



Important Instructions to examiners:

- 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills).
- 4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for anyequivalent figure drawn.
- 5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
- 6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
- 7) For programming language papers, credit may be given to any other program based on equivalent concept.

**MODEL ANSWER**

WINTER- 17 EXAMINATION

Subject Title: PHARMACEUTICAL CHEMISTRY-I

Subject Code: 0806

Q. No.	Sub Q.N.	Answer	Marking Scheme
1		ATTEMPT ANY <u>EIGHT</u> OF THE FOLLOWING.	16M (8X2)
1	a)	Explain the following terms. (Any 2) i) Achlorhydria- Achlorhydria is a condition in which there is absence or insufficient secretion of hydrochloric acid in stomach. The symptoms of achlorhydria vary in patients. Common symptoms of achlorhydria are mild diarrhoea, abdominal pain, sensitivity to spicy foods, loss of appetite etc. The lack of secretion of hydrochloric acid thus causes gastrointestinal disturbances. ii) Emetics- These are the agents which induce vomiting. They produce their action directly by stimulating chemoreceptor trigger zone (CTZ) or by directly irritating intestinal mucosa. iii) Astringents- In general term, astringents are the compounds that bring about mild protein precipitation. This action may be on mucosal membrane when taken internally or on skin for topical use. Astringents when applied topically cause precipitation of protein of surface cell by coagulation. The action depends upon the extent of penetration of agent and the type of chemical action resulting with protein.	1 M each
1	b)	Write the chemical incompatibilities of the following. (Any 2) i) Hypophosphorus acid- Since Hypophosphorus acid is reducing agent, it gets readily oxidised by usual oxidizing agents. Mercury, Silver, bismuth, lead salts are reduced partly to metallic state exhibiting darkening in color and partial precipitation.	1 M each

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		<p>ii) Sulphur dioxide -</p> <p>Sulphur dioxide being a reducing agent, it is in general incompatible with oxidizing agents and thiamine. Its bleaching action removes color from the preparation.</p> <p>iv) Ferrous Sulphate-</p> <p>Ferrous Sulphate is incompatible with alkali and gets oxidised in air easily in presence of arsenates and mercuric salts. It is also incompatible with phosphates, tannates and benzoates.</p>	
1	c)	<p>Give synonym for the following. (Any 2)</p> <p>i) Magnesium sulphate- Epsom Salt.</p> <p>ii) Sodium potassium tartarate- Rochelle salt, Seignette salt, Potassium sodium tartarate.</p> <p>iii) Precipitated sulphur- Milk of sulphur.</p>	1 M each
1	d)	<p>Write the molecular formula for the following. (Any 2)</p> <p>i) Sodium Metabisulphite- $\text{Na}_2\text{S}_2\text{O}_5$</p> <p>ii) Calcium Carbonate- CaCO_3</p> <p>iii) Stannous Fluoride- SnF_2</p>	1 M each
1	e)	<p>Discuss uses of the following compounds. (Any 2)</p> <p>i) Sodium Nitrite-</p> <ul style="list-style-type: none">• It is used as an antidote in cyanide poisoning.• It is used as antioxidant.• Due to its vasodilation action, it is considered effective in angina pectoris.	1 M each

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		<ul style="list-style-type: none">• It is used as food preservative. <p>ii) Sodium Acetate –</p> <ul style="list-style-type: none">• Is used as systemic alkaliniser.• It is an ingredient of peritoneal dialysis fluid.• It is used as diuretic.• Is used to prepare buffer solutions. <p>iii) Sodium Thiosulphate-</p> <ul style="list-style-type: none">• It is used as an antioxidant.• Is used in parasitic skin diseases.• Is used in controlling infection to athlete's foot.• It is effective in cyanide poisoning.• It is used extensively in photographic industry.	
1	f)	Discuss the uses of boric acid. Discuss the effect of heat on boric acid. Uses- <ul style="list-style-type: none">• Boric acid is used in preparation of buffer solution.• It is used to maintain acidic pH in various topical medications.• Boric acid is used in ointment for emollient & antiseptic action.• Boric acid solutions are used mainly as eye & mouth wash for local anti-infective action.• Since boric acid has smooth unctuous nature it is employed as an ingredient in dusting powder.	1 M each

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		<p>Effect of heat on boric acid-</p> <p>i) When heated above 100°C, it dehydrates, forming metaboric acid (HBO₂):</p> $\text{H}_3\text{BO}_3 \rightarrow \text{HBO}_2 + \text{H}_2\text{O}$ <p>ii) Boric acid melts at about 160°C, forming tetra boric acid or pyro boric acid (H₂B₄O₇):</p> $4 \text{HBO}_2 \rightarrow \text{H}_2\text{B}_4\text{O}_7 + \text{H}_2\text{O}$ <p>iii) And when heated above 160°C further dehydrates, forming boron trioxide.</p> $\text{H}_2\text{B}_4\text{O}_7 \rightarrow 2 \text{B}_2\text{O}_3 + \text{H}_2\text{O}$	
1	g)	<p>Write properties and uses of calcium hydroxide.</p> <p>Properties-</p> <ul style="list-style-type: none">• It occurs as white, soft powder.• It is odourless.• It has alkaline and slightly bitter taste.• It is slightly soluble in water, soluble in aq. solutions of glycerine and sugar.• Solubility of calcium hydroxide diminishes with increasing temp. <p>Uses-</p> <ul style="list-style-type: none">• It acts as an antacid• Used as an astringent in infantile diarrhea & vomiting in the form of lime water.• It reacts with fatty acids, forming calcium soaps which act as emulsifying agent.• It is an ingredient in some skin lotions.• Calcium hydroxide along with sodium hydroxide in a particular mixture known as Soda Lime is used for its ability to absorb CO₂ from expired air.• Its CO₂ absorbing property is useful in certain types of gas traps.	1 M each

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1	h)	<p>Explain the importance of Glycerin in the assay of boric acid.</p> <p>Glycerin is used in the assay of Boric Acid because; boric acid is a very weak acid which is to be titrated against strong alkali like sodium hydroxide, but it does not give sharp end point. So when glycerin is added, it forms glyceroboric acid complex which acts as a strong monobasic acid and is strong enough to titrate against strong solution of sodium hydroxide by using phenolphthalein as an indicator. Reactions involved in the assay of boric acid-</p> $\begin{array}{c} \text{H}_2\text{C}-\text{OH} \\ \\ \text{CH}-\text{OH} \\ \\ \text{H}_2\text{C}-\text{OH} \end{array} + \begin{array}{c} \text{HO} \\ \\ \text{HO}-\text{B} \\ \\ \text{HO} \end{array} \longrightarrow \begin{array}{c} \text{H}_2\text{C}-\text{OH} \quad \text{HO}-\text{CH}_2 \\ \quad \quad \quad \\ \text{CH}-\text{O} \quad \quad \text{O}-\text{CH} \\ \quad \quad \quad \\ \text{H}_2\text{C}-\text{O} \quad \quad \text{O}-\text{CH}_2 \end{array} + \text{H}_3\text{O}^+ + 2\text{H}_2\text{O}$ <p style="text-align: center;">Glycerol Boric acid Glyceroboric acid complex</p> $\begin{array}{c} \text{H}_2\text{C}-\text{OH} \\ \\ \text{CH}-\text{OH} \\ \\ \text{H}_2\text{C}-\text{OH} \end{array} + \text{NaOH} \longrightarrow 2 \begin{array}{c} \text{H}_2\text{C}-\text{OH} \\ \\ \text{CH}-\text{OH} \\ \\ \text{H}_2\text{C}-\text{OH} \end{array} + \text{NaBO}_2$ <p style="text-align: center;">Glycerol Glycerol Sodium Metaborate</p>	2M
1	i)	<p>Write properties, storage and handling of NaOH.</p> <p>Properties-</p> <ul style="list-style-type: none">• It occurs as white sticks, pellets, scales or masses, it is highly deliquescent powder.• It is strongly alkaline.• When exposed to air, it rapidly absorbs moisture and CO₂.• It is soluble in boiling water, alcohol, glycerin.• When it is dissolved in water, considerable heat is generated.	1 M

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		Storage and handling- It is stored in tightly closed container as it absorbs moisture and CO ₂ . It should not be touched with hands but handled with spatula.	1 M
1	j)	Classify antacids with examples. Write two properties of Aluminium hydroxide gel. Classification of antacids is as follows: A) Systemic/ Absorbable antacids- E.g. Sodium Bicarbonate B) Non systemic/ Non absorbable antacids: <ul style="list-style-type: none">Aluminium containing antacids- E.g. Aluminium Hydroxide, Aluminium Phosphate, Basic aluminium carbonateCalcium containing antacids- E.g. Calcium carbonate, Calcium PhosphateMagnesium containing antacids- E.g. Magnesium carbonate, Magnesium oxide, Magnesium hydroxide, Magnesium trisilicate C) Combination antacids- E.g. Aluminium Hydroxide and Magnesium hydroxide, Aluminium Hydroxide gel and Magnesium trisilicate. Properties of Aluminium hydroxide gel- <ul style="list-style-type: none">It is aqueous white viscous suspension of hydrated Al₂O₃ with Aluminium carbonate or bicarbonate.Its pH is 5.5 to 8.0.It contains sodium benzoate as preservative, oil of mentha or peppermint oil as flavouring agent and sucrose or sorbitol as sweetening	1 M each
1	k)	Give two Identification test for each ion- Chloride- <ul style="list-style-type: none">Dissolve in 2ml of water a quantity of the substance being examined equivalent to about 2mg of chloride ion. Acidify with dilute nitric acid & add 0.5ml of silver nitrate solution. Shake & allow to stand, a curdy white ppt. is formed, which is insoluble in nitric acid but soluble after being well washed with water, in dil. ammonia solution, which is reprecipitated by addition of dil. nitric acid.	1 M each

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		<ul style="list-style-type: none">• Take 2mg of substance in test tube add 0.2gm of potassium dichromate & 1ml of sulphuric acid. Place filter paper strip moistened with 0.1ml of diphenylcarbazide solution over the opening of the test tube, the paper turns violet red.• Chloride when heated with manganese dioxide & sulphuric acid, chlorine gas is liberated. <p>Sulphate-</p> <ul style="list-style-type: none">• Solution of sulphate with barium chloride gives a white precipitate of barium sulphate which is insoluble in dil. HCl.• Sulphate with lead acetate solution gives a white precipitate soluble in ammonium acetate solution and also in a solution of sodium hydroxide.	
1	1)	<p>Write uses and storages and labeling of Oxygen.</p> <p>Oxygen:</p> <p>Storage and labeling - Oxygen is stored and supplied in metallic cylinder under pressure and pressure gauge. The shoulder of the cylinder is painted white and the remainder is painted black. The name and symbol of oxygen O₂ is stenciled on the cylinder. It should be stored in special cool room which is free from inflammable chemicals.</p> <p>Uses –</p> <ul style="list-style-type: none">• It is used in hypoxia for artificial respiration.• It is used as inhalant for supporting respiration during anesthesia.• Therapeutically, it is used in treatment of anoxia, anemia, stagnant type anoxia, asphyxia and in histotoxic conditions.• It is used in asthma, shock and poisoning due to Carbon monoxide or barbiturates.• O₂ mixed with 5-7% CO₂ is used as respiratory stimulant.	1 M 1M
2		ATTEMPT ANY <u>FOUR</u> OF THE FOLLOWING:	12M (4x3)
2	a)	Define Antacids. Explain why combination antacid therapy is preferred over single	



<p>antacid therapy with examples.</p> <p>Definition- Antacids are the drugs or preparations which neutralize excess hydrochloric acid secreted in the stomach.</p> <p>Because no single antacid meets all the criteria for an ideal antacid several products are in the market containing mixtures of antacids. Most of these combination products are an attempt to-</p> <ul style="list-style-type: none">• Balance the constipative effect of calcium & aluminium with the laxative effect of magnesium.• Some of these products are a mixture of an antacid with rapid onset of action and one with a longer duration of action.• In another type the antacids are combined with simethicone type of compounds which has antifatulent action as they are antifoaming agents & causes dispersion of gases. <p>Some preparations are mixtures of two antacids are as follows:</p> <p>1. Aluminium hydroxide gel: Magnesium hydroxide combinations: The USP prescribes two dosage forms suspensions & tablets.</p> <p>A) Suspensions: -Alumina& magnesia oral suspension -Magnesia & alumina oral suspension</p> <p>B) Tablets: -Alumina & magnesia tablets. -Magnesia & alumina tablets.</p> <p>2. Aluminium hydroxide gel: Magnesium trisilicate combinations</p> <p>3. Calcium carbonate- containing antacid mixture</p> <p>4. Algenic acid-Sodium bicarbonate combination</p> <p>5. Simethicone-containing antacid</p> <p>6. Magaldrate</p> <p>7. Aluminium hydroxide gel-Kaolin combinations</p>	<p>1 M</p> <p>2 M</p>
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2	b)	<p>Explain Protectives and Adsorbents. Give properties and uses of Kaolin.</p> <p>Protectives and adsorbents are the chemical agents used internally in treatment of disturbances of gastrointestinal tract like diarrhea & dysentery because they are water insoluble substances and they form a protective coat on the mucosal membrane and offer mechanical protection, furthermore, they adsorb bacterial toxins which are believed to stimulate flow of electrolytes into intestine resulting in watery stools.</p> <p>Examples: Bismuth Sub carbonate, Kaolin etc.</p> <p>Note - Some protectives and adsorbents are used externally.</p> <p>Properties of Kaolin-</p> <ul style="list-style-type: none">• It occurs as a soft white or yellowish white powder, odourless and has clay like taste.• When moistened with water, assumes a darker color & develops a marked clay-like odor.• It is insoluble in water, in mineral acids and in solutions of alkali hydroxides.• Chemically, it is practically inert, since it is insoluble in all the common solvents. <p>Uses-</p> <ul style="list-style-type: none">• It is used in mixtures intended for treatment in dysentery, diarrhea and for symptomatic treatment of colitis, cholera etc.• It is employed in the treatment of food and alkaloidal poisoning as it adsorbs toxins.• It also finds use in dusting powder, cosmetic preparations and is an ingredient of Kaolin poultice.• For the internal use, it is mainly the light Kaolin which is employed.• It is used as a drying agent for moist sores and infections e.g. weeping eczema, as weeping ulcers.• It is also used as a clarifying agent.	1 M each
2	c)	<p>Name the three official compounds of Iron along with their molecular formula.</p> <p>Official compounds of Iron-</p> <p>1. Ferrous sulphate –$\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$</p>	1 M each



	<p>tissue & initiate the undesirable 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 peroxides are also formed.</p> $xH_2O \rightarrow xH + xHO$ $\begin{array}{cc} \downarrow & \downarrow \\ yH_2 & yH_2O_2 \end{array}$ <p>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.</p> <p>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.</p> <p>Gamma rays have relatively low ionizing power, even though the range & penetrating power of this type of radiation are high enough to produce significant damage in the particular tissue at distances of several meters from the source.</p>	
2	<p>f) Explain the term ‘Inhalants’. Mention uses and properties of carbon dioxide.</p> <p>Definition: Inhalants are gaseous substances directly administered by nasal or oral respiratory route for its local or systemic effect. OR Inhalants are drugs or chemicals which in vapor form are inhaled in the body.</p> <p>Properties of carbon dioxide-</p> <ul style="list-style-type: none">• It is colourless, odorless gas.• It has faintly acidic taste.• It is soluble in water.• It does not support combustion. However when Mg ribbon burns in atmosphere of CO₂ metal oxide is formed. $2Mg+CO_2 \longrightarrow 2MgO + C$ <ul style="list-style-type: none">• CO₂ when passed in water forms carbonic acid.	1 M each

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Subject Title: PHARMACEUTICAL CHEMISTRY-I

Subject Code: 0806

		$\text{H}_2\text{O} + \text{CO}_2 \longrightarrow \text{H}_2\text{CO}_3$ <p>Uses-</p> <ul style="list-style-type: none">• It is used as a respiratory stimulant.• By combining with oxygen it is used in carbon monoxide poisoning.• It is used in treatment of drug addiction.• It is used to prepare dry ice, which is used in minor surgical operation for destroying tissue.• It is widely used in beverages industry for preparation of cold drinks• It is also used to replace air in some pharmaceutical preparations.• CO₂ inhalation releases persistent hiccups.	
3		Attempt any FOUR of the following:	12M (4X3)
3	a)	Define antioxidants. Discuss properties required of an ideal antioxidant. <p>Antioxidants are the agents which prevent oxidation and deterioration when added to pharmaceutical preparations.</p> <p>Properties of an ideal antioxidant-</p> <ul style="list-style-type: none">• They should be non-toxic.• They should be physiologically & chemically inert (other than the action required to prevent oxidation of active ingredient).• They should be physiologically & chemically compatible.• They should not have solubility problem• They should be effective in very small concentration.	1 M 2 M
3	b)	Define the following terms with examples <p>i) Expectorants</p> <p>The drugs or compounds that remove sputum from the respiratory tract are known as expectorants. These drugs either increase the fluidity of sputum or increase the volume of fluids that have to be expelled from respiratory tract.</p>	1.5 M each



		<p>Eg – ammonium chloride, potassium iodide</p> <p>ii) Antidotes</p> <p>Antidotes are the agents which are used to reverse, stop or counteract the action of poisons.</p> <p>Eg – sodium nitrite, sodium thiosulphate, activated charcoal.</p>	
3	c)	<p>Explain properties, uses and storage conditions of Hydrogen peroxide.</p> <p>Physical properties:</p> <ul style="list-style-type: none">• It is colourless, odorless, transparent liquid.• It has slight astringent and acid taste.• It is miscible with water, alcohol and ether having a weakly acidic reaction. <p>Chemical properties:</p> <ul style="list-style-type: none">• It oxidizes potassium iodide to iodine and potassium bromide to bromine in acidic medium.• When black lead sulphide reacts with hydrogen peroxide, it is oxidized to white lead sulphate.• Hydrogen peroxide reduces silver oxide to metallic silver.• Hydrogen peroxide oxidizes many organic substances like hair, fibers and textiles. <p>Its dilute solution has decolorizing and bleaching actions.</p> <p>Uses-</p> <ul style="list-style-type: none">• Mild antiseptic.• Disinfectant.• Cleansing agent for cuts & wounds and for loosening ear wax.• 1.6% solution is used in deodorants, gargles & mouth washes.• Antidote in phosphorous & cyanide poisoning.• Bleaching agent. <p>Storage condition - It is stored in containers protected from light, in bottles closed with glass stoppers or plastic caps provided with a vent for the escape of oxygen. It is kept in cool place.</p>	1 M each

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3	d)	<p>Discuss the role of calcium cation in the body.</p> <p>Calcium is one of the essential element required for various functions in the body. Calcium ions are essential for</p> <ul style="list-style-type: none">• Normal functioning of nervous system• Normal cardiac function• Contraction of muscles• Formation of bones and certain tissues• Coagulation of blood <p>When there is deficiency of ionized calcium in blood, the condition is known as Hypocalcemia. It is characterized by increased neuromuscular excitability, muscle cramps and convulsions. It may be due to – nutritional deficiencies, hypoparathyroidism, advanced renal insufficiency with hyperphosphatemia and if large volumes of citrated blood are administered.</p> <p>Hypercalcemia is a condition in which high concentration of calcium ions are present in blood. It is characterized by loss of weight, bradycardia, muscular pain, arrhythmia and improper kidney function. Hypercalcemic condition can be associated with various clinical conditions –hyperparathyroidism, hyperthyroidism, milk alkali syndrome, excess of vitamin D and administration of benzothiazide diuretics.</p>	3M
3	e)	<p>Explain importance of 'Electrolyte Combination Therapy' with special reference to ORS.</p> <p>When patient is unable to take normal diet, the 'Electrolyte Combination Therapy' is used. Infusions containing glucose & normal saline are used.</p> <p>Electrolyte combination products are divided into –</p> <ol style="list-style-type: none">Fluid maintenanceElectrolyte maintenance <p>Fluid maintenance – The solutions of electrolytes are administered intravenously which provide normal requirement of water & electrolytes to the patients who cannot take food orally. All electrolyte infusions contain at least 5% glucose which helps to reduce</p>	1.5 M each



metabolites like urea, ketone bodies & phosphate usually associated with starvation. Electrolyte maintenance – When there is heavy loss of water and electrolytes e.g., in vomiting, diarrhea, prolonged fever, electrolyte combinations are used as replacement therapy. Electrolyte combinations & different concentrations are commercially available as dry powders to be dissolved in water or in the form of oral electrolyte solutions. Some important products are Sodium lactate injection IP, BP, Compound sodium chloride injection IP.

ORS is used to supply water and electrolytes in amounts needed for maintenance as soon as intake of usual foods and liquids is discontinued, and before serious fluid losses occur. They are also given to replace mild to moderate fluid losses due to excessive vomiting, diarrhoea, or prolonged fever.

The following three formulations are usually prepared when glucose is used, sodium bicarbonate is packed separately. The quantities given below are for preparing one litre solution.

Composition of ORS recommended by WHO and UNICEF.

Ingredients	Formula I	FormulaII	Formula III
Sodium chloride	1.0 gm	3.5 gm	3.5 gm
Sodium bicarbonate	1.5 gm	2.5gm	-----
Sodium Citrate	-----	-	2.9 gm
Potassium Chloride	1.5 gm	1.5 gm	1.5 gm
Anhydrous Glucose	36.4 gm	20 gm	20 gm
Or glucose	40.0gm	22.0gm	—

Formula II and III are recommended by WHO and UNICEF for control in diarrhoeal diseases.

3

f)

Discuss the properties and uses of Ammonium Chloride.

Properties of Ammonium chloride:

- It occurs as white crystalline powder.

**1.5 M
each**

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		<ul style="list-style-type: none">• It is odourless and has a cooling or saline taste.• Slightly hygroscopic, soluble in water, sparingly soluble in alcohol but freely soluble in glycerine.• It sublimes on heating.• Its aqueous solution is acidic to litmus.• It shows reactions of ammonium and chloride radicals. <p>Uses of Ammonium chloride:</p> <ul style="list-style-type: none">• Expectorant• Diuretic• Replaces chloride lost during vomiting or severe sweating.• Systemic acidifier (treatment of metabolic alkalosis)• It is also used in the treatment of urinary tract infections.	
4		Attempt any FOUR of the following	12M (4X3)
4	a)	<p>Discuss the effects of impurities present in the pharmaceuticals.</p> <ul style="list-style-type: none">• Toxic impurities- These impurities have toxic effect on body if present beyond prescribed limit. E.g.- lead or arsenic.• Impurities which are harmless- These may lower the active strength of the substance. E.g- impurities of sodium salts in potassium salts.• Impurities which affects the storage capacity of pharmaceuticals. E.g- presence of moisture beyond limit may affect the flow property of substance or decompose it.• Impurities causing technical difficulties. E.g- presence of carbonate impurity in ammonia solution.• Impurities may cause changes in odour, colour, and taste thereby making the substance unethical and unhygienic.• Impurities may cause incompatibility with other substances.• Impurities may decrease the shelf life of substances.• Impurities, even when present in traces, may show a cumulative toxic effect after a certain period.	3M

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		$\text{mEq/L} = \frac{9000}{58.5} = 153.84$ <p>As the number of sodium ions is equal to number of chloride ions, therefore concentration of each ion is equal, ie, 153.84 mEq Na⁺/ lit & 153.84 mEq Cl⁻ /</p>	
4	d)	Enlist the various units used to measure radioactivity. <ul style="list-style-type: none">• Curie- The basic unit of radioactivity is curie, symbolised as “C”.• The subunits of Curie are called as Milli curie and Micro curie.• Rad (Radiation absorbed dose)• Roentgen• Relative biological effectiveness or RBE• REM (Roentgen equivalent man).	3M
4	e)	Explain the importance of use of the following reagents:- <p>i) Thioglycolic acid in iron limit test IP. Thioglycolic acid acts as a reducing agent and reduces ferric ion impurity(if any) to ferrous ion & then acts as a complexing agent to form a purple colored ferrous thioglycolate complex by reacting with ferrous ion.</p> <p>ii) Barium chloride in sulphate limit test IP. Barium chloride reacts with sulphate in presence of dilute HCl to form barium sulphate precipitate. The turbidity of test solution is compared with the standard solution.</p> <p>iii) Mercuric chloride Paper in Arsenic limit test IP. In the Arsenic limit test IP, Arsine gas reacts with mercuric chloride paper to produce yellow stain of mercuric arsenide. The stain of test is compared with standard stain.</p>	1 M each
4	f)	Define buffers. Explain mechanism of action of buffers. <p>Definition-The solutions that resist changes in pH values upon addition of small amounts of acids and bases are called buffer solutions.</p> <p>Mechanism of action of buffers-</p> <p>Acidic buffer- Let us consider acidic buffer containing acetic acid and sodium acetate. The acetic acid is a weak electrolyte and sodium acetate a strong electrolyte. So, the dissociation of acetic acid is suppressed due to the common ion that is acetate ion. The result is that the</p>	1 M 2 M

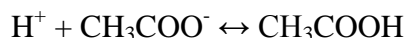
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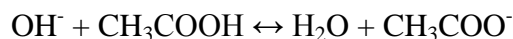
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solution contains less hydrogen ions and more sodium and acetate ions.

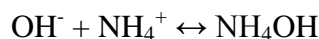
When a small quantity of acid is added, H^+ combines with CH_3COO^- and forms undissociated acetic acid.



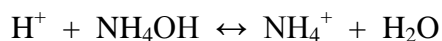
When small quantity of base is added, the OH^- are neutralized by acetic acid and the pH does not change.



Basic buffer- Ammonium hydroxide and ammonium chloride buffer- On addition of small quantity of base, OH^- combines with NH_4^+ and pH does not change.



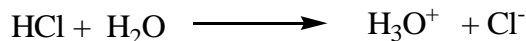
If small quantity of acid is added, NH_4OH neutralizes it.



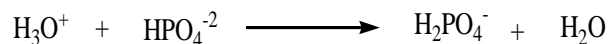
E.g. Phosphate buffer system contain

- i) $H_2PO_4^-$ - act as a weak acid
- ii) HPO_4^{2-} - act as a base

In non-buffered solution, if small amount of HCl is added, it will ionize to hydronium ion and chloride (Cl^-) resulting in remarkable lowering of pH



If small amount of HCl is added to buffered solution H_3O^+ ion will react with the base and converted in to weak acid.



Weak acid

If small amount of NaOH is added to non-buffered solution, it will ionized to hydroxide ion (OH^-) and Na^+ , hence it will increase pH of preparation.



If small amount of NaOH is added to solution containing phosphate buffer, hydroxide ion

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		will react with weak acid and converted in to weak base. $\text{OH}^- + \text{H}_2\text{PO}_4^- \longrightarrow \text{HPO}_4^{-2} + \text{H}_2\text{O}$ Weak acid	
5		Attempt any FOUR of the following	12M (4X3)
5	a)	Which salt is commonly used in Sodium Replacement Therapy? Mention various preparations containing it. Sodium chloride is used commonly in Sodium Replacement Therapy. Various preparations containing it are- <ul style="list-style-type: none">• Sodium Chloride Eye Lotion (B.P.)• Sodium Chloride Solution (B.P.)• Sodium Chloride Injection (I.P., B.P.): (Sodium chloride intravenous infusion)• Sodium Chloride Hypertonic Injection (I.P.): (Hypertonic saline)• Sodium Chloride Tablets (B.P.)• Sodium Chloride and Dextrose Injection (I.P.) (Sodium chloride and dextrose intravenous infusion)• Mannitol and Sodium Chloride Injection (U.S.P.)	1 M 2 M
5	b)	Discuss the various handling and storage conditions for Radioisotopes. Great care must be taken in handling and storage of radioactive materials. This is to protect people and personnel who handle it from harmful radiations which the radioactive material emits. Certain precautions to be taken while working with materials, detectors, in experiments, in radio assays and in handling are as follows: <ul style="list-style-type: none">• Radioactive materials should never be touched with hands but handled with the help of forceps.• Smoking, eating and drinking activities should not be carried out in laboratory where radioactive materials are stored.	3M



		<ul style="list-style-type: none">• Sufficient protective clothing must be used while handling the radioactive material.• Radioactive materials should be stored in suitable labelled container shielded by lead bricks and preferably in remote area.• Areas where radioactive materials are stored should be monitored regularly.• There should be a proper disposal of radioactive material.	
5	c)	<p>Discuss Lowry-Bronsted Theory for acid and base with examples. Explain its advantages over Arrhenius Acid-Base theory.</p> <p>According to Bronsted Lowry concept, an acid is any substance capable of donating a proton in a chemical reaction. A base is any substance capable of accepting a proton in a chemical reaction. An acid is a proton donor and a base is a proton acceptor. This theory is also called Protonic concept.</p> <p>According to this concept, Bronsted acid ionizes to produce a proton and the conjugate base of the acid. This can be shown in following half reaction:</p> $\text{HCl} \rightarrow \text{H}^+ + \text{Cl}^-$ <p>Bronsted base accepts a proton & forms conjugate acid. This is shown by:</p> $\text{OH}^- + \text{H}^+ \rightarrow \text{H}_2\text{O}$ <p>Advantages over Arrhenius theory-</p> <ol style="list-style-type: none">i) It can explain the basic character of substances like Na_2CO_3, NH_3 i.e. which do not contain OH^- group and hence were not bases according to Arrhenius concept on the basis that they accept protons.ii) This concept is not limited to molecules but also covers even the ionic species to act as acids or bases.iii) It can also explain the acid-base reactions in the non-aqueous medium.	<p>2 M</p> <p>1 M</p>



5	d)	<p>Mention the synonyms and uses of:-</p> <p>(i) Hydrochloric acid- Synonym-muriatic acid or spirits of salt, acidum hydrochloricum Uses-</p> <ul style="list-style-type: none">• Hydrochloric acid as such cannot be used as medicine.• The dilute hydrochloric acid is used as acidifying agent in the treatment of achlorhydria.• It is also used as a solvent in numerous industries.• Also used as laboratory reagent. <p>(ii) Sodium bicarbonate- Synonym- Baking Soda Uses-</p> <ul style="list-style-type: none">• It is used as an alkalizing agent to combat systemic acidosis; it is used as an electrolyte replenisher.• Used as a soluble type of antacid.• It is an ingredient of effervescent powder. <p>(iii) Zinc Sulphate- Synonym- white vitriol Uses-</p> <ul style="list-style-type: none">• Zinc sulphate solutions in 0.1 -1% is used as ophthalmic astringent, in 0.25-1.5% for topical application as astringent.• Solution of zinc sulphate is employed in protein precipitation for preparation of some vaccines.• Zinc sulphate may be used internally as an emetic.• Insoluble zinc sulphate are mainly used as protective and are used in bandages, adhesive tapes etc.	1 M each
5	e)	<p>Enlist various Iodine preparations. Explain role of Iodine in body.</p> <ul style="list-style-type: none">• Aqueous Iodine Solution -It is known as Lugol's solution.• Weak Iodine Solution	2 M

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6		Attempt any FOUR of the following	16M (4X4)
6	a)	<p>Enlist the various sources of impurities found in pharmaceutical substances. Describe any two.</p> <p>Sources of impurities in pharmaceuticals.</p> <ul style="list-style-type: none">• Raw materials used in manufacturing• Processes used in the manufacturing• Material of plant• Storage conditions• Accidental substitution or deliberate adulteration• Manufacturing hazards <p>-Raw materials used in manufacturing – Traces of impurities in raw materials may be carried to contaminate the final product. Example – NaCl prepared from the rock salt will almost certainly contain traces of Ca & Mg compounds.</p> <p>-Processes used in the manufacturing – Some impurities are incorporated during the manufacturing process. This may occur due to –</p> <ol style="list-style-type: none">Reagents used in the processReagents added to remove the other impurities.Solvents – Water is the cheapest solvent available and widely used. Tap water has chloride ions, carbonate ions, sulphate ions, calcium ions, magnesium ions and sodium ions as impurities in very small amounts.The intermediate products may come along the process in the final product as impurity. <p>-Material of the plant – The vessel used in the manufacturing process is generally made of metal like iron, copper, zinc, nickel, aluminum and steel. Due to solvent action on the plant material, the traces of material i.e. impurities come in the product. The water pipe and steam pipe may contain lead and hence Pharmacopoeias prescribe limit test for</p>	2 M 2 M for any two descrip tion

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Lead.

-Storage conditions –

- a) Filth- Stored product may become contaminated with dust, insects and insect excreta.
- b) Decomposition of the product during storage – Many chemical substances undergo changes and decomposition due to careless storage. E.g. – Ferrous Sulphate is slowly converted into insoluble ferric oxide by air and moisture.

-Accidental substitution or deliberate adulteration – Accidental substitution can take place if toxic substances are stocked with other substances or compounds. Some pharmaceutical products may be adulterated with cheaper substances. Example – Honey may be adulterated with commercial sugar, acacia powder with clay and potassium bromide with sodium bromide.

-Manufacturing Hazards – Even in well run manufacturing companies, product contamination may arise due to existence of certain hazards.

- a) Particulate contamination – accidental inclusion of dirt, glass, porcelain, metallic or plastic fragment from sieves, granulating, tableting and filling machines or even from product containers may occur.
- b) Process error – Gross errors due to incomplete mixing in liquid preparations must be detected by normal analytical procedures.
- c) Cross contamination – the handling of powders, granules and tablets in large quantity create considerable amount of airborne dust and may lead to cross contamination.
- d) Microbial contamination – liquid preparations and creams for topical application are prone to bacterial, fungal and mold contamination. Special care should be taken in parenteral and ophthalmic preparation to avoid microbial contamination.
- e) Packaging errors – products of similar appearance as tablets of same size, color and shape packed in similar containers may lead to mislabeling.



6	b)	<p>Define 'Topical Agents'. Classify them with examples.</p> <p>Definition: Topical agents are the compounds that act locally on skin or mucous membrane, their action is of different types depending upon the nature of compound and its chemical properties & they mainly act by mechanical or physical mechanism.</p> <p>Classification:</p> <ol style="list-style-type: none">1) Protectives and adsorbents: e.g. Talc, Calamine, Zinc Oxide, Titanium Dioxide, silicone polymers.2) Anti-microbial agent: They are further classified based on their mechanism of action:-<ol style="list-style-type: none">a) Acting by oxidation e.g. Hydrogen peroxide solution, potassium permanganate.b) Acting by halogenation e.g. Iodine and iodine preparation, chlorinated lime.c) Acting by protein precipitation e.g. Boric acid, Silver and Silver compounds, Mercury compounds.3) Astringent: e.g. Alum, Aluminum chloride, Zinc Sulphate, Zinc chloride4) Miscellaneous agent: e.g. Sulphur and sulphur compounds, Selenium Sulphide.	1 M 3 M
6	c)	<p>Discuss Arsenic Limit Test IP along with the apparatus used and reactions involved.</p> <p><u>Limit Test for Arsenic :</u></p> <ul style="list-style-type: none">• Arsenic is an undesirable and harmful impurity in medicinal substances, and all Pharmacopoeias prescribe a limit test for it.• The Pharmacopoeial method is based on the Gutzeit test.• When the sample is dissolved in acid, the arsenic present in the sample is converted to arsenic acid.• The arsenic acid is reduced, by reducing agents (like potassium iodide, stannated acid, etc.) to arsenious acid.• The nascent hydrogen produced during the reaction, further reduces arsenious acid to arsine (AsH_3 gas), which reacts with mercuric chloride paper, producing a yellow stain.• The intensity of the stain is proportional to the amount of arsenic present.• A standard stain produced from a definite amount of arsenic, is used for comparison	4 M

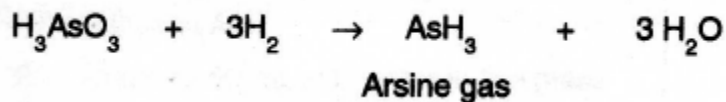
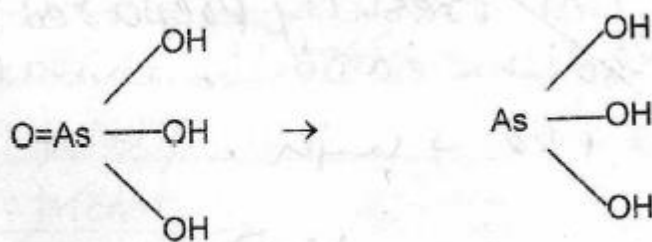
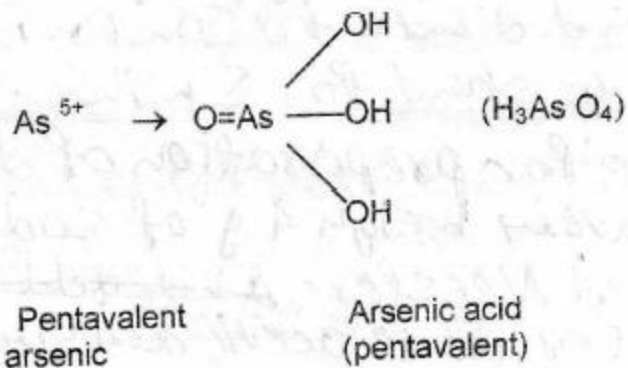
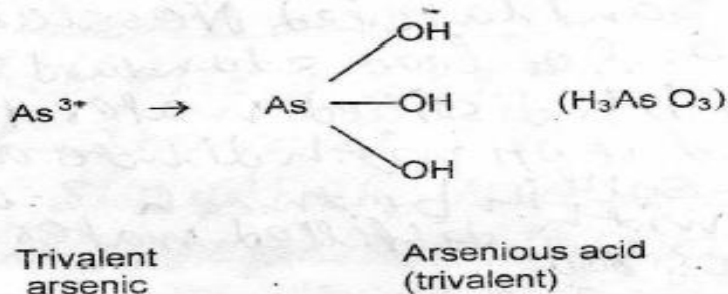
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Reactions:-



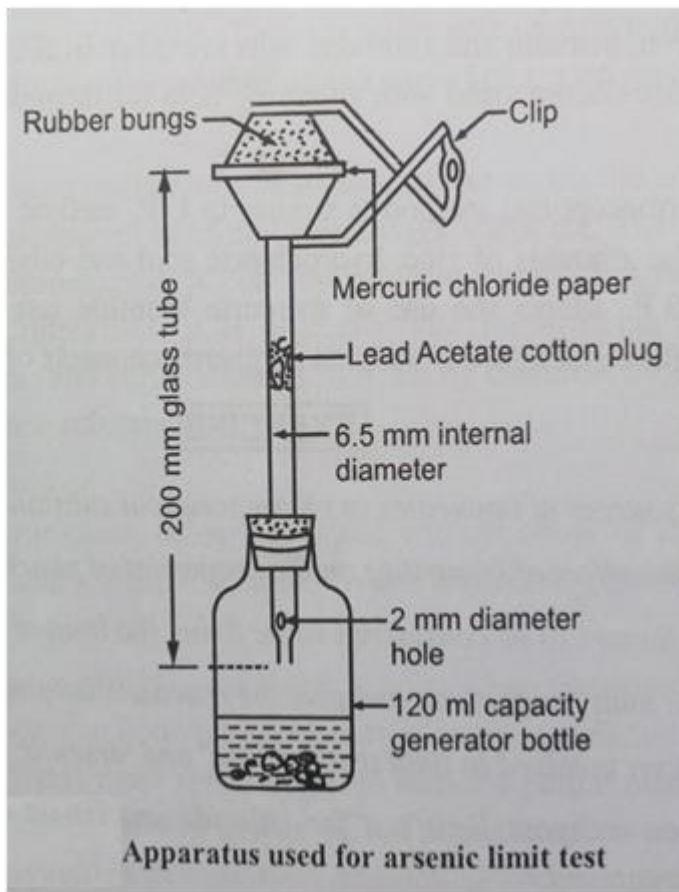
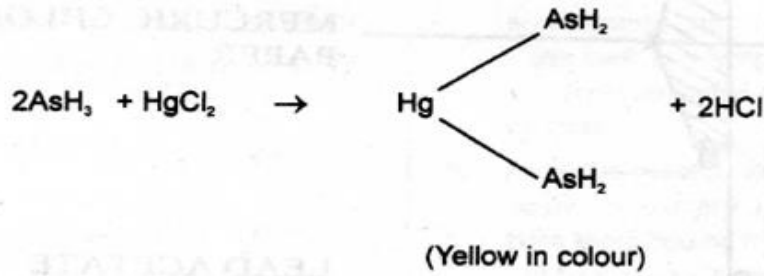


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6	<p>d) Enlist the major anions and cations found in body fluids. Explain how physiological acid-base balance is maintained.</p> <p>Major cations-</p> <p>Sodium</p> <ul style="list-style-type: none">• Potassium• Calcium• Magnesium <p>Major anions-</p> <ul style="list-style-type: none">• Chloride• Sulphate• Phosphate• Bicarbonate <p>Physiological acid-base balance-</p> <p>The acid base balance in the body is well regulated by intricate mechanism. A number of chemical reactions takes place in the cell and the reactions occurring inside is greatly influenced by pH or hydrogen ion concentration.</p> <p>Acids are being constantly produced in process of metabolism. E.g. carbonic acid, lactic acid.</p> <p>Acids or alkalis produced in the body may cause change in pH. Most of metabolic reactions occur between body pH 7.38-7.42.</p> <p>Required pH (7.38-7.42) of plasma is maintained by:</p> <p>1) Buffering system: Three major systems of buffering system occurring in the body are:</p> <ol style="list-style-type: none">a) $\text{HCO}_3^- / \text{H}_2\text{CO}_3$ found in plasma & kidneysb) $\text{HPO}_4^{2-} / \text{H}_2\text{PO}_4^-$ present in cells & kidneysc) Protein or Hb buffer system <p>2) Respiratory mechanism</p> <p>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</p>	2 M each
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		<p>depression due to narcotic drugs, CHF etc. induces respiratory acidosis This can be overcome by renal mechanism by :</p> <p>i) Increase in acid excretion by Na^+- H^+ exchange</p> <p>ii) Increase in ammonia (NH_3) formation</p> <p>iii) Increase in reabsorption of HCO_3^- (bicarbonate)</p> <p>In respiratory alkalosis, there is excess loss of CO_2 from body due to over breathing or hyperventilation as a result of emotional factors, fever, hypoxia, loss of appetite, salicylate poisoning etc. This can be overcome by renal mechanism by :</p> <p>i) Increase in bicarbonate (HCO_3^-) excretion</p> <p>ii) Decrease in ammonia (NH_3) formation</p> <p>iii) Decrease in reabsorption of HCO_3^- (bicarbonate)</p> <p>3) Renal mechanism</p> <p>The third mechanism is via elimination of some ions through urine by kidney.</p> <p>Absorption of certain ions and elimination of other ions control the acid-base balance of blood and thus of body fluids.</p>	
6	e)	<p>Classify the G.I.T. agents with examples. Discuss uses and properties of Bismuth Sulphate.</p> <p>Classification -</p> <ul style="list-style-type: none">• Acidifying agent: Dilute Hydrochloric Acid• Antacid: Aluminum Hydroxide, Aluminum Phosphate, Basic aluminum carbonate, Magnesium carbonate, Magnesium oxide, Magnesium hydroxide, Magnesium trisilicate, Calcium carbonate, Calcium Phosphate, Sodium bi-carbonate etc.• Protective and Adsorbent: Bismuth Sub carbonate, Bismuth sub nitrate, Kaolin, Milk of bismuth• Cathartics –They are further classified as-<ul style="list-style-type: none">i) Stimulant ii) Bulk purgative iii) Lubricants iv) Saline catharticsE.g. – castor oil, Methyl cellulose, liquid paraffin, mineral oil, Senna, magnesium sulphate, isabgol, etc.	2 M

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		<p>Properties of Bismuth subcarbonate -</p> <ul style="list-style-type: none">• It is available as white or pale yellowish white tasteless powder.• It is stable in air but is affected by light.• It is insoluble in alcohol and water but dissolves with effervescence in HCl or HNO₃.• When ignited, it decomposes into yellow bismuth trioxide. <p>Uses of Bismuth subcarbonate -</p> <ul style="list-style-type: none">• Bismuth sub carbonate mainly acts as antidiarrhoeal by protective-adsorbent mechanism.• Since bismuth subcarbonate is basic and water insoluble it also acts as antacid.• The small amount of solubility of bismuth cation exerts a mild astringent and antiseptic action.• It can be used as a topical protective in lotions & ointments.	<p>1 M</p> <p>1 M</p>
6	f)	<p>Explain Radio-opaque Contrast Media. Discuss Synonym, Properties and Uses of Barium Sulphate.</p> <p>Radio-opaque contrast media- are the chemical compounds which have the ability to absorb X-rays & block the passage of X-rays. Thus, they are opaque to x-ray examination, such compounds & their preparations are called as radio opaque contrast media. X-rays are electromagnetic radiation of short wavelength & thus have high penetrating power. They are capable of passing through most soft tissues since they are made of elements of low atomic no. like carbon, hydrogen, oxygen, nitrogen. The X rays darken the photographic film or photosensitive plate. The darkening is proportional to the number of X rays that pass through the patient's body. Bones & teeth containing elements like calcium & phosphorus having high atomic number are the only type of tissues which appear light on the exposed X ray film. This helps in diagnosis of fractures. X ray contrast media are used as diagnostic aids in radiology for malfunctions in the GIT.</p> <p>Synonym- Shadow meal/ Barium meal.</p> <p>Properties-</p> <ul style="list-style-type: none">• It is a fine, white, odourless, tasteless & bulky powder that is free from grittiness.• The salt is insoluble in water, organic solvents & dilute acid & alkalis.	1 M each

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	<ul style="list-style-type: none">• It is soluble in concentrated H_2SO_4 $BaSO_4 + H_2SO_4 \rightarrow Ba(HSO_4)_2$• It can be solubilized with sulphuric acid or by fusing it with alkali carbonates. Once it is converted to carbonates, it reacts with acids easily. <p>Uses-</p> <ul style="list-style-type: none">• It is used for preparation of barium sulphate compound powder & also as a contrast medium for x-rays examination of the alimentary tract. It is administered orally or in the form of enema.• Barium sulphate is ingested for use in GIT, in the form of a suspension usually with flavouring & suspending agents (200-300g orally). It is given by enema in a dose of 400 - 750 g rectally for the examination of colon.	
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