help maintain a balanced pH level in the stomach for an extended period. This helps prevent the recurrence of symptoms.

5. Safe and well-tolerated: Antacids should be safe for consumption and have minimal side effects. They should be well-tolerated by most individuals, including those with underlying health conditions.

6. Non-systemic: Antacids primarily work within the gastrointestinal tract and should not be absorbed into the bloodstream in significant amounts. This minimizes the risk of systemic side effects.

7. Convenient dosage form: Antacids are commonly available in various forms, such as tablets, chewable tablets, powders, or liquids. Ideal antacids should be formulated in a convenient dosage form that is easy to administer and suitable for individual preferences.

8. Broad-spectrum action: An ideal antacid should be able to neutralize different types of acids, including hydrochloric acid (HCl) and other acid derivatives present in the stomach.

Q 17. What is difference between gravimetric and volumetric Analysis?

Answer: - Gravimetric analysis and volumetric analysis are two different methods used in quantitative chemical analysis. Here are the key differences between the two:

Gravimetric Analysis:

1. Principle: Gravimetric analysis is based on the measurement of mass. It involves the determination of the quantity of a substance by weighing a precipitate or a substance formed during a chemical reaction.

2. Method: In gravimetric analysis, a sample is subjected to a chemical reaction that leads to the formation of a solid precipitate. The precipitate is then collected, filtered, washed, dried, and weighed. The mass of the precipitate is used to calculate the amount of the analyte in the original sample.

3. Precision: Gravimetric analysis is often considered more precise than volumetric analysis because it involves direct measurement of mass, which is less susceptible to errors associated with volume measurements.

4. Time-consuming: Gravimetric analysis is generally more time-consuming compared to volumetric analysis. The process of precipitate formation, filtration, washing, and drying requires several steps, which can prolong the analysis.

Volumetric Analysis:

1. Principle: Volumetric analysis, also known as titration, is based on the measurement of volume. It involves the reaction between a solution of known concentration (titrant) and a solution of unknown concentration (analyte) to determine the concentration or quantity of the analyte.

2. Method: In volumetric analysis, a precise volume of the analyte solution is measured and then reacted with a titrant solution of known concentration. The reaction is monitored using an indicator or an instrument, such as a pH meter, until the reaction is complete or reaches an endpoint. The volume of the titrant solution required to react completely with the analyte is used to calculate its concentration or quantity.

3. Rapid analysis: Volumetric analysis is generally faster compared to gravimetric analysis because it involves direct measurement of volume, which can be done more quickly and easily.

4. Flexibility: Volumetric analysis allows for the determination of various types of substances, including acids, bases, and redox reactions, by selecting appropriate titrants and indicators.