TIRUPATI COLLEGE OF POLYTECHNIC AND PHARMACY, RATIA

D. PHARMACY FIRST YEAR

PHARMACEUTICAL CHEMISTRY – I

Section – A

Fill in the blanks with answers. 1x10=10

1. The unit of radioactivity is **curie.**
2. $Na_2B_4O_7 + 3H_2O \longrightarrow$ **$2NaBO_2 + 2H_3BO_3$**
3. Chemically white vitriol is **zinc sulphate.**
4. Astringents are locally applied to precipitate **protein.**
5. The normal pH range of blood is **7.4 -7.5**
6. Hypertonic and hypotonic solutions are employed to restore **isotonicity.**
7. **Cathartics** are the drugs used to relieve constipation.
8. Mandrell's salt is **sodium metaphosphate.**
9. Chemical formula of magnesium trisilicate is **$2MgO.3SiO_2.xH_2O$**
10. Insufficient secretion of HCl in stomach leads to **achlorhydria**
11. Boric acid is incompatible with **alkali carbonates and hydroxides.**
12. Germicides are defined as **different agents employed to kill various kinds of micro-organism.**
13. Sodium chloride injection is a **0.9% w/v** solution of **NaCl in water.**
14. Mass number is defined as **sum of no. of proton & neutron in nucleus.**
15. Sodium nitrite is used as antidote in **cyanide poisoning** in a dose of **10-15ml of 3% solution through intravenous route.**
16. Aluminium Hydroxide gel should be stored **not exceeding 25^0C in airtight container.**
17. Iodine is incompatible with **alkali** and **alkali carbonates.**
18. Zinc chloride is used as **an antiseptic astringent.**
19. Alum causes precipitation of **protein.**
20. Rochelle salt is **sodium potassium tartrate.**
21. Silver nitrate is incompatible with **alkali, halogen acids & tannins.**
22. Half life is defined as **one half of its initial value.**
23. **Desferrioxamine** is used to treat iron poisoning.
24. Sodium fluoride is used for **prophylaxis of dental caries.**
25. Barium sulphate is used for **examination of GIT tract.**
26. Potassium permanganate should be handled with care because it is **dangerous explosive.**
27. Sodium nitrite is used as **an antioxidant.**
28. Baking soda is **sodium bicarbonate.**

29. Zinc oxide is used as **mild antiseptic & an astringent.**
30. Full form of PVP-I is **polyvinyl pyrrolidine.**
31. An agent, which stops bleeding from small cuts, is known as **astringent.**
32. **Magnesium** containing antacids have laxative also.
33. Standard buffer solutions are used for **reference.**
34. Official name of ZnO, Fe_2O_3 is **calamine.**
35. Hyperkalemia mainly occurs due to **increase in serum potassium level.**
36. Cylinder of CO_2 is painted **grey.**
37. Acute loss of water and electrolytes from body is termed as **dehydration.**
38. Full form of RBC is **red blood cell.**
39. Hydrogen peroxide is incompatible with **organic substance, alkali and iodides.**
40. Muriatic acid is the other name of **hydrochloric acid.**
41. Chemically slaked lime is **calcium hydroxide.**
42. Officially a strong ammonia solution contains **27** to **30** % w/w of ammonia.
43. **Sodium hydroxide** is an important ingredient of many effervescent mixtures.
44. $2Na_2S_2O_3 + I_2 \longrightarrow \mathbf{Na_2S_4O_6 + 2NaI}$
45. Chemically precipitated Chalk is **calcium carbonate.**
46. A condition where no hydrochloric acid is secreted in stomach is called **achlorhydria.**
47. Povidon-iodine is used as **topical anti-infective and antiseptic**
48. ORT stands for **oral rehydration therapy.**
49. **N_2O** is also called laughing gas.
50. Dialysis solutions are used in **kidney failure.**
51. When calcium hydroxide is mixed with 3 to 4 times its weight of water, the suspension is called **lime water.**
52. Chemically green vitriol is **$FeSO_4.7H_2O$**
53. An agent which stops bleeding from small cut is known as **ferric salt in gargles**
54. Carbon dioxide and oxygen mixture is used in the treatment of **CO (carbon monoxide)** Poisoning.
55. Baking soda is prepared by **Ammonia Soda/ Solvary** process.
56. ORS stands for **oral rehydration salt**
57. Deficiency of iodine causes **goitre.**
58. Alum causes precipitation of **Borax**
59. Sodium hydroxide is prepared by **soda lime** and **electrolysis of NaCl solution process**
60. Bacteria responsible for causing dental caries is **streptococcus mutans & sorbrinus**
61. Ammonium carbonate is used in the preparation of **aromatic spirit of ammonia**
62. Sodium bicarbonate is used as **antacid**

63. Indicator used in the assay of ammonium chloride is **phenolphthalein**
64. Silver nitrate should be stored in **amber colored bottle**
65. Polarimeter is used to determine the **angel of rotation**
66. Nutritional deficiency of calcium leads to **rickets**
67. Calcium Gluconate is assayed by **complexometric type**
68. Sodium metabisulphate is used as an **antioxidant**
69. Blue vitriol is **copper sulphate pentahydride**
70. Cobalt -60 is used in the treatment of **cancer**
71. **Heparin** is an example of anticoagulant.
72. An example of redox titration is **potassium permanganate**
73. Acid turns blue litmus to **red.**
74. The main therapeutic use of sodium fluoride is to prevent **dental caries**
75. Chemical formula of chlorinated lime is **Ca (OCl) Cl**
76. Ferrous sulphate should be stored in tightly closed containers **on exposure to moist air**
77. Hyperkalemia mainly occurs due to **impaired renal function**
78. Muriatic acid is **hydrochloric acid**, used as **pharmaceutical aid**
79. Atomic number is defined as **equal number of protons present in nucleus of its atom.**
80. **Aluminium hydroxide gel-magnesium** is a combination antacid preparation.
81. Strontium chloride is used as **dentifrices**
82. **Iron** is used as haematinic.
83. Alum is incompatible with **borax**
84. Chemically talc is **approx $3MgO.\ 4SiO_2.H_2O$**
85. Cylinder of N_2 is painted **grey with black neck.**
86. Nutritional deficiency of sodium leads to **metabolic acidosis.**

Give the uses of the following compounds:

1. Sodium metabisulphates: **antioxidant and reducing agents**
2. Calamine: **topical protective and soothing**
3. Boric acid: **antiseptic**
4. Zinc oxide: **astringents and mild antiseptic**
5. Silver nitrate: **astringents and bactericidal/bacteriostatic**
6. Sodium potassium tartarate: **saline purgative and mild laxative**
7. Kaolin: **diarrhea, enteritis and dysentery**
8. Precipitated sulphur: **mild antiseptic and parasiticide**
9. Sodium thiosulphate: **antioxidants**
10. Ammonium carbonate: **reflux stimulant by inhalation of vapour**

11. Zinc sulphate: **reflux emetic specially in narcotic poisoning**
12. Chlorinate Lime: **bactericidal action**
13. Ammoniated mercury: **anti-infective**
14. Magnesium trisilicate: **emulsifying agent for mineral, vegetable and animal oils**
15. Sodium bicarbonate: **antacid**
16. Yellow mercuric oxide: **local antibacterial properties**
17. Potassium permanganate: **topical anti-infective**
18. Sodium fluoride: **prophylaxis of dental caries**
19. Sodium nitrite: **antioxidant**
20. Ammonium chloride: **expectorants**
21. Calcium hydroxide: **antacid and astringent**
22. Potassium chloride: **oral replacement of potassium**
23. Nitrogen: **antioxidant**
24. Aluminium hydroxide gel: **astringent and dessicant**
25. Sulfur: **mild antiseptic and parasiticide**
26. Bismuth subcarbonate: **mild antacid and astringent**
27. Titanium dioxide: **coloring agent**
28. Alum: **astringents**
29. Iodine: **antiseptics**
30. Talc: **lubricants, dusting powder**
31. Sodium bicarbonate: **antacid**
32. Sodium chloride: **electrolyte replenisher**
33. Sodium nitrate: **antidote**

Give the chemical name of the following compounds.

1. Kaolin: **Native hydrated aluminium silicate**
2. Bleaching Powder: **chlorinated lime**
3. Talc: **native silicate of magnesium**
4. Lime stone: **calcium hydroxide**
5. Eposm salt: **magnesium sulphate**
6. Calamine: **zinc carbonate**
7. Mandrell's salt: **sodium metaphospate**
8. Precipitated chalk **calcium carbonate.**

Question No. 1. Explain why nitrobenzene is used in the assay of ammonium chloride.

Answer: Function of nitrobenzene is to form an organic layer around the precipitate of silver chloride to make it completely insoluble so as to prevent its reaction with ammonium thiocynate.

Question No.2: Explain why do we add alcohol in the limit test for sulphate?

Answer: The presence of alcohol helps to prevent supersaturation and keeps precipitated barium sulphate in the form of turbidity.

Question No. 3. Explain why citric acid is added in limit test of iron.

Answer: Citric acid prevents precipitation of iron with ammonia as iron hydroxides. It keeps iron in the solution form even in the presence of ammonia by forming a complex.

Question No. 04. Explain why potassium Iodide is added to iodine solution.

Answer: Iodine has limited solubility in water; however it is quite soluble in many organic solvents. When it is desired to solve the iodine in aqueous solution, potassium iodide is added to iodine solution to form triodide complex which is quite soluble in water.

Section – B

Each question carries three marks.

Question No. 01) What is the use of nitric acid in the assay of mercuric oxide?

Question No. 02) Explain why in the limit test of iron, thioglycollic acid is added.

Question No. 03) What are the various classes of gastro intestinal agents?

Question No. 04) Explain why glycerin is added in the assay of boric acid?

Question No. 05) Give the titrant used in the assay of the following- a) Sodium hydroxide b) Copper sulphate c) Mercuric oxide d) Ferrous sulphate

Question No. 06) Give medical use of following: a) Silver b) Alum

Question No. 07) Give medicinal use and storage conditions of Ammonium Carbonate.

Question No. 08) Give assay and procedure of chlorinated lime.

Question No. 09) Give uses and properties of yellow mercuric oxide.

Question No. 10) What are expectorant? Give examples.

Question No. 11) Explain why cotton wool is dipped in lead acetate in the limit test of arsenic

Question No. 12) Give identification test for one anion.

Question No. 13) Write note on saline cathartics.

Question No. 14) Write a note on iron compound

Question No. 15) Write a note on anti caries agents

Question No. 16) What are handling and storage conditions of radiopharmaceuticals?

Question No. 17) Give identification test of two cations.

Question No. 01. What is the use of nitric acid in the assay of mercuric oxide?

Answer: This volumetric assay is based upon Volhard's method. The substance is weighed and dissolved in dilute nitric acid to form mercuric nitrate. This is titrated with a standard solution of ammonium thiocyanate using ferric alum (ferric ammonium sulphate) as indicator. The end point is appearance of brick-red color.

$$HgO + 2HNO_3 \longrightarrow Hg(NO_{3)2} + H_2O$$

$$2NH_4SCN + Hg(NO_{3)2} \longrightarrow Hg(SCN)_2 + 2NH_4NO_3$$

$$3NH_4SCN + Fe^{+++} \longrightarrow Fe(SCN)_3 + 3NH_4^+$$

Question No. 02. Explain why in the limit test of iron, thioglycollic acid is added.

Answer: Limit test for iron depends upon the interaction of thioglycollic acid with iron in the presence of citric acid and in the ammonical alkaline medium. This results in the formations of purple coloured ferrous salt of thioglycollic acid.

$$2HSCH_2COOH + Fe^{+++} \longrightarrow Fe(HSCH_2COO)_2 + 2H^+$$

Thioglycollic acid performs the following two functions-

1. Iron impurity may be present in the trivalent ferric form or in the divalent ferrous form. If it is present in the ferric form then thioglycollic acid reduces it to the ferrous form.
2. Thioglycollic acid produces purple colour with the ferrous iron in the ammonical alkaline medium.

.**Question No. 03 What are the various classes of gastro intestinal agents?**

Answer: It is broadly classified into four categories:-

1. Acidifying agents or acidifier- Acidifying agents are the inorganic chemical substance that either produce or increase acid in the G.I.T. e. g Hydrochloric acid
2. Antacids- Those substances which are used to neutralize the gastric contents. e.g. Sodium bicarbonate.
3. Protective's and adsorbents- Protective and adsorbents are the chemically inert substances which are used in the treatment of diarrhoea. e.g. Kaolin.
4. Saline cathartics- Those drugs which are used to bring about defecation i.e. emptying of the stomach. e.g. magnesium sulphate.

Question No. 04 Explain why glycerin is added in the assay of boric acid.

Answer: Boric acid is a very weak acid and cannot as such be titrated accurately with alkali. However, it can be titrated accurately with a standard solution of a strong alkali if glycerol is first added to the boric acid solution before starting the titration. Glycerol reacts with boric acid to form glyceroboric acid which is a much stronger acid as compared to boric acid. The glyceroboric acid has an ionization constant 10,000 times greater than that of boric acid. Therefore, glyceroboric acid gives a satisfactory

end point when it is titrated against a standard alkali using phenolphthalein as an indicator. Glycerol is a polyhydric alcohol. In place of glycerol, other polyhydric alcohol such as mannitol, can also be used for this purpose.

Question No. 05 Give the titrant used in the assay of the following

a) Sodium hydroxide b) Copper sulphate c) Mercuric oxide d) Ferrous sulphate

Answer: The following titrant are used in the assay-

a) Sodium hydroxide- Titrated with 1N sulphuric acid and phenolphthalein as indicator.

b) Copper sulphate- The liberated iodine is titrated with a standard solution of sodium thiosulphate using starch using starch solution (mucilage of starch) as an indicator.

c) Mercuric oxide- This is titrated with a standard solution of ammonium thiocynate using ferric alum as an indicator.

d) Ferrous sulphate- This is titrated with the standard solution of potassium permanganate in the presence of sulphuric acid. In this case potassium permanganate itself acts as indicator (self indicator).

Question No. 06. Give medical use of following- a) Silver nitrate b) Alum

Answer: Silver nitrate; 1 .It has antiseptic property.

2. It is widely used as an astringent and germicide.

3. Dilution solution of $AgNO_3$ used to be dropped into new born babies at birth to prevent concentration of gonorrhea from the mother.

Alum- 1. It is used as an ingredient of some brands of toothpaste or powders.

2. It is used many subunits vaccines as an adjuvant to enhance the body's response to immunogen. Vaccines include hepatitis A, hepatitis B, and DTAP.

3. It is used by pet owners to stem bleeding associated with animal injuries caused by improper nail clipping.

4. It is used in making lotions and douches.

5. It has also been used as vaginal cleaning and deodorant preparations.

Question No. 07. Give medicinal uses and storage condition of Ammonium carbonate

Answer: Uses 1. It is used in baking powder, mordant dyeing and tanning.

2. It is an active ingredient intended to relieve symptoms from bronchitis.

3. It is also used as medication in certain diseases.

4. It is also used as an emetic.

Storage- It should be stored in tightly closed containers in a cool, well-ventilated area, away from water and avoid contact with air.

Question No. 08. Give assay procedure of chlorinated lime.

Answer: Chlorinated lime (iodometric)-An aqueous suspension of weighed quantity is treated with acetic acid in the presence of excess of potassium iodide. The following reactions occur-

$$Ca(OCI)CI + 2CH_3COOH \longrightarrow Ca(CH_3COO)_2 + HCl + HOCl$$

$$HOCl + HCl \longrightarrow H_2O + Cl_2$$

$$2\ KI + Cl_2 \longrightarrow 2\ KCl + I_2$$

Hypochlorous acid hypochloric acid reacts to form chlorine. The chlorine react to produced, displaces an equivalent amount of iodine from potassium iodide. The liberated iodine is titrated with a standard solution of sodium thiosulphate using mucilage of starch as an indicator. The end point is disappearance of blue colour.

Question No. 09 Give uses and chemical properties of yellow mercuric oxide.

Answer: Yellow mercuric oxide- Properties

1. It is odorless orange yellow amorphous powder.
2. It is insoluble in water and alcohol.
3. It is soluble in acids.
4. It gets decomposed on exposure to light.

$$HgO + 2\ HCl \longrightarrow HgCl_2 + H_2O$$

$$HgO + 2\ HNO_3 \longrightarrow Hg\ (NO_3)_2 + H_2O$$

Uses- 1 It has been used as topical antiseptic and in chronic ulcers.

2. It is used in eye ointments for the local treatment of minor infections and inflammation of eye including conjunctivitis.

Question No.10. What are expectorant? Give examples.

Answer: Expectorants are the drugs used to help in removal of exudates from trachea, bronchi or lungs, & hence they are used in treatment of cough. They act upon the respiratory tract in two ways.

1. By decreasing the viscosity of bronchial secretion and facilitating their elimination.

2. By increasing the amount the respiratory tract fluid, a demulcent action is exerted on dry mucosal linings, thus relieving the unproductive cough. e.g. Ammonium chloride NH_4Cl and Potassium Iodide KI.

AMMONIUM CHLORIDE:

Chemical formula: NH_4Cl

Synonym: Amchlor

Preparation: It is prepared by neutralizing hydrochloric acid with ammonia

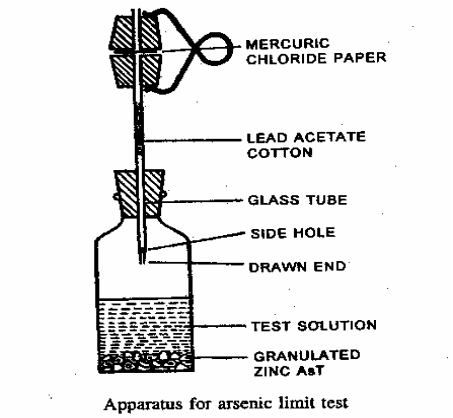
$$NH_3 + HCl \longrightarrow NH_4Cl$$

Physical Properties: It is a white crystalline powder, odourless, and saline in taste. Freely soluble in water and 5% solution is acidic.

Uses: It is used as expectorant, diuretics in the treatment of lead poisoning and systemic acidifier in treatment of urinary infection.

Question No. 11. Explain why cotton wool is dipped in lead acetate in the limit test of arsenic.

Answer: The glass tube is lightly packed with cotton wool which has been previously moistened with lead acetate solution and dried. The purpose of lead acetate cotton wool is to trap any hydrogen sulphide gas which would otherwise interfere with this test as it also give some stain with mercuric chloride paper. The tube is fitted at its upper end with two rubber bungs as shown in Fig.1 A piece of dry mercuric chloride paper is placed flat on the top of the bung and the other bung is placed over it and secured by means of clips in such a manner that the borings of the two bungs meet to form a true tube of the same diameter interrupted by a diaphragm of mercuric chloride paper.



Apparatus for arsenic limit test

Fig. 1

Question No. 12. Give identification test for one anion.

Answer: Chlorides (Cl^-): Aqueous solution of substance containing chloride is acidified with dilute nitric acid and treated with silver nitrate solution, shake and allow to stand for few minutes. A cruddy white precipitates of silver chloride is formed.

$$NaCl + AgNO_3 \longrightarrow AgCl + NaNO_3$$

(b) Introduced into a test tube a quantity of the substance being examined equivalent to about 10mg of chloride ion, add 0.2g of potassium dichromate and 1ml of sulphuric acid. Place a filter paper strip moistened with 0.1 ml of diphenylcarbazide solution over the opening of the test-tube the paper turns violet red.

$$K_2Cr_2O_7 + 4NaCl + 6H_2SO_4 \longrightarrow 2CrO_2Cl_2 + 2KHSO_4 + 4NaHSO_4 + 3H_2O$$

Chromyl chloride

$$CrO_2Cl_2 + H_2O + \text{diphenylcarbazide} \longrightarrow \text{violet red colour}$$

Question No. 13 Write note on saline cathartics.

Answer: Cathartics are drugs used to relieve constipation. The term laxative is used for mild cathartics where as purgative is used for strong cathartics.

The cathartics can be considered under following class -

1. Mild purgative or laxative: Mild purgatives or laxatives are those which promote defaecation causing minimum adverse effects. Drugs included in this group are-

a) Bulk producing drugs - Which promote evacuation by increasing the stools in bulk volume along with water contents, For Example - Isapgol, Agar-Agar, and Bran.

b. Stool softners - Which penetrate lubricant and soften the stool, for example - liquid paraffin.

2. Strong purgative: Strong purgative cause complete evacuation of the bowel and the bowel become inactive; constipation usually follows for which a milder purgative is again required after the use of strong purgative.

a) Stimulant Purgative, for example - Seena, Aloe, Castor oil, Phenolphthalein etc.

b) Saline cathartics – These are further sub- classified as under:-

(i) Sodium containing products, For example - Sodium Biphosphate, Sodium Phosphate, Potassium Sodium Tartrate etc.

(ii) Magnesium containing product, for example - Magnesium Citrate, Magnesium Sulphate.

(iii) Sulphur as cathartics.

Question No. 14. Write a note on iron compound.

Answer: Iron compound: Ferrous fumarate, ferrous sulphate, ferrous gluconate, Iron and ammonium citrate

Ferrous sulphate: chemical formula: FeSO4.7H2O

Synonym: iron vitrol, Green vitrol

Preparation: It is prepared by adding a slight excess of iron to dilute sulphuric acid. When the reaction slackens the liquid is concentrated by boiling, filtered and cool. The crystals are separated and dried at room temperature.

Properties: It occurs as transparent green crystals, odorless and its taste is metallic and freely soluble in water.

Storage: Stored in tightly closed containers.

Uses: It is used as a heamatinic, dye fabric, disinfectant property

Question No.15. Write a note on anti caries agents .

Answer- Anticaries agent: They prevent tooth decay and consequently caries e.g. sodium fluoride, stannous fluoride.

Example**: Sodium fluoride**

Chemical formula: NaF

This salt is manufactured by passing hydrogen fluoride into a a solution of sodium carbonate.

Properties: colorless, odorless crystals, powder is soluble in water and insoluble in alcohol.

Uses; it is used for prophylaxis of dental caries in communities where the intake of fluoride from drinking water and food is low. A 2% solution of sodium fluoride in water may be applied to children teeth after preliminary cleansing,3 times at interval of one week of 3,7,10,and 13 year of the age to correspond with the tooth eruption.

Application: 1.5 to 3 ppm in drinking water; topically as a 2% solution to the teeth.

Question No-16. What are handling and storage conditions of radiopharmaceuticals?

Answer- Handling and storage: A care should be taken to protect people and personnel from harmful radiations during handling and storage of radioactive material. The following precautions are taken as:

1. These materials should be handled with forceps or suitable instruments and direct contact should be avoided.
2. Any substance that is taken internally [food, drinks], should not be carried in laboratory.
3. Sufficient shielding must be provided on protective cloths.
4. Sufficient protective clothing must be used while handling the materials.
5. Disposal of radioactive materials should be done with great care.

Question No. 17. Give identification test of two cations.

Answer: Sodium (Na^+): Dissolve 0.1 gm of the substance being examined in 2 ml of water or use 2 ml of the prescribed solution. Add 2 ml of a 15 percent w/v solution of potassium carbonate and heat to boiling, no precipitates are formed. To this add freshly prepared potassium antimonate solution (4 ml) and boil. Allow to cool in ICE water and scratch the sides of the test tube with a glass rod to give a dense, white precipitates of disodium antimonate.

$$2\ NaCl + 2KH_2\ SbO_4 \longrightarrow Na_2\ H_2\ SbO_4 + 2KCl$$

Potassium Antimonate — Disodium Antimonate

2. Potassium (K^+): (i) An aqueous solution of the substance is acidified with dilute acetic acid (1ml). On addition of a freshly prepared solution of sodium cobalt nitrate (10% w/v) an orange yellow ppt is formed immediately.

$$3\ KCl + Na_3\ [CO\ (NO_2)]_6 \longrightarrow K_2\ [CO(NO)_2]_6 + 2NaCl$$

Sodium cobalt nitrate — Yellow precipitates

SECTION-C

Each question carries five marks.

Question No. 01. What are the respiratory stimulants? Give examples.

Question No. 02. Comment on the role of iron in body.

Question No. 03. Give theory involved in the limit test of sulphate.

Question No. 04. Give uses of (a) Sodium potassium tartrate (b) Precipitated sulphur

Question No. 5. Give the treatment of cyanide poisoning

Question No. 6. What are buffers? Give examples.

Question No. 7. What are antimicrobial agents? Give properties of hydrogen peroxide.

Question No. 8. Define the following with example: a) Inhalants (b) Astringents.

Question No. 9. Write a note on official compounds of iodine.

Question No. 10. What is complexometric titration? Explain its principle?

Question No. 11 Write a short note on ORS (Oral rehydration salts).

Question No.12 What are the radiopaques? Explain with example.

Question No. 13. What are biological effects of radioactive radiations?

Question No. 14. What are antacids? Give example of magnesium containing antacids**.**

Question No. 01. What are the respiratory stimulants? Give examples.

Answer: Respiratory stimulant are the drugs that are prescribed to help in a patient breathing. They belong to the class of CNS stimulants. These agents cause a reflex action in the patient's taking a sudden breath.

Examples of respiratory stimulants are ammonia, ammonium carbonate.

Ammonium carbonate

Chemical formula- $(NH_4)_2\,CO_3$

It is a variable mixture of ammonium bicarbonate, ammonium carbamate, anhydride of ammonium carbonate.

Synonym- Hart Shorn, Baker's ammonia, Preston's salt.

Method of preparation

It is manufactured by subliming a mixture of ammonium sulphate or chloride with calcium carbonate.

$$(NH_4)_2SO_4 + CaCO_3 \longrightarrow (NH_4)_2CO_3 + CaSO_4$$

Properties: It is white crystalline powder with a strong ammonia odour. It is freely soluble in water and the solution is alkaline to litmus. Hot water decomposes ammonium carbonate. Ammonium carbonate can spontaneously decompose into ammonium bicarbonate and ammonia.

$$(NH_4)_2CO_3 \longrightarrow NH_4HCO_3 + NH_3$$

Uses:

1. It is an active ingredient intended to relive symptoms from bronchitis.

2. It is used as medication in certain diseases.
3. It is used in baking powder and in mordant dye.
4. It is also used as emetic.

Question No. 2. Comment on the role of iron in body.

Answer: Iron forms an important component of haemoglobin which acts as a carrier of oxygen in the blood. The main sources of iron include green leafy vegetables, millets like bajra and ragi. It is necessary for growing children and pregnant women. The deficiency of iron causes anaemia and goiter. Iron and its preparations fall into two categories-

1. Internal preparations
2. External preparations

1. Internal preparations- Those preparations which are used to supplement the iron present in the body which is so essential in the formation of haemoglobin, myoglobin, catalase, electron transport and enzyme cofactor.

2. External preparation- Those preparations which are almost exclusively of ferric type and depend for their action principally on their ability to precipitate proteins. Ferric salts used externally as astringents are of value in stopping the bleeding of small cuts, in gargle etc. The phenol- precipitating and oxidizing properties of ferric ions makes ferric chloride solution useful as an application to the skin in cases of poison – Plant poisoning.

Question No. 3. Give theory involved in the limit test of sulphate.

Answer: Limit test for sulphate depends upon the interaction of sulphates with barium chloride in the presence of hydrochloric acid. This results in the precipitation of sulphates as barium sulphate.

$Bacl_2$ + sulphates $\longrightarrow$ $BaSO_4$+ Chlorides

Hydrochloric acid is added to prevent precipitation of other acid radicals with barium chloride solution. However, in the presence of hydrochloric acid, only sulphates are precipitated.

Limit test for sulphate in sodium chloride

Test	Standard
Dissolve 2gm of sodium chloride in about 10ml distilled water and transfer it to a Nessler cylinder labeled as Test.	Place 1ml of 0.1089 w/v solution of potassium sulphate in Nessler cylinder labeled as Standard. Add about 9 ml of distilled water.
Add 2 ml of dilute hydrochloric acid.	Add 2 ml of dilute hydrochloric acid.
Dilute to 45 ml with distilled water.	Dilute to 45 ml with distilled water.
	Add 5 ml of barium sulphate reagent.

Question No. 04. Give uses of (a) Sodium potassium tartrate (b) Precipitated sulphur

Answer: Uses of Sodium potassium tartrate -

1. It is a saline purgative,
2. It is also used in the food items such as in cheese and meat products.

Uses of precipitated sulphur-

1. Sulphur is used as a germicide in vineyards and in homeopathic medicine.
2. It is effective against mildew disease and black spot.
3. It can also be used as an organic insecticide.
4. It has also been used for internal purpose as cathartics. It is also used mainly as a dermatological agent in the treatment of acne, psoriasis.

Question No. 5. Give the treatment of cyanide poisoning.

Answer: Process of cyanide poisoning in the body: Cyanide readily combine with ferric ion (Fe^{3+}) of cytochrome oxidase which prevent electron transfer & thus stops the cellular respiration or oxidation reduction reaction.

Treatment: *Sodium nitrite and sodium thiosulphate* finds special place in the treatment of cyanide poisoning. Firstly injection of sodium nitrite is given which cause the oxidation of the ferrous (Fe^{2+}) ion of haemoglobin to the ferric ion of methaemoglobin. The methaemoglobin so formed then combines with serum cyanide that has not yet entered in the cell, to produce cyanmethaemoglobin. After 5 minutes, a slow intravenous infusion of sodium thiosulphate (50 ml in 10 minutes) is given. The thiosulphate ions react with cyanide ions set free owing to slow dissociation of cyanmethaemoglobin and form non-toxic thiocyanate ions. Usual dose & Antidote in cyanide poisoning used are:

1. Sodium Nitrite – 10 to 15 ml of 3% solution intravenously.
2. Sodium thiosulphate – 1g (range 500 mg to 2 g) in a 5 -10% solution intravenously.

Question No. 6. What are buffers? Give examples.

Answer: The solutions that are able to resist the change pH values are termed as buffer. Buffer solution consists of a mixture of a weak acid and its salt and weak base and its salt.

Buffer solutions are broadly classified into three categories-

1. Acidic buffer solution
2. Basic buffer solution
3. Neutral buffer solution

Examples of buffer solutions-

1. Acetate buffer pH 2.8- Dissolve 4g of anhydrous sodium acetate in about 840 ml of water, add sufficient glacial acetic acid to adjust the pH to 2.8 and dilute with water to 1000 ml.

2 Hydrochloric acid, 0.2 N- Hydrochloric acid diluted with freshly boiled and cooled water to contain in 1000 ml 7.292 g of HCl. Standardize as directed under volumetric reagents and solutions.

3 Potassium hydrogen phthalate 0.2 M- Dissolve 40.846 of potassium hydrogen phthalate in water and dilute with water to 1000 ml.

Question No. 7. What are antimicrobial agents? Give properties of hydrogen peroxide.

Answer: Antimicrobials: Antimicrobials are the chemical agents used to destroy or inhibit the growth of pathogenic micro-organisms. They are normally ineffective in the sporing state of micro-organisms. The **disinfectants** are used for the application to inanimate objects and materials to get them rid of micro-organisms, but they may be applied to skin, body membranes and cavities. An **antiseptic** is applied before all invasive procedure. Antiseptic are also applied prophylactically to hands of surgeons, dentists, nurses and other in their routine procedures.

Example: Potassium Permanganate (KMnO4), Hydrogen peroxide (H_2O_2)

Hydrogen Peroxide (H_2O_2)

Chemical Formula: H_2O_2

Physical and Chemical Properties: Hydrogen peroxide solution is a colorless syrupy liquid. It is odorless and its taste is slightly acidic. It rapidly decomposes in contact with oxidisable organic matter and with certain metals. It also decomposes if it is allowed to become alkaline.

$$2\,H_2O_2 \rightarrow 2\,H_2O + O_2$$

Storage: It should be stored in containers made of aluminium.

Uses:

1. It is mild oxidizing antiseptic.
2. It is used for its cleansing action on cuts and wounds.
3. It is also used for bleaching of hairs.

Question No. 8. Define the following with example: a) Inhalants (b) Astringents.

Answer: a) Inhalants: Inhalants are directly administered by the nasal or oral respiratory route for local or systemic effect. E.g. N_2O

Chemical Formula: N_2O

Physical and Chemical Properties: Nitrous oxide is a colorless, non-toxic gas with a faint, sweet odour. It is freely soluble in ether and oils.

Storage: It should be stored under compression in metallic cylinder of the type confirming to the appropriate safety regulation and a temperature not exceeding 37^0C.

Uses: It is used in dental and obstetric practice for producing both analgesia and light anesthesia.

1. It is also used in conjunction with local anesthetic and muscle relaxant.

b) Astringent: They are locally applied protein precipitants which have low cell permeability so that the action is limited essentially to the cell surface and interstitial space. E.g Zinc sulphate.

Chemical Formula: $ZnSO_4 .7H_2O$

Physical and Chemical Properties: It is colorless transparent crystals, odorless but its taste is metallic and astringent. It is freely soluble in glycerin but is insoluble in alcohol.

Storage: It should be stored in tightly closed container.

Uses: 1**.** It is used in narcotic poisoning.

2. It is used externally for its antiseptic and astringent properties in powder and lotions.

Question No. 9. Write a note on official compounds of iodine.

Answer: Iodine is essential ion necessary for the synthesis of two thyroid hormones, lithyronine or triidothyronine and thyroxine. Thyroid hormones affect some fundamental physiological processes such as a oxygen consumption, heat production and metabolism of carbohydrates, proteins and fats. They are required for growth regulators and maintain BMR of whole body. Iodide ions from blood plasma utilized by the synthesis of two active principle of the gland. These hormones are basically iodine containing amino acids and stored as a part of thyroglobulin and are released into the blood streams after proteolysis. Inadequate or excessive secretions of these hormones results in hypothyroidism or hyperthyroidism respectively, directly affecting the cardiovascular, GI, skeletal, neuromuscular and reproductive systems.

Hypothyroidism or myxedema is a condition marked by slowing down of all the metabolic processes of the body, which may lead to bradycardia, decreased refluxes, weight gain, constipation, dry skin, loss of hair, slow speech, anxiety, poor memory etc. Lack of sufficient iodine in the diet results in an enlargement of the thyroid gland, leading to swelling at the neck, known as simple or colloidal goiter.

Hyperthyroidism is the excessive secretion of thyroid hormones may cause increase in the BMR and may be characterized by tachycardia, cardiac arrhythmias, angina pain, tremors, sweating, weight loss and diarrhea.

Iodine is therapeutically used as: leprosy, fibrolytic agent in syphilis, sporotrichosis, an expectorant and bacterial agent.

Question No. 10. What is complexometric titration? Explain its principle?

Answer: Principle: **Complexometric titration** (sometimes chelatometry) is a form of volumetric analysis in which the formation of a colored complex is used to indicate the end point of a **titration**. **Complexometric titrations** are particularly useful for the determination of a mixture of different metal ions in solution.

A **complexometric indicator** is an ionochromic dye that undergoes a definite color change in presence of specific metal ions. It forms a weak complex with the ions present in the solution, which has a significantly different color from the form existing onside the complex. Complexometric indicators are

also known as pM indicators

1. Direct Titration: It is the simplest and the most convenient method in which the standard solution of EDTA is slowly added to the metal ion solution till the end point is achieved. It is similar to simple acid-base titrations.

2. Back Titration: In this method, an excess of a standard solution of EDTA is added to the metal solution being determined so as to complex all the metal ions present in the solution..

3. Replacement Titration: When direct or back titrations do not give sharp end points or when there is no suitable indicator for analyze the metal may be determined by this method.

4. Indirect Titration: Certain anions that form precipitate with metal cations and do not react with EDTA can be analyzed indirectly

Question No- 11 Write a short note on ORS (Oral rehydration salts).

Answer- (Oral rehydration salts): Oral rehydration salt is a fluid replacement strategies used to prevent or treat dehydration. Dehydration is most commonly caused by diarrohea. It involves drinking water with modest amounts of sugar and salt added, while continuing to eat. When diarrhea is severe or long-lasting, the therapy also includes supplemental zinc. Caretakers are taught the signs of dehydration and/or worsening dehydration. The world health organization and UNICEF specify indications, preparations and procedures for ORT. Vomiting seldom prevents successful rehydration since much of the fluid is still absorbed. If the patient vomits, the World Health Organization (WHO) recommends taking a pause of five to ten minutes and then restarting the solution more slowly. For example, a child under two can be given a teaspoonful of fluid every two to three minutes.

Medical uses

Oral rehydration salt is used in the treatment for the symptoms of dehydration and rehydration in burns in resource-limited settings.

Preparation:-

These are mainly used to supplement water and electrolyte before serious fluid losses occurs and to replace fluid losses due to diarrhoea and other condition associated with excessive fluid loss. A large number of formulations of oral rehydration preparations are available in the market, which contains anhydrous glucose, sodium chloride, potassium chloride and either sodium bicarbonate or sodium citrate. These dry powder preparations are to be mixed in specific amount of water and are used for oral rehydration therapy. These preparations may contain a flavouring agent and a suitable agent for free flow of the powder. The following three formulations are usually prepared. When glucose is used, sodium bicarbonate is packed separately. The quantities given below are for preparing 1 litre solutions.

Ingredient	Formula I	Formula II	Formula III
Sodium chloride	1.0g	3.5g	3.5g
Potassium chloride	1.5g	1.5g	1.5g
Sodium bicarbonate	1.5g	2.5g	-----
Sodium citrate	------	-------	2.9g
Anhydrous glucose	36.4g	20.0g	20.0g
Glucose	40.0g	22.0g	------

Question No-12 What are the radiopaques? Explain with example.

Ans. Radio–Opaque contrast media (radiopaques): The X-ray contrast media are the chemical compounds which have the ability to absorb X-rays and block the passage of X-rays. Thus they are opaque to X- ray examination. X-rays are capable of passing through most soft tissues. When a photographic film or a photosensitive plate is placed opposite to the X-ray source through patient's body/organ portions, the film or plate is darkened in an amount proportional to the number of X-rays that are able to pass. Bony structures, cartilage and teeth are capable of blocking the passage of X-rays and appear light on exposed X-ray film. But skin and soft structures, being less dense and they appears only as shadows on X-ray film. So to make a correct diagnosis of soft organ, radiopaques substances are used. Radiopaques substances have no pharmacodynamic effect in the body. The most common example of contrast media is barium sulphate.

Barium sulphate:

Synonym: Barium meal

Chemical formula: $BaSO_4$

Preparation: It is prepared from a solution of Barium chloride with cold dilute H_2SO_4 or soluble sodium sulphate. $BaCl_2 + H_2SO_4 \longrightarrow BaSO_4 + 2\,HCl$

$BaCl_2 + Na_2SO_4 \longrightarrow BaSO_4 + 2\,NaCl$

The Barium sulphate precipitated, washed and dried.

Properties: It is a fine, white powder free from gritty particles, odorless and tasteless and insoluble in water and organic solvent. It dissolves in concentrated H_2SO_4 with the formation of bisulphate salt.

$BaSO_4 + H_2SO_4 \longrightarrow Ba\,[HSO_4]_2$

Storage: Store in well-closed containers.

Uses:

i) Barium is given only by its salt i.e. Barium sulphate. Its salt is given to identify location of ulcers in G.I.T. wherever ulcer is formed.

ii) It is also used on respiratory muscles and muscles of cardiovascular system but cause toxicity.

iii) In G.I.T. mucosa, cells absorb $BaSO_4$ and ulcer spot is identified with the help of X-Ray film.

Question No. 13. What are biological effects of radioactive radiations?

Answer: Biological effects of radiations: Effect of radiations on biological tissues is known as biological effect of radiations. Radiations have dangerous effects on biological tissues depending on ability of radiations to penetrate the tissue, energy of radiation, surface area exposed etc. The radiations promote a number of irreversible changes in living cells. These are:

1. The chemical changes either the pH or initiate free radical chain reactions and forms peroxides and other toxic substances.
2. These can create necrosis and ultimately complete destruction of cell, tissue or organ.
3. The toxic substances produced from reactions of free radicals after DNA in cells and cause cross linking between amino acids and proteins. This leads to various defects in body. The reaction of free radicals occurs in following steps:-

(I) Chain Initiation

$$H_2O \xrightarrow[\text{Particles}]{\text{Radiation}} H. + HO.$$

(II) Chain propagation

$$H_2O + H. \longrightarrow H_2 + .OH$$

$$H_2O + OH. \longrightarrow H_2O_2 + H.$$

(III) Chain termination

$$H. + H. \longrightarrow H_2$$

$$OH. + OH. \longrightarrow H_2O_2$$

$$H. + OH. \longrightarrow H_2O$$

Question No. 14. What are antacids? Give example of magnesium containing antacids.

Answer: Antacids: Antacids are substances which on ingestion react with the gastric acid and lower the acidity of gastric contents. They produce a symptomatic relief of heartburn, pain and also reduce spasm in addition to relief from the uncomfortable feeling from overeating and grow hungry feeling between meals.

Magnesium oxide: Chemical formula- MgO

Synonym- Magnesia

Properties-

1. It is odorless.
2. It is slightly alkaline taste.
3. It is practically insoluble in water.
4. It readily dissolves in dilute acids with slight effervescence.

Uses-

1. It is used as an antacid and laxative.

2. It is used as an ingredient of universal antidote along with tannic acid and charcoal.

3. It is used for compounding and preserving fluid extract because of its absorptive powder.

Magnesium carbonate -

Chemical formula- $(MgO_3)_4\,Mg\,(OH)_2.\,5H_2O$

It is a hydrated basic magnesium carbonate containing 40-50% of Magnesium oxide.

Properties-

1. It occurs as light, white, friable mass or as bulky white powder.

2. It is odorless powder.

3. It is practically insoluble in water and alcohol but solubilizes in dilute acids with strong effervescence.

Uses:

1. It is used as an antacid and mild laxative.

2. It is used as pharmaceutical aid.

SECTION-D

Question no. 1 to 7 carries ten marks.

Question No. 01. What are the antioxidants? Give examples.

Question No. 02. What is the principle of Geiger muller counter?

Question No. 03. Define radiopharmaceuticals. Discuss method of quality control of active pharmaceutical ingredient as per pharmacopoeia

Question No. 04. Define electrolyte replacement therapy. What are the role of major intra and extra cellular electrolytes?

Question No. 05. Describe limit test of iron.

Question No .06. Write note on physiological acid base balance.

Question No. 01. What are the antioxidants? Give examples.

Answer: Antioxidant is an agent which is added to pharmaceutical preparation to prevent oxidation and subsequent deterioration of the product. For Example: - Hypophosphorous acid, Sulphur dioxide, sodium bisulphate. The mechanism of action of antioxidants is given as follows.

i) By inhibiting oxidation

ii) By reacting with free radicals.

iii) By blocking side chain reaction.

Selection for a substance to act as an antioxidant-

i) They should be chemically inert.

ii) They should be physiologically and chemically compatible.

iii) They should not be toxic or harmful to the human body.

iv) They should not possess any solubility problem in either reduced or oxidized form.

Sulphur dioxide

Chemical formula - SO_2

Molecular weight- 64 a.m.u

Method of preparation- Sulphur dioxide can be obtained by burning sulphur in air or oxygen.

$$2S + 2O_2 \longrightarrow 2SO_2$$

In laboratory, it is prepared by the action of sodium sulphite with mineral acid such as sulphuric acid.

$$Na_2SO_3 + 2HCl \longrightarrow 2NaCl + H_2O + SO_2$$

Physical properties-

1. It is colorless, non-inflammable gas.
2. It has a specific gravity of about 2.264.
3. It possesses a strong suffocating, pungent & irritating odor characteristic of burning sulphur.
4. Sulphur dioxide is stable even at high temperature. It does not burn or support combustion.

Chemical properties-

Sulphur trioxide is formed, when sulphur dioxide combines with oxygen in presence of a catalyst.

$$2SO_2 + O_2 \longrightarrow 2SO_3$$

Uses : 1 It is used as a germicide and disinfectant refrigerant in form of liquid SO_2.

2 It is used for bleaching delicate clothes like silk, wool, etc.

3 It is used as a lotion for sore throat in colds, tonsillitis and skin infection.

4. It is mainly used as antioxidant in pharmaceutical aids.

Sodium Bisulphite

Chemical Formula- $NaHSO_3$

Synonym: Sodium acid sulphite, Sodium pyrosulphate.

Physical properties-

1. It occurs as a white, granular powder or yellowish white crystals.
2. It is unstable in air.
3. It is freely soluble in air and slightly soluble in alcohol.

Chemical properties- The bisulphite is neutralized by addition of acids to yield sulphurous acid.

$$NaHSO_3 + HCl \longrightarrow NaCl + H2SO3$$

$$H_2SO_3 \longrightarrow H_2O + SO_2$$

Uses-

1. It is used as an antioxidant and stabilizing agent.
2. It is used to remove permanganate stains & for solubilizing certain dyes and other chemicals.

3. It is also well employed for its dermatological properties

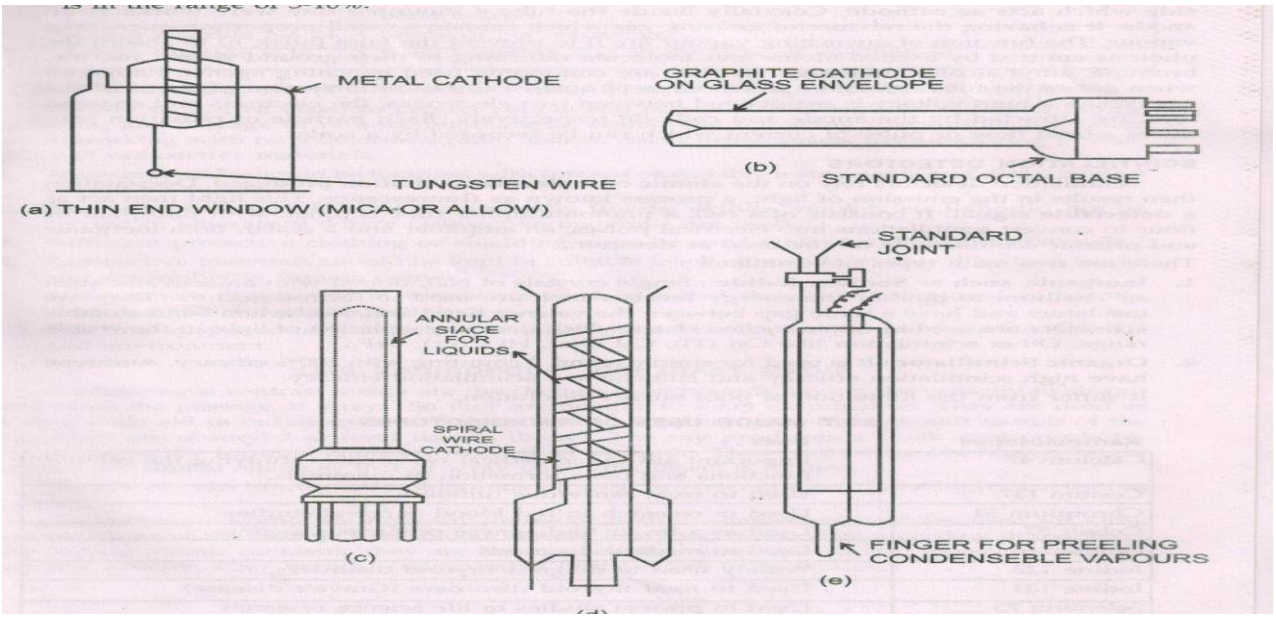
Question No. 2. What is the principle of Geiger muller counter?

Answer: Geiger- Muller counter- It is one of the oldest radiation detector types in existence, having been introduced by Geiger and Muller in 1928. It is referred to as G-M counter or simply tube. The simplicity, low cost and of ease of operation of these detector have lead to their continued use to the present time. They can detect α, β and γ radiations. It consists of a cylinder made up of stainless steel or glass coated with silver on the inner side which acts as cathode. Coaxially inside the tube a mounted fine were works as an anode. It is having the mixture of ionizing gas which contain a small proportion quenching vapour. The functions of quenching vapour are

1) To prevent the false pulse.

2) To absorb the photons emitted by excited atoms and molecules returning to their ground state.

Chlorine, bromine, ethyl alcohol and ethyl formate are commonly used quenching agents. Radiation when enters the tube through a thin section of outer wall causes ionization of atoms of the gas. When a high voltage is maintained between two electrodes, the electrons and charged ions are attracted by the anode and cathode respectively. Each particle of radiation produces a brief flow or pulse of current which can be recorded by a scalar.



Question No. 03. Define radiopharmaceuticals. Discuss method of quality control of active pharmaceutical ingredient as per pharmacopoeia.

Ans. Radiopharmaceuticals: The compounds or substances which emit radiations (alpha, beta, and gamma) continuously and which are used in medicines are called as radiopharmaceuticals.

Methods used for quality control: The pharmacopoeial monograph of each compound/product is the a guiding document. A substance is required to confirm with the following parameters:

1. Description: Statements of those superficial qualities that can be determined without formal scientific examination e.g. colour, crystalline form, odour, taste etc.

2. Identification: It includes various specific and non-specific tests; physical constants and spectrophotometric matching.

3. Method of assay: - The term assay is used in the pharmacopoeias for the quantitative deterioration of principal ingredients of the official substance and their preparations. This is quantitative determination of principal ingredients by gravimetric or volumetric or instrumental or biological method, etc.

4. Tests for purity: - I.P prescribes tests for purity of almost all the official substances. These tests include melting point, boiling point, weight per ml., limit tests for chlorides, sulphates, iron, heavy metals, lead and arsenic, specific optical rotation, sulphated ash, loss drying, pH of solution etc. as may be applicable for the substance.

a) Colour, odour and taste- Though these have limited values, still they are useful in determining whether the substance is reasonably pure, hygienic etc. or not, especially when other tests for purity are not available.

b) Physico-chemical constants - Physico-chemical constants are important criteria of purity of many pharmaceutical substances. Certain materials of indefinite or variable composition do not respond well to chemical analysis and for these physical methods are of prime importance. The pharmacopoeia attaches due importance to solubilities, determination of melting point, distillation range/boiling point, weight per ml/ density/ specific gravity, viscosity and other physical measurements. Chromatographic constants e.g. Rf values and retention time also serve as a good constant.

c) Acidity, alkalinity and pH - On account of incomplete purification of substances by inappropriate and insufficient washings after their separation in acidic or alkaline media, some degree of acidity or alkalinity may still remain in the final product. Further, solutions of certain substances have a definite pH at a specified concentration. A deviation of pH from a normal value in a given substance at the specified concentration will be indicative of the presence of incorporated impurities.

d) Moisture determination- Of some substances especially crude drugs provide valuable information about purity of specified substances.

e) Insoluble residue- Pure substances generally give a clear solution in a proper solvent at a specified concentration. Insoluble ingredients or impurities may make the solution cloudy, turbid or opaque or even insoluble suspension. The measurement of turbidity or opalescence or weighing the filtered the insoluble residue can serve as determination of the insoluble residue.

f) Loss on drying/ignition- On specified heating loss in weight upon drying or ignition also serves as an useful index towards purity determination.

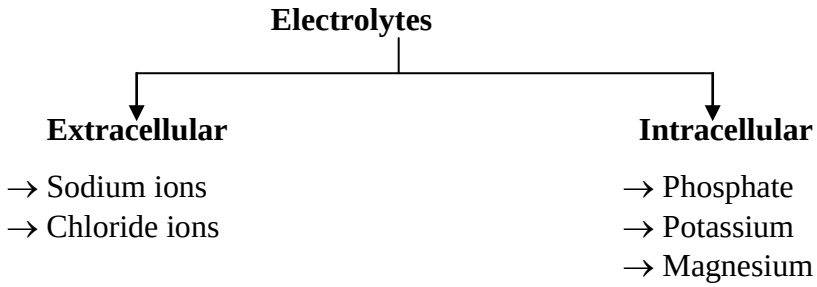
g) Organic impurities and carbonisable substances- These are determined in the specified substances as required in the monograph of the pharmacopoeia to ensure desired purity.

h) Other physic-chemical parameters- Such as swelling powder (e.g. bentonite, kaolin), bulkiness (barium sulphate), sedimentation volume (bentonite), soluble matter (kaolin) and stability of solution etc. also serves as parameters toward ensuring properties.

Question No. 04. Define electrolyte replacement therapy. What are the role of major intra and extra cellular electrolytes?

Ans. Electrolytes: These are those substances which are used to improve or correct the imbalance of intracellular and extra cellular ions in body for normal metabolism

Electrolytes are classified as:



Role of extracellular electrolytes:

Sodium ion (Na^+): It maintain normal hydration and osmotic pressure, buffer constituent, acid- base balance, cell membrane permeability, muscle contraction, carbon dioxide transport, transmission of nerve impulses in nerve fibers. It is completely and readily absorbed, excreted in sweat and urine. Low serum Na^+ may occur with extreme loss of urine in diabetes leads to condition *hyponatremia.* High serum Na^+ level may occur in Cushing's syndrome leads to condition *hypernatremia.*

Chloride ion (Cl^-): It maintains proper hydration, osmotic pressure, normal electrolyte balance, acid-base balance and gastric HCl. It is obtained from common table salt and animal foods. It is completely absorbed, eliminates from blood by glomerular filtration and possibly reabsorbed by the kidney. Due to kidney diseases, diabetes and prolonged vomiting leads to deficiency of Cl^- , condition is known as *hypochloremia.* Excessive Cl^- intake leads to condition *hyperchloremia.*

Role of Intracellular Electrolytes:

Phosphate ion (HPO_4^{2-} and $H_2PO_4^-$): It is predominant constituent of bones, teeth, HPO42$^-$ /$H_2PO_4^-$ buffer, cell phosphoproteins, phospholipids and cofactors of ATP, NAD, and FAD etc. It is obtained from milk and milk products, whole grains, legumes and egg yolk. It is easily absorbed from intestines and excreted mainly

through urine. Excess and deficiency leads to condition *hyperphosphatemia* and *hypophosphatemia* respectively.

Potassium (K^+): It maintains acid-base and water balance. It is a buffer constituent, help in muscle contraction, membrane transport and carbon dioxide transport. It is obtained from fruits, vegetables, legumes and meat. It is rapidly absorbed, excreted by kidneys. Excess and deficiency leads to condition *hyperkalemia* and *hypokalemia* respectively.

Magnesium (Mg^{2+}): It is essential component of several enzymes involving phosphate metabolism, constituent of bones, teeth, help in protein synthesis and smooth functioning of neuromuscular function. It is not readily absorbed from GIT, unabsorbed Mg^{2+} eliminated through faeces and absorbed portion is excreted through urine and intestinal secretions. Excess and deficiency lead to condition *hypermagnesemia* and *hypomagnesaemia* respectively.

Question No- 05. Describe limit test of iron.

Limit test for Iron: Limit test of iron depends upon the interaction of thioglycollic acid with iron in the presence of citric acid in the ammoniacal alkaline medium. This results in the formation of purple colored ferrous salt of thioglycollic acid.

$$2\,HSCH_2COOH + Fe^{++} \xrightarrow{\text{Citric acid}} Fe(HSCH_2COO)_2 + 2H^+$$

Thioglycollic acid — ferrous thioglycollate

1. Thioglycollic acid converts the iron impurities, if present, from the ferric form to ferrous form.
2. Thioglycollic acid forms the purple color with the ferrous form of iron in the ammoniacal alkaline medium.

Note: All the reagents/solutions used in the test must be free from iron:

Procedure of limit test of iron-

Steps	Test Solution	Standard Solution
01.	Dissolve 1gm of test preparation (Sodium Chloride) in 40 ml of distilled water in Nessler cylinder and label it as test solution.	Dissolve 2 ml of standard iron solution (20 ppm) in about 40 ml of distilled water in a Nessler cylinder and label it as standard solution.
02.	Add 2 ml of 20% solution of Iron free citric acid.	Add 2 ml of 20% solution of Iron free citric acid.
03.	Add 0.1 ml of Thioglycollic acid.	Add 0.1 ml of Thioglycollic acid.
04.	Make the solution alkaline with iron free ammonia solution.	Make the solution alkaline with iron free ammonia solution.
05.	Dilute up to 50 ml mark with distilled water, stir it with the help of glass rod and allow to stand for 5 minutes .	Dilute up to 50 ml mark with distilled water, stir it with the help of glass rod and allow to stand for 5 minutes.

Compare the purple colors in the two Nessler cylinders by viewing vertically downward, if the intensity of purple color in standard is more than that in test, the sample complies with limit test of iron.

Question No .06 Write note on physiological acid base balance.

Ans. Physiological acid-base balance: All body fluids have definite pH values which must be maintained within relatively narrow limits. The normal range of pH values of few selected fluids are:

Blood	7.4-7.5	Duodenal fluid	5.5- 7.5
Saliva	6.4-7.4	Gall bladder bile	5.5-7.5
Urine	4.5-8.0	Gastric juice	1.5-1.8

Disturbance in acid- base balance- The buffer, respiratory and excretory systems of the body work together to maintain the acid-base balance of the body, so that the pH range of various body fluids remain within normal but narrow limits. A primary defect in elimination of CO_2 or a metabolic disorder can lead to alteration of pH of blood beyond physiological limits and these disturbances in acid-base balance are classified accordingly.

(1) Respiratory acidosis: The H_2CO_3 content of plasma is increased due to interference with the elimination of CO_2 by lungs. This occurs mainly in conditions such as congestive heart failure, pneumonia and poisoning with barbiturates or narcotic drugs which depress the respiratory centre.

(2) Respiratory alkalosis: There is a fall of H_2CO_3 level of plasma due to hyperventilation in the lungs. This occurs mainly in fever, anoxia, salicylate poisoning and at high altitudes.

(3) Metabolic acidosis: The HCO_3^- fraction of plasma is lowered in conditions such as renal failure, diabetes mellitus and severe dehydration due to diarrhea and vomiting. Compensation to some extent in initial stages occurs by increased respiration whereby more CO_2 is eliminated to maintain the HCO_3^-/H_2CO_3 ratio.

(4) Metabolic alkalosis: An increase in the bicarbonate content of plasma due to ingestion of large volume of alkalis in the treatment of peptic ulcer and vomiting due to high intestinal obstruction are the two main causes. Compensation to some extent is attempted by a depression of respiration and an excretion of alkaline urine by kidneys.