Q.1 Attempt any EIGHT: (Each question will carry TWO marks) **(16)**

a) Explain Acid-Base as per Bronsted & Lowry Theory.

Answer- (One mark each for the definition of acid and base with examples. At least one example of acid and base is expected)

According to Bronsted & Lowry Theory-

Acid- Acid is any substance capable of donating proton (H^+) in a chemical reaction; in short acid is a proton donor. Examples-

$$HCl \rightleftharpoons H^+ + Cl^-$$

$$H_2SO_4 \rightleftharpoons H^+ + HSO_4^-$$

$$H_3O^+ \rightleftharpoons H^+ + H_2O$$

$$NH_4^+ \rightleftharpoons H^+ + NH_3$$

Base- Base is any substance capable of accepting a proton (H^+) in a chemical reaction; in short base is a proton acceptor. Examples-

$$OH^- + H^+ \rightleftharpoons H_2O$$

$$H_2O + H^+ \rightleftharpoons H_3O^+$$

$$HSO_4^- + H^+ \rightleftharpoons H_2SO_4$$

$$NH_3 + H^+ \rightleftharpoons NH_4^+$$

b) List some important Antioxidants used in pharmaceutical formulations.

Answer- (At least FOUR antioxidants are expected. So one antioxidant will carry half mark)

Some important Antioxidants used in pharmaceutical formulations-

1. Hypophosphorus acid
2. Sulfur dioxide gas
3. Sodium bisulphite
4. Sodium metabisulphite
5. Sodium thiosulphate
6. Nitrogen gas
7. Sodium nitrite

c) Classify Topical agents with examples.

Answer- (Each category will carry half mark.)

The compounds used topically are broadly categorized according to their main action. Classification of topical agents:-

1] Protectives and adsorbents.e.g.talc, silicone polymers, titanium dioxide, calamine, zincoxide,

2] Antimicrobial agents.

- Acting by oxidation.e.g. Hydrogenperoxide, Potassium permanganate. Sodium perborate.
- Acting by halogenation.e.g. Iodine & iodine preparations, Chlorinated lime, sodium hypochlorite solution,
- Acting by protein precipitation. E.g. Boric acid, Borax, Silver & Silver compounds,Mercury compounds.

3] Astringents. E.g. Zinc chloride, Zinc sulphate, Aluminium sulphate, Alum, Aluminium subacetate solution.

4] Miscellaneous compounds. E.g. sulphur & sulphur compounds.

d) What are desensitizing agents?

Answer- (One mark for Definition and one mark for examples)

Desensitizing agents: These agents are used to decrease hypersensitivity of teeth to heat, cold & sweet, when applied to outer surface of teeth.

Examples: Zinc Chloride, Strontium Chloride.

e) Give the different conditions under which oxygen is required to the body.

Answer-(Each condition will carry half mark, so at least four conditions are expected. But along with respiratory and cardiac conditions, other at least two conditions are expected)

Following are the different conditions under which oxygen is required to the body-

Respiratory diseases like:

1. Chronic Bronchitis
2. Pneumonia
3. Pulmonary Oedema

Cardiac diseases like:

1. Cardiac arrest
2. Myocardial Infarction
3. Congestive Heart Failure

Other Conditions- Hypoxia, Asphyxia, Carbon monoxide gas poisoning, diluents for volatile and gaseous anesthetic agents etc.

f) What are respiratory stimulants?

Answer- (One mark for Definition and one mark for examples)

Respiratory stimulants- Respiratory stimulants increases Pulmonary ventilation by their effect on depth and rate of respiration by stimulating respiratory center in the medulla.

Examples- Gaseous ammonia, dilute Ammonia solution, ammonium carbonate etc.

g) Give uses of Ammonium chloride.

Answer- (One use will carry half mark so at least Four uses are expected)

Uses of Ammonium chloride-

1. Expectorant- Increases secretion of respiratory tract and makes the mucus less viscous.
2. Diuretic- Treatment of lead poisoning by increasing its excretion.
3. Replace chloride lost during vomiting
4. Systemic acidifier (treatment of metabolic alkalosis)
5. Treatment of Urinary tract infection.
6. Diaphoretic.

h) Define and classify Antidotes.

Answer- (One mark for definition and one mark for classification)

Definition: Antidote is any Substance which counteracts the effect of poison.

Classification: Depending on their mechanism of antidotal action they are classified as

1. **Physiological antidote:** It counteracts effect of poison by producing other physiological effect

   Example- Sodium nitrite

2. **Chemical antidote:** It changes chemical nature of poison.

   Examples- Sodium Thiosulphate

   Chelating agents- Sodium & Calcium Edetate

3. **Mechanical antidote:** They prevent absorption of poison across the intestinal wall.

   e.g. Activated charcoal, copper sulphate, magnesium sulphate

i) Give formula for ORS.

Answer- (Any one formula will carry two marks. So half mark for each ingredient)

ORS composition is approved and recognized by WHO in 1971

Formula 1

1. Sodium chloride 3.5 gm
2. Sodium bicarbonate 2.5 gm
3. Potassium Chloride 1.5 gm
4. Dextrose or Glucose 20 gm
5. Water To Prepare 1 Liter.

Formula 2

1. Sodium chloride 3.5 gm
2. Sodium Citrate 2.9 gm
3. Potassium Chloride 1.5 gm
4. Dextrose or Glucose 20 gm
5. Water To Prepare 1 Liter.

j) Enlist the official compounds of Iron.

Answer- (At least Four compounds are expected so half mark for one iron compound)

Official compounds of Iron-

1. Ferrous sulphate

2. Dried Ferrous Sulphate

3. Ferrous Gluconate

4. Ferrous Fumarate

5. Ferrous Succinate

6. Ferric Chloride

7. Iron Phosphate

8. Iron dextran injection

9. Iron Sorbitol injection etc.

k) Enlist various devises used in measurement of radiations.

Answer- (One devise will carry half mark so at least Four devises are expected)

Various devises used in measurement of radiations

1. Ionisation Chamber
2. Proportional Counter
3. Geiger-Muller Counter
4. Scintillation Counter
5. Autoradiography.
6. Solid state detectors

l) Define: i) Accuracy ii) Precision

Answer- (One mark for each definition)

Accuracy- It is a closeness of experimental results or in other word it is a difference between true value and experimental value.

Precision- Precision means reproducibility of experimental results or in other word it is the variability among replicate measurements i.e. how close the values of the results of replicate measurements are to each other.

Q.2 Attempt any FOUR: (Each question will carry THREE marks) (12)

a) Give properties, storage and uses of Boric acid.

Answer- (One mark each for properties, storage and uses of boric acid. Any 2-3 important properties and uses are expected)

Properties of Boric acid-

1. It is a white, colorless crystalline powder, odorless, unctuous to touch.
2. It has bitter, sweetish after taste
3. It is soluble in alcohol, freely soluble in glycerin, propylene glycol and boiling water
4. Stable in air
5. On heating at 100^0C it is converted in to Metaboric acid, at 160^0C in to tetraboric acid and at more than 160^0C boric acid is converted in to boron trioxide.
6. Boric acid is very weak acid, so it cannot be titrated accurately with standard alkali. Hence glycerin is added in its titration.

Storage of Boric acid- It should be stored in air-tight, well closed container.

Uses of Boric acid-

1. It has weak bacteriostatic and fungistatic action
2. It is used as local anti-infective drug in the form of cream, ointment and lotion
3. Buffer in topical preparations
4. Vehicle for ophthalmic solution
5. Boric acid is useful as Suppositories base
6. It is also used to impregnate surgical dressings

b) Give four ideal characteristics of an antacid. Describe importance of combination preparations of antacid.

Answer-(One and half mark each for ideal properties and importance of combination antacids. At least 3-4 ideal properties are expected, and at least 2-3 examples of combination preparations of antacid are expected)

Ideal characteristics of an antacid-

1. It should not be absorbable and cause systemic alkalosis
2. It should not be laxative or cause constipation
3. It should exert effect rapidly & over a long period of time
4. It should buffer in pH 4-6.
5. It should not produce large volume of gas
6. It should be palatable & inexpensive
7. It should probably inhibit pepsin

Importance of combination preparations of antacid-

No single antacid meets all requirements for ideal antacid hence Antacids are used in combination. Antacids are used in combination for following reasons-

1. To balance constipating effect of Aluminium and Calcium containing antacids with laxative effect of Magnesium containing antacids.
2. Some antacids gives rapid action but for short duration while some antacids gives delayed action but for longer duration. So to get quick and longer duration of action antacids are used in combinations.
3. Few combination antacids contain Simethicone, Dimethicone as they are Antiflatulents or antifoaming agents and reflux suppressants like alginic acid.

Examples of Combined Antacids-

1. Combination of Aluminium hydroxide gel and Magnesium hydroxide
2. Combination of Aluminium hydroxide gel and Magnesium trisilicate
3. Combination of Aluminium hydroxide gel and Calcium carbonate
4. Combination of Aluminium hydroxide gel, Calcium carbonate and Magnesium hydroxide
5. Sodium bicarbonate and alginic acid
6. Simethicone containing antacids
7. Magaldrate- $Mg(OH)_2$ & $Al(OH)_3$
8. Aluminium hydroxide gel & kaolin combination etc.

c) How will you treat cyanide poisoning using inorganic compounds?

Answer- (Treatment will carry Three marks)

Treatment of cyanide poisoning-

1. Cyanide poisoning may occur by inhalation of hydrocyanic acid like fumigates or from the ingestion of soluble inorganic cyanide salts or cyanide releasing substances like cyanamide, cyanogens chloride, photographic chemicals etc.
2. Symptoms of Cyanide poisoning : Nausea, drowsiness, headache, hypotension, dyspnoea, coma, convulsion, death
3. Death may occur with in minute of inhalation of hydrogen cyanide
4. Effect of Cyanide poisoning: Cyanide stops cellular respiration and oxidation-reduction reactions.

Treatment:

1. Sodium nitrite and Sodium thiosulphate is useful in the treatment of cyanide poisoning
2. Firstly Sodium nitrite injection is given which causes the oxidation of ferrous ion of haemoglobin to the ferric ion of methaemoglobin, hence it convert Haemoglobin in to methaemoglobin.
3. The methaemoglobin so formed then combine with serum cyanide that has not yet entered the cell, to produce cynomethaemoglobin, thus protecting essential enzymes from cyanide ions.
4. After 5 minutes, slow intravenous infusion of Sodium thiosulphate is given.
5. Thiosulphate ion react with cyanide ion and it convert toxic cyanide ion to non toxic thiocyanate ion which is excreted in the urine easily.

d) Enlist sodium chloride formulations used in electrolyte replacement therapy.

Answer- (Injections will carry Two marks and half mark each for Tablets and powder. At least Four injections are expected)

Sodium chloride formulations used in electrolyte replacement therapy-

I) Injections:

1. Sodium chloride (NaCl) injection I.P. (0.9% NaCl)
2. Sodium chloride hypertonic injection I.P. (1.6% NaCl)
3. Compound Sodium chloride injection (Ringer's inj.): contain NaCl, KCl & $CaCl_2$
4. Bacteriostatic Sodium chloride injection U.S.P. (0.9% NaCl & antimicrobial agents)
5. Sodium chloride and dextrose injection I.P.
6. Sodium chloride and mannitol injection
7. Sodium chloride and Fructose injection N.F. XIII

II) Tablets:

1. Sodium chloride Tablets I.P.
2. Sodium chloride and dextrose Tablets U.S.P.

II) Powders:

1. Compound Sodium chloride and dextrose oral powder B.P.

e) Give formula, synonym, properties and uses of ferrous sulphate.

Answer- (Half mark for formula, Half mark for Synonym and One mark each for properties and uses)

Molecular formula- $FeSO_4.\ 7H_2O$

Synonym: Iron vitriol, Green vitriol

Ferrous sulphate properties:

1. It is odorless, bluish-green crystalline powder
2. It has astringent or metallic taste
3. It efflorescence in dry air
4. On exposure to air ferrous sulphate oxidized to brown color ferric sulphate
5. It is soluble in water and insoluble in ethanol
6. It gives tests for Fe^{+2}, & $SO4^{-2}$

Uses of ferrous sulphate:

1. It is used as Haematinic (treatment of anemia caused by iron deficiency)
2. It is used to dye fabrics & cloths
3. Manufacturing of ink
4. It has also applications in photography
5. It has disinfectant properties
6. Ferrous sulphate is used as coloring agent in paint

f) Describe the limit test for Iron.

Answer- (One mark each for Principle, reaction and roles of different reagent used)

Limit test for Iron- Principle

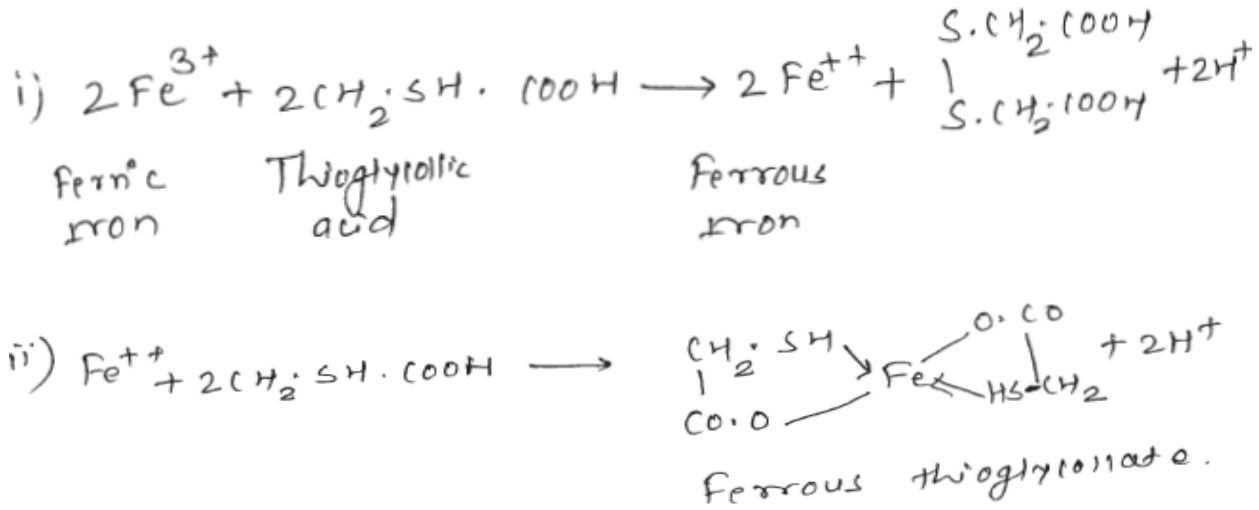
Limit test for iron depends upon the interaction of thioglycolic acid with iron in the presence of citric acid and in the ammonical alkaline medium.

This results in the formation of purple colored ferrous salts of thioglycolic acid.

The limit test of iron is carried out in two Nessler Cylinders, one for the 'Test' and other for 'standard'. The intensity of purple color produced in the two is compared by viewing vertically downwards.

If the intensity of color is more in the 'test' sample than in the 'standard' it means that the sample contains more quantity of iron impurity than the permissible limit and hence sample is declared as not of standard quality.

Reaction:



Role of Thioglycolic acid-

1. Iron impurity may be present in trivalent ferric form or in the divalent ferrous form. If it is in ferric form thioglycolic acid convert ferric form of impurity into ferrous form

2. It produce purple color to ferrous thioglycolate complex

Role of Citric acid- To prevent precipitation of iron (ferrous) with ammonia

Role of Ammonia- To maintain alkaline condition.

Q3. Attempt any Four(03 marks each)

a) **Definition of Achlorhydria (01 mark):-** When due to some reasons, there is no secretion of hydrochloric acid in gastric secretion; the condition is called as achlorhydria.

Properties of HCl (01 mark):-

1] It occurs as a colourless fuming liquid with pungent odour.

2] It is miscible with water, alcohol & has a specific gravity of 1.18.

3] It is a strong acid & attacks metals forming their hydrochlorides with the evolution of hydrogen gas.

Storage of HCl((01/2 mark):- It is stored in glass-stoppered containers at a temperature not exceeding 30°C.

Uses of HCl((01/2 mark):-

- Hydrochloric acid as such cannot be used as medicine.
- The dilute hydrochloric acid is used as acidifying agent.
- It is also used as a solvent in numerous industries.
- Also used as laboratory reagent.

b) Properties & uses of Calamine(01&1/2 mark):-

Properties :

- It occurs as a pink powder, almost odourless and tasteless.
- It passes through sieve no 100.
- It is practically insoluble in water and dissolves in mineral acids with effervescence.

Action and Uses :

- It acts as mild astringent, antiseptic and protectant for skin.
- It gives soothing effect in skin itching and irritations for which it is employed in various forms like aqueous calamine cream, calamine and coal-tar ointment, calamine lotion, calamine ointment etc.

Properties & uses ofSilicones (01&1/2 mark):-

- The silicone polymers are generally known as **silicone oils.**
- The silicone polymers are prepared synthetically by polymerization reaction.
- The oily nature of these compounds makes it useful as water repellent and protective to skin from contact irritants.
- The silicone oils, thus in general act as protective, it also act as an antiflatulent and used in varying amount in antacid preparations.

Dimethicone:

- It is an inert silicone, oily in nature, it is stable and has low surface tension.
- It forms a protective layer on skin like plastic and acts as water protective agent.
- It is mainly used in ointments, sprays, lotions and creams.

Simethicone :

- It occurs as a light gray, translucent liquid with greasy consistency. It is prepared from dimethylpolysiloxane.
- It is used as an antiflatulent and is employed in antacid, antispasmodic, sedative and digestant preparations in 40 - 80 mg dose at bed time.

c) Role of fluoride as anticaries agent (03 marks):-

- Dental caries or tooth decay has been defined as a disease of the teeth caused by acids formed by the action of microorganisms on carbohydrates and is characterized by decalcification of tooth accompanied by foul mouth odour.
- Though the exact cause and mechanism of dental caries is not known, it is believed that dental caries begins on the surface of the teeth.

- Acids produced by bacterial metabolism of fermenting carbohydrates act on teeth, produce lesions where bacterias get localized and dental caries is produced.
- Today, when considering dental caries prevention, one usually thinks of fluorides, since fluoridated water, fluoride drops, topical fluoride application to teeth, fluoride-containing vitamins & fluoride dentifrices are now common place.
- Administration of traces of fluoride containing salts or their use in topical use to the teeth has found to give encouraging results.
- When a fluoride containing salt or solution is taken internally, it gets readily absorbed, transported and deposited in the bone or developing teeth and remainder is excreted by the kidneys.
- The deposited fluoride on the surface of teeth prevents the action of acids or enzymes in producing lesions.
- A small quantity (1 ppm) of fluoride is thus necessary to prevent caries. However when more quantity of fluoride (more than 2-3 ppm) is ingested it is carried to bones and teeth and produces mottled enamel known as **dental fluorosjs.**
- Fluoride is administered by two routes (i) orally and (ii) topically.
- The use of fluoridation of public water supply is the most common and effective way of oral administration.
- Water supply containing about 0.5 to 1 ppm is provided which is sufficient.
- Alternatively, it can be given in drinking water or fruit juice in such a concentration to have about 1 ppm per day.
- Sodium fluoride tablets or solution of sodium fluoride in a dose of 2.2 mg per day is employed.
- For topical application 2% solution is used on teeth.
- The mechanism by which fluoride inhibits caries formation is still to be completely elucidated. There are two current hypotheses: (1) decreased acid solubility of enamel; (2) bacterial inhibition.

d) Metabolic acidosis & metabolic alkalosis(03 marks):-

- The acid-base balance in the body is well regulated by intricate mechanisms.
- Number of chemical reactions takes place inside the cells and the activity of cell and the reactions occurring inside the cell is greatly influenced by pH or hydrogen ion concentration.

- The hydrogen ion concentration in the extra-cellular fluid is regulated at a value of approximately 4 x 10^{-8} Eq/Iit.
- The pH of blood of healthy person remains constant around 7.35-7.45.
- When the pH of the blood falls below 7.35, the condition is known as **metabolic acidosis,** while when the pH of blood is higher than 7.45, it is known as **metabolic alkalosis**.

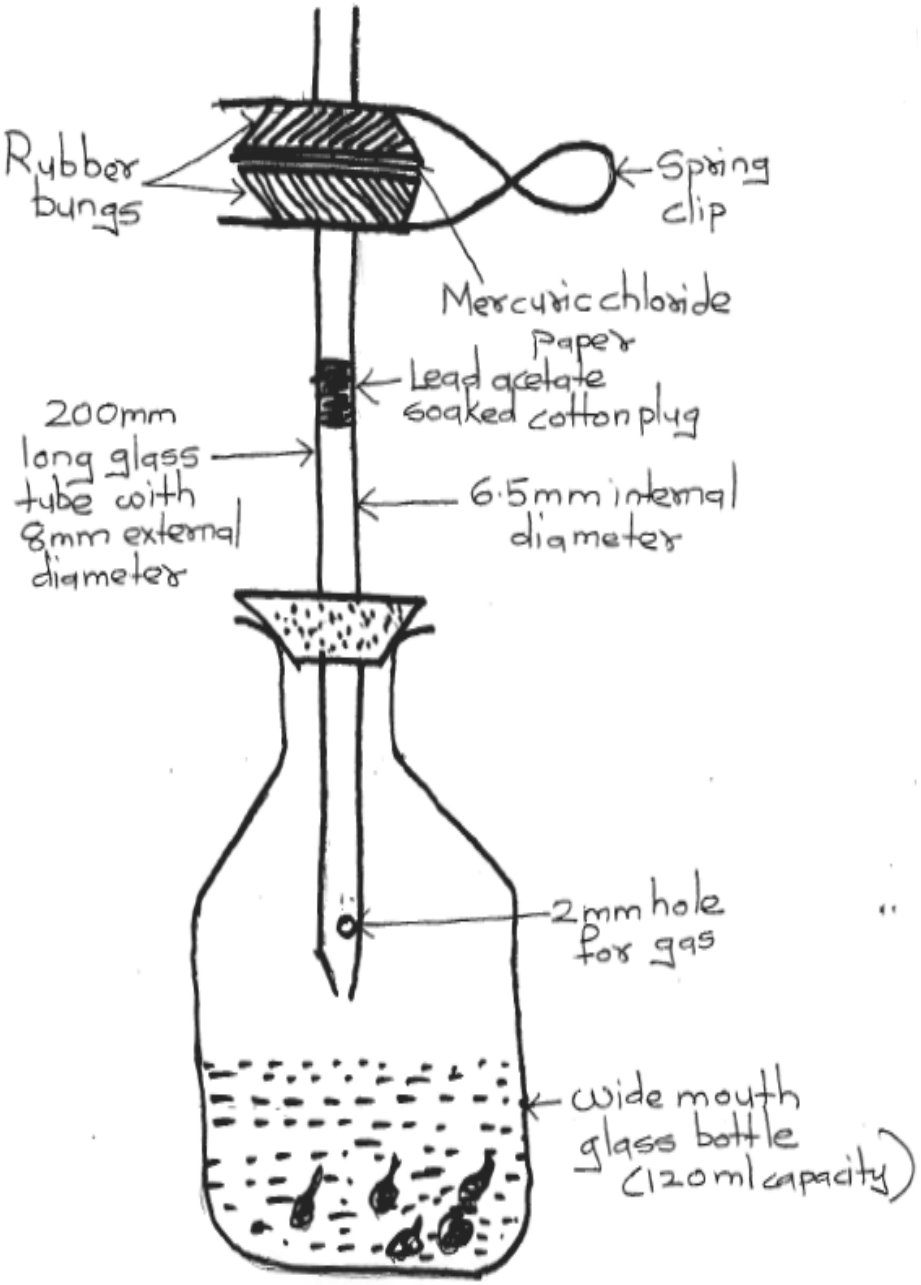
Metabolic acidosis can result from :-

- Failure to excrete metabolic acids by kidney.
- Formation of excessive quantities of metabolic acids (like carbonic acid).
- Absorption or administration of excess metabolic and other acids.
- Loss of base from body fluids under certain conditions.
- The metabolic acidosis results due to diarrhea, vomiting, uremia or diabetes mellitus.

Metabolic alkalosis generally doesnot normally occur.

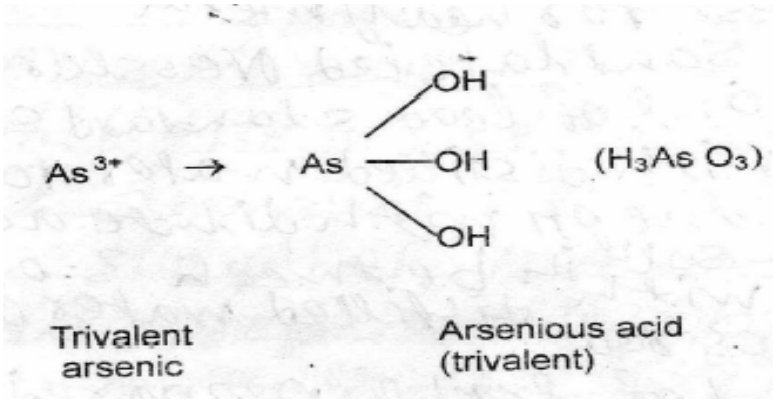
- However, it may result under certain conditions like administration of diuretics or excessive ingestion of alkaline drugs or due to loss of chloride ions etc.
- **Note :-When the conditions of acidosis or alkalosis results certain drugs are administered to control the acid-base balance.**
- **ELECTROLYTES USED IN ACID-BASE THERAPY :**
- Generally potassium/sodium compounds like bicarbonates, lactate, acetate are used to treat metabolic acidosis, where as metabolic alkalosis is treated with ammonium salt, important being ammonium chloride.
- Administration of bicarbonate increases the HCO_3^- / H_2CO_3 ratio when there is a bicarbonate deficit.
- Lactate, acetate, & citrate ions are normal components of metabolism & will be degraded to CO_2 & water by the TCA cycle. The CO_2 by the action of carbonic anhydrase will form bicarbonate & thereby reduce the bicarbonate deficit.
- Metabolic alkalosis has been treated with ammonium salts. Its action is in the kidneys where it retards the Na^+-H^- exchange.

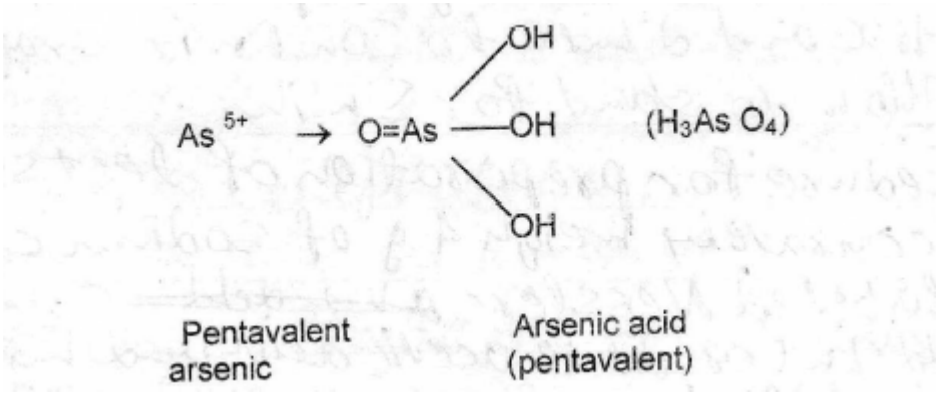
e) **Gutzeit Apparatus (1&1/2marks)**

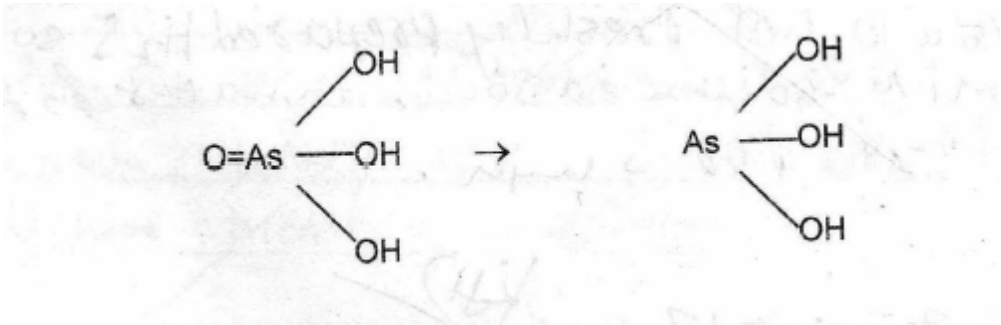


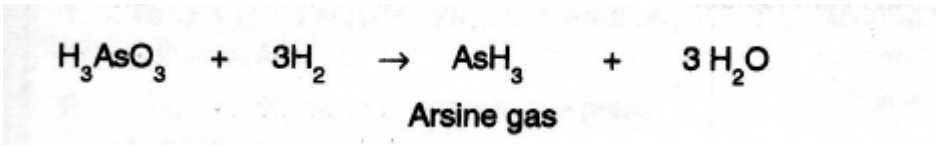
LIMIT TEST FOR ARSENIC

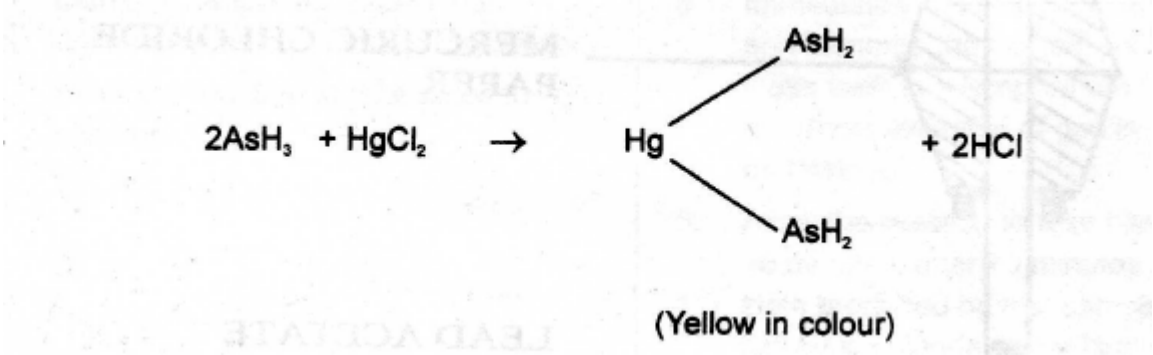
Reactions involved in limit test of Arsenic:- **(1 and ½ Marks)**











f) i) Bicarbonates ion (1&1/2 mark for identification, write any two identification tests):-

- Aqueous solution of bicarbonates on boiling liberates CO_2, which when passed in calcium hydroxide solution gives a white precipitate of calcium carbonate.
- When aqueous solution of bicarbonate is treated with magnesium sulphate, no ppt. is formed, but on boiling a white ppt. of magnesium carbonate is formed.
- Aqueous solution of bicarbonates on treatment with acetic acid liberates $CO_{2,\ which}$ when passed in barium hydroxide solution gives a white ppt. of barium carbonate, which dissolves on addition of HCl, as it gets converted to barium chloride.
- Aqueous solution of bicarbonates on treatment with mercuric chloride solution produces a white ppt. of mercuric bicarbonate.

ii) Bromide ion (1 and 1/2 mark for identification, write any two identification tests):-

- When bromides are heated with sulphuric acid & strong oxidizing agents like manganese dioxide or potassium dichromate, yield vapours of bromine which imparts yellow colour to filter paper moistened with starch solution.
- Aqueous solution of bromides when acidified with nitric acid & treated with silver nitrate solution gives curdy pale ppt. of silver bromide, which dissolves slightly in dilute ammonia.
- Aqueous solution of bromides liberate bromine on treatment with chlorine solution, this liberated bromine gets dissolved in solvents like chloroform & imparts reddish colour to chloroform layer.

Q4. Attempt any Four (03 marks each)

a) Mechanism of action of Antioxidants:-(1&1/2 marks)

- The mechanism of action of inorganic type of antioxidants is the same as it is involved in redox chemical reaction.
- In a redox reaction, there is a transfer of electron from one compound to the other.
- Since oxidation is the loss of electrons from chemical species and reduction is the gain of electrons the overall reaction can be shown as

  $OX + e^- \rightarrow Red$
- When a substance acts as antioxidant (it being a reducing agent) it gets oxidised itself and prevents the oxidation of the active pharmaceutical species.
- A strong antioxidant will protect the material when used in small amount and for longer period.
- The inorganic type of antioxidants basically acts as reducing agents.
- They are used in pharmaceutical preparations containing easily oxidizable substances to protect them in their original form.
- The antioxidant usually prevents the oxidation of active compound and in place gets oxidised itself.

Properties of sulphur dioxide (1&1/2 mark):-

- Sulphurdioxide is a colourless, non-inflammable gas with characteristic pungent odour.
- The gas is soluble in water and in alcohol. Aqueous solution of gas is acidic (H_2SO_4) to litmus.
- The gas can be liquified which boils at -10°.
- Sulphurdioxide is a very good reducing agent and thus acts as an antioxidant.
- Sulphurdioxide is stable only in acidic pH.
- At alkaline pH it is converted to bisulphite and sulphite.

b) Saline Cathartics (01 mark):-

- The saline cathartics act by increasing the osmotic load of intestine by absorbing large quantity of water and thus stimulate peristalsis.
- Poorly absorbable cations like calcium, magnesium and anions like phosphate, sulphate, tartarate contribute to this effect.
- The saline cathartics are water soluble, mainly inorganic chemicals and they are taken with plenty of water.

Properties & uses of magnesium sulphate (01 mark each):-

- **Properties :**
- It occurs as colourless crystals, with cool, saline and bitter taste.
- It effloresces in dry air.
- It is freely soluble in water, sparingly soluble in alcohol and dissolves slowly in glycerin.
- **Uses :**
- Magnesium sulphate is given orally in dilute solutions as a cathartic & parenterally as an anticonvulsant.
- Because of bitter and nauseating taste it is given in fruit juices.

c) Definition of antimicrobial agents (01 mark) & mechanism (02 marks):-

Antimicrobial is a broad terminology describing activity against microbes. Specific terminology describes exact mode or mechanism of action.e.g. **Antiseptics, Disinfectant, Germicide('bactericide' (against bacteria), 'fungicide' (against fungi), 'virucide' (against virus) etc. denotes exact action.), Bacteriostatic.**

Inorganic compounds generally exhibit antimicrobial action by,either of the three mechanisms viz.

(i) oxidation

(ii) halogenation

(iii) protein binding or precipitation.

Oxidation Mechanism :

Compounds acting by this mechanism belong to class of peroxide, peroxyacids, oxygen liberating compounds like permanganate and certain oxo-halogen anions.

They act on proteins containing sulphadryl group and oxidises free sulphadryl to disulphide bridge and inactivate its function.

Halogenation Mechanisms:

Compounds which liberate chlorine or hypochlorite or iodine act by this mechanism.

This category of agents act on peptide linkage and alter its potential and property.

The destruction of specific function of protein results in death of microorganisms.

Protein Precipitation :

Many metals in their cation form exhibit protein binding or protein precipitation.

The nature of interaction with protein occurs through polar group of protein which acts as ligands and metal ion acts as Lewis acid.

The complex formed may be a strong chelate leading to inactivation of protein.

This action in general is non-specific. Protein precipitants do not distinguish between the protein of microbes and that of host.

Germicidal action results when the concentration of ion is such that reaction is restricted largely to the parasite cell.

d) Method of preparation of zinc chloride: (1 Mark)

It is obtained by reacting metallic or granular zinc with hydrochloric acid . The solution is evaporated to dryness.

Alternatively, it is obtained by treating zinc oxide or carbonate with appropriate amount of HCl.

Properties & uses of Zinc chloride:- (1 Mark each)

Properties :

- It is a white crystalline powder or granules, odourless and is deliquescent.
- It is very soluble in water, freely soluble in alcohol and glycerine.
- The compound is reasonably soluble in polar organic solvents.
- Aqueous solution is distinctly acidic (pH 4.0).
- This is due to its hydrolysis to form hydrochloric acid and basic zinc chloride similar to aluminium salts.

Uses :

- Zinc chloride is a powerful astringent and mild antiseptic.
- It is also used in mouth wash and deodorant preparations.
- The antiseptic action is considered to be due to its interaction of the metal with certain microbial enzymes.

- The protein precipitation action also contributes to this effect.
- The other uses of zinc chloride include protein precipitation, in various insulin preparations also as desensitizer of dentin (in dental preparations).
- It is also used in fire proofing wood.

e) Electrolyte combination therapy (03 marks):-

• Usually when patient is unable to take normal diet before or after surgery, the electrolyte combination therapy is used.

• Infusions containing glucose and normal saline are used.

• But when the patient is deficient or in protracted illness, other electrolytes are also needed and in such cases the combination of electrolytes are prepared and given as per the need of the patient.

• Various combinations of electrolytes, varying in concentration are available commercially.

• Electrolyte combination products are divided in two categories:-

-Fluid maintenance therapy.

-Electrolyte replacement therapy.

• In the fluid maintenance therapy, the fluid or solutions of electrolytes are administered intravenously which provides the normal requirement of water and electrolytes to patients who cannot take food orally.

• All the fluid maintenance electrolyte infusions contain at least 5.0% glucose, which helps to reduce formation of certain metabolites like urea, ketone bodies and phosphate, which are usually associated with starvation.

• When there is a heavy loss of water and electrolytes e.g. in excessive vomiting, diarrhoea, or prolonged fever, electrolyte combinations are used as electrolyte replacement therapy.

• Various electrolyte combinations in varying concentrations are commercially available as dry powders to be dissolved in specified amount of water or in the form of prepared solutions as “oral electrolyte solutions” or “oral rehydration salts”.

Some important products used in electrolyte combination therapy are as follows:

1. Sodium Lactate Injection (I.P., BP.) : (Sodium lactate intravenous infusion)

2] Compound Sodium Chloride Injection (I.P.): (Ringers injection)

3] Compound Sodium Lactate Injection (IP)/ Compound Sodium Lactate Intravenous Infusion (B.P.) :(Ringer lactate solution for injection, Hartmann's solution for injection)

4] Oral Rehydration Salts(ORS).

f) Official compounds of calcium (01 mark):-

1. Calcium carbonate I.P.

2. Calcium Hydroxide B.P.

3. Calcium gluconate

4. Calcium chloride

5. Calcium Acetate B.P.

6. Calcium lactateI.P.

7. Calcium Levulinate I.P.

8. Calcium Dibasic Phosphate I.P

9. Calcium phosphate Tribasic.

Properties & uses of calcium gluconate (01 mark each):-

Properties:-

- It is available as white crystalline or granular powder, odourless &n tasteless.
- It is stable in air.
- It is sparingly soluble in water, freely soluble in boiling water & insoluble in alcohol.

Uses:-

- Calcium gluconate & its preparations are used as a source of calcium in calcium deficiency.
- It is the drug of choice for severe hypocalcemic tetany.

Q.5 a) Definition of Astringent. (1 mark)

Define as compounds that show protein precipitation by the action coagulation when applied to damage skin or mucous membrane.

Properties (1 mark)-:

- odourless, colorless, transparent, crystalline powder.
- Sweet astringent taste.
- soluble in water & insoluble in alcohol

Uses :- (1 mark)

- Topical astringent
- Mouth wash & gargles
- Dusting powder
- Styptic & antiseptic
- Haemostatic for cuts & ulcers

b) Role of oxygen :- (3Marks)

1) Oxygen is important to the living cell

2) It is necessary for normal metabolic process in body & also for production of energy.

3) Transport of oxygen is carried by hemoglobin a constitute of blood.

4) Oxygen combines with hemoglobin to form oxyhaemoglobin.

$Hb + O_2 = HbO_2$

5) This complex rapidly dissociates to release oxygen in the cell.

6) Number of factors responsible for association & dissociation of Oxyhaemoglobin.
Example-temperature, PH, electrolyte, carbon dioxide

7) By inhalation during respiration oxygenation of blood takes place in alveoli in the Lungs. Thus more oxygen is needed in anoxic condition.

c) <u>Antimony Potassium Tartrate</u>

Synonym-Tarter emetic **(½ Mark)**

Formula-$C_4H_4KO_7.Sb.1/2H_2O$ **(½ Mark)**

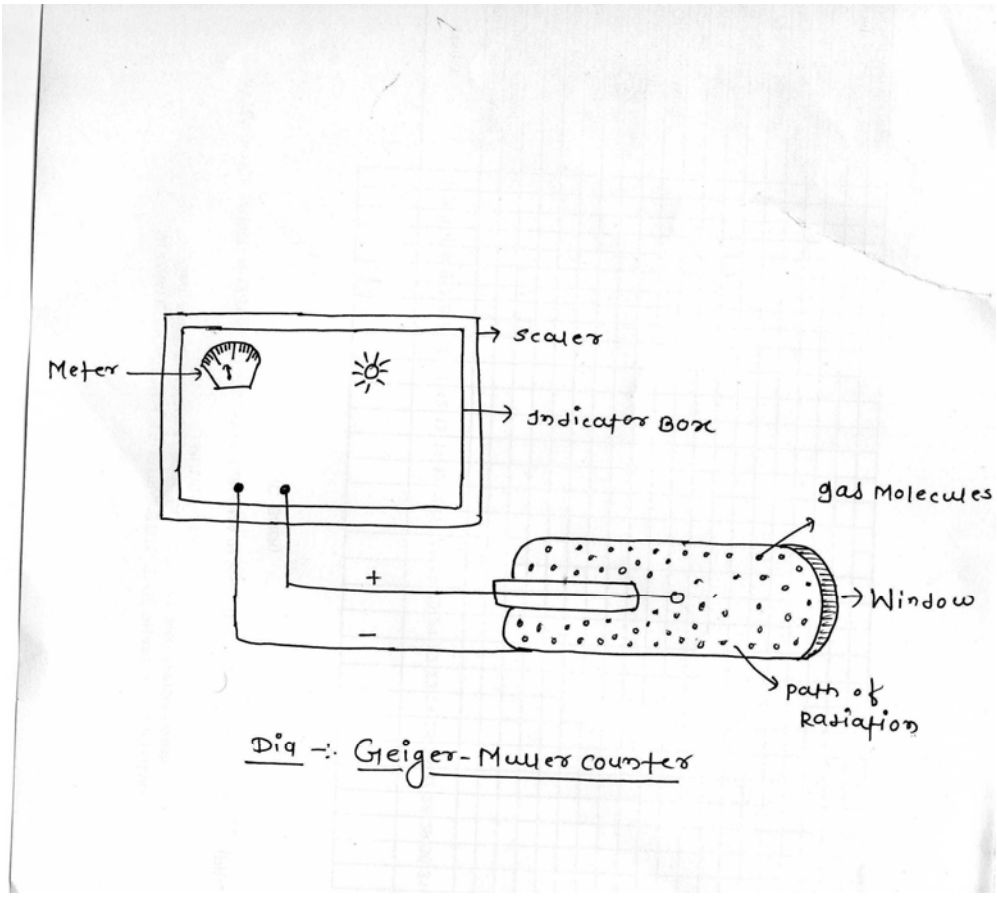
Properties- (1 Mark)

- Colorless, crystalline powder
- Odorless & sweet in taste
- Soluble in water & insoluble in alcohol
- It effloresces on exposure to air

Uses :- **(1 mark)**

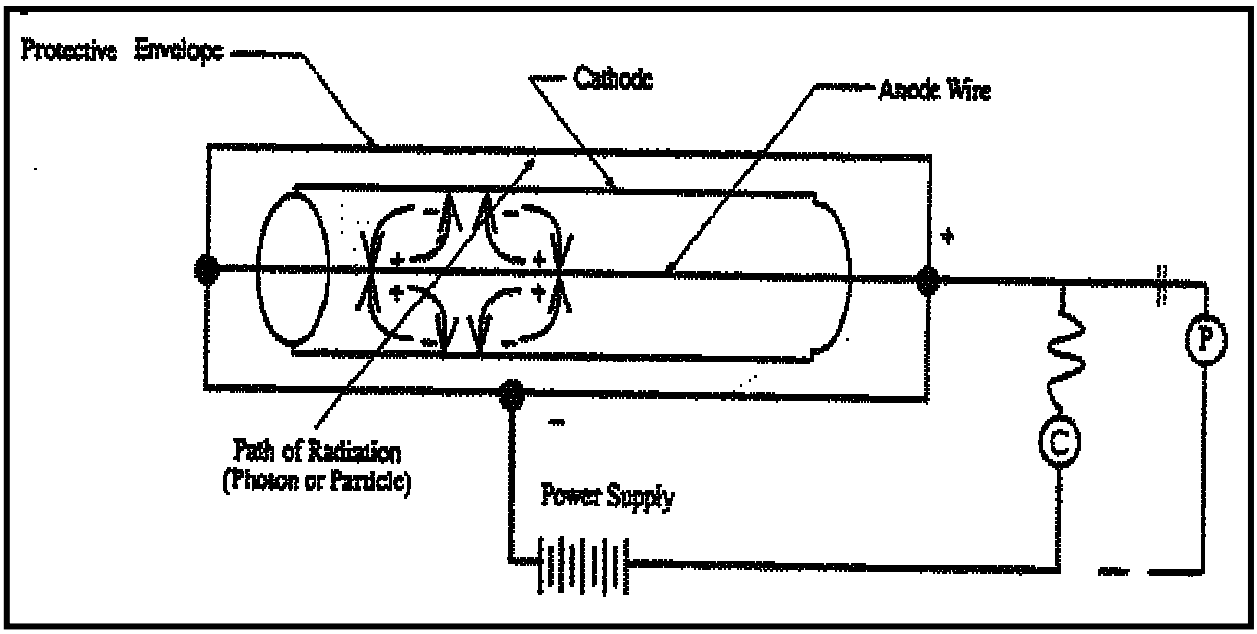
- Emetic
- Expectorant (in low dose)
- Treatment of Kala Azar

d) GEIGER-MULLER COUNTER (1&1/2MARKS)



Dig :- Geiger-Muller counter

OR



Biological effect of Radiation (1&1/2 marks)

The effect of radiation upon biological tissue depends upon a number of factors such as:

-Ability of the radiation to penetrate tissue.

-The energy of Radiation

-The kind of Tissue

-Surface area of the tissue exposed

-Dose rate of the Radiation

The radiation interacts with the molecules present in the tissue & forms abnormal chemical species like ions &/or free radicals.

These ions or free radicals can alter the local PH in the tissue & initiate the undersirable free radical chain reactions, producing peroxides & other compounds toxic to the tissue .this may lead to necrosis & ultimately destroy the tissue or organ.

Water molecules in the tissue are the most probable reactive species in the path of ionizing radiation. Other Free Radicals & Hydrogen peroxidases also formed.

$\times H_2O \rightarrow \times H + \times HO$

$\downarrow \quad \downarrow$

$yH_2 \quad yH_2O_2$

Free radicals formed from water can also abstract radicals from other molecules &produce various toxic species which can alter the DNA in cells & cause cross linking between certain amino acids in proteins. Thus the particular tissue gets destroyed.

Alpha particles also have a potential to produce a tremendous amount of ionization or free radicals but the range & penetration of these particles are very slight. Therefore, the isotopes emitting alpha particles must be close enough to the individual for the radiation to reach the skin, in order to get observable effects.

Gamma rays have relatively low ionizing power ,even though the range & penetrating power of these type of radiation are high enough to produce significant damage in the particular tissue at distances of several metres from the source.

e) Principle (1MARK)—

This is based upon the interaction of sulphate with barium chloride in presence of Hydrochloric acid. This results in the precipitation of sulphate as barium sulphate.

HCl is added to prevent precipitation of other acid radicals. Alcohol prevents super saturation & potassium sulphate increases sensitivity of the test when very small quantity of sulphate ions are present. Barium sulphate appears as turbidity. This is compared with standard turbidity. If turbidity produced in test sample is less than standard, it means sample passes test.

Reaction—$BaCl_2 + SO_4^{--} \rightarrow BaSO_4 + 2Cl^-$ (1 M)

Procedure – (1 Mark)

SR.NO	Test solution	Standard solution
1	1ml of 25% w/v of Barium chloride in Nesseler cylinder.	1ml of 25% w/v of Barium chloride in Nesseler cylinder.
2	Add 1.5 ml ethanolic sulphate standard solution (10ppm SO_4^{--})mix & allow to stand for 1 min	Add 1.5 ml ethanol sulphate standard solution (10ppm so4)mix & allow to stand for 1 min
3	Add 1 gm of sodium bicarbonate, add 10ml distilled water, neutralize with HCl.	Add 0.15 ml of 5 M acetic acid in nesseler cylinder
4	Add 0.15 ml of 5 M acetic acid in nesseler cylinder	
5	Dilute upto 50 ml water & stir with glass rod & allow to stand for 5 min	Dilute up to 50 ml water & stir with glass rod & allow to stand for 5 min

Compare the opalescence against black background.

f) Chloride test- (1&1/2)

i) To the aqueous solution of substance dil.silver nitrate solution is added, white precipitate of Silver chloride is obtained.

$NaCl + AgNO_3 \text{ -------} \rightarrow AgCl + NaNO_3$

ii) Chloride when heated with manganese dioxide & sulphuric acid, chlorine gas liberated

$2NaCl + 2H_2SO_4 + MnO_2 \text{ ----} \rightarrow MnSO_4 + Na_2SO_4 + 2H_2O + Cl_2$

ii) Calcium Test((1&1/2)

i) Calcium salt dissolved in HCl neutralized with NaOH & treated with carbonate solution to give White ppt of Calcium carbonate.

$$Ca^{++} + CO_3^{--} \rightarrow CaCO_3\downarrow$$

ii) Concentrated solution of calcium salt treated with chromate gives yellow ppt of calcium chromate.

$$2Ca^{++} + 2 \text{ chromate ion} \rightarrow 2CaCrO_4\downarrow$$

Q.6 a) (One mark for definition & three mark for mechanism)

Definition-It composed of weak acid & its salt of strong base or weak base & its salt of strong acid Capable of resisting large change in PH.

Mechanism - i) When small amount of acid is added to the solution containing basic buffer system, acid will react with weak base & it is converted into weak acid.

ii) If small amount of base is added to the solution containing acidic buffer system, base will react with weak acid & converted into weak base.

iii) Thus each component of buffer system will react with either added acid or base & resist or prevent Change in P^H.

iv) E.g. Phosphate buffer system contain

i) H_2PO_4- act as weak acid

ii) HPO_4 – act as weak bas

v) In non buffer solution, if small amount of HCl is added, it will ionize to hydronium Ion & Chloride resulting in remarkable lowering P^H

$$HCl + H_2O \text{ --------} \rightarrow H_3O + Cl^-$$

vi) If small amount of HCl is added to buffered solution H3O ion will react with weak

Base & converted into weak acid.

$H_3O + HPO_4 \rightarrow H_2PO_4 + H_2O$

vii) If small amount of NaOH is added to non buffered solution, it will ionize to Hydroxide ion & Na, hence it will increase PH of preparation

$NaOH \rightarrow Na^+ + OH^-$

viii) If small amount of NaoH is added to solution containing phosphate buffer, OH ion will react with weak acid & converted into weak base.

$OH^- + H_2PO_4 \rightarrow HPO_4 + H_2O$

b) Protective & Adsorbent—it is used internally in the treatment of disturbance of GIT. Disturbance in the normal functioning of GIT result in dysentery or Diarrhea. **(1 Mark)**

Synonym—Basic bismuth carbonates **(1 Mark)**

Properties—White odourless powder **(1 Mark)**

- Insoluble in water & alcohol
- Tasteless & soluble in mineral acid

Uses—Protective adsorbent **(1 Mark)**

- Antacid & mild astringent
- Antiseptic & Antidiarrhoeal

c) Different from of sulphur are Rhombic Sulphur, Sublimed, Precipitated sulphur, Monoclinic, Liquid, Plastic sulphur and Amorphous Sulphur. **(2 Marks)**

Properties: **(1 mark)**

- Bright orange to reddish brown powder
- insoluble in water & alcohol
- It is dissolved in nitric acid.

Uses: (1 mark)

- Highly toxic if taken internally
- Shampoo & antidandruff
- Seborrhic dermatitis
- Selenium salt causes irritation of the GIT mucosa.

d) The acid base balance in the body is well regulated by intricate mechanism.

The acid base balance in the body is well regulated by intricate mechanism.

Number of chemical reactions takes place in the cell and the activity of cell and the reactions occurring inside is greatly influenced by pH or hydrogen ion concentration.

Acids are being constantly produced in process of metabolism. E.g. carbonic acid, lactic acid

Acids or alkalis produced in the body may cause change in PH

Most of metabolic reactions occur between PH 7.38-7.42

Increase in acidity of body fluid & tissues means (PH < 7.38) is called as acidosis and increase in alkali reserve in blood & body fluid (PH > 7.38) is called as alkalosis.

Required pH (7.38-7.42) of plasma is maintained by

1. **Buffer mechanism**

   Three major system of buffering system occurring in the body are

   a) HCO_3^-/ H_2CO_3/ carbonic acid found in plasma & kidney
   b) HPO_4^{-2}/ $H_2PO_4^-$ present in cells & kidney
   c) Protein or buffer system

   Proteins are composed of amino acids bound together by peptide linkage. However some amino acids like histidine have free acidic group which on dissociation from base and H+ which participate in buffering of the body fluid.

2. **Respiratory mechanism**

The other important pH control is through the control of respiratory centre. When this is stimulated it alters the rate of breathing.

Through the rate, the removal of CO_2 from body fluid leads to the changes in pH of blood

Retention of CO_2 in the body due to decrease in ventilation as a result of mechanical/muscular impairment, lung disease, pneumonia, CNS depression due to narcotic drugs, CHF etc. induces repiratory acidosis This can be overcome by renal mechanism by

i) Increase in acid excretion by Na^+-H^+ exchange

ii) Increase in ammonia (NH_3) formation

iii)Increase in reabsorption of HCO_3^- (bicarbonate)

In repiratory alkalosis there is excess loss of CO_2 from body due to over breathing or hyperventilation as a result of emotional factor, fever, hypoxia, loss of appetite, salicylate poisoning etc. This can be overcome by renal mechanism by

i) Increase in bicarbonate (HCO_3^-) excretion

ii) Decrease in ammonia (NH_3) formation

iii) Decrease in reabsorption of HCO_3^- (bicarbonate)

3. **Renal mechanism**

The third mechanism is via elimination of some ions through urine by kidney.

Absorption of certain ions and elimination of other control the acid-base balance of blood and thus of body fluids.

e) Labeling, Storage & Handling (02 marks)

i) The material should be handled with forceps or suitable instrument & direct contact should be avoided.

ii) Eating, drinking, smoking all such activities should not be carried out in laboratory where Radioactive materials are used.

iii) Sufficient shielding must be provided on protective cloth while handling the materials.

iv) It should be stored in lead brick shielded container with suitable level in a remote corner.

v) Radioactive substance is stored that area should be monitored constantly.

vi) The final disposal of radioactive material should b done with great care.

Properties of Barium sulphate (01 mark)-

- fine white odorless
- Tasteless bulky powder
- free from grittiness
- In soluble in water, dil.acid

Uses of Barium sulphate (01 mark)-

- It is used in the preparation of barium sulphate powder & used as a contrast media
- For x-ray examination of eliminatory tract.
- It is used orally or by enema for the examination of colon.

f) Source of impurities in pharmaceuticals –(1 mark for each point)

i) **Raw Materials**- When substance or chemical are manufacture, the raw materials from which these are prepared contain impurities. These impurities get incorporated into final product.

Example-arsenic, lead, heavy metal impurities.

ii**) Chemical process**- In synthesis of drug many chemical reaction like nitration, halogenations Oxidation, hydrolysis.In these chemical process different chemical are used.

Example-When chemical reaction are carried out in reaction vessel,the material of these vessel are reacted upon by the solvent & chemical & reaction product are formed.

iii) Storage condition- The chemical when prepared is stored in different types of container. Various types of materials are used for storage purpose.

Example-Reaction of substance with material of the storage vessel may take place & product formed. The reaction may take place directly or leaching out effect on the storage vessel.

iv) Decomposition- Decomposition is caused by light, air, oxygen & causes contamination of final product.

Example-A number of organic substance get spoiled, because of decomposition on exposure to the atmosphere.e.g amines, phenol, potent drug.