

**PART C**  
**PHARMACEUTICAL CHEMISTRY-I**  
**(Inorganic Pharmaceutical Chemistry)**  
**(Pharm-113)**



# INORGANIC PHARMACEUTICALS

## KEY FACTS

- A.** Sources of impurities and their control, limit test for iron, arsenic, lead, heavy metals, chloride and sulphate
- B.** An outline of methods of preparation, uses, sources of impurities, tests of purity and identification and special tests, if any, of the following classes of inorganic pharmaceuticals included in Indian Pharmacopoeia. (1996)
- Gases and Vapors:** Inhalants (Oxygen), Anesthetics (Nitrous oxide).
- Pharmaceutical aids and necessities:** water (purified water, water for injection and sterile water for injection), pharmaceutical acceptable glass, acids and bases (Sodium hydroxide, phosphoric acid).
- Topical Agents:** Protectives (Calamine, titanium dioxide, talc, kaolin), astringents (Zinc oxide, Zinc Sulphate) and anti-infectives (Boric Acid, Hydrogen peroxide, Iodine, Povidone Iodine, Potassium permanganate, Silver nitrate).
- Dental Products:** Dentrifices-anti-caries agents (Sodium fluoride).

## OBJECTIVE TYPE QUESTIONS

### I. Multiple Choice Questions

Each of the following questions have four alternatives. Only one of them is correct. Choose the correct answer.

- Impurities in pharmaceutical preparation may be due to following sources:
  - Raw material
  - Manufacturing process
  - Chemical instability
  - All of the above
- Oxygen requirement in the body can be classified into four major divisions.
  - Anoxic
  - Stagnant
  - Anemic
  - All of these
- Nitrous oxide is
  - analgesic
  - anaesthetic
  - both (a) and (b)
  - none of these
- Temporary hardness of water may be softened by
  - boiling
  - clarks lime process
  - deionized water
  - all of the above
- Permanent hard water may be softened by
  - addition of soluble carbonate
  - polyphosphate chelation

- (c) zeolite  
(d) all of the above
6. Sterile water for injection may be stored in  
(a) Type 1 (b) Type 2  
(c) Both (a) and (b)  
(d) Type 3
7. Water attack test can be applied for  
(a) berosilicate glass  
(b) treated sodalime glass  
(c) soda lime glass  
(d) general purpose soda lime glass
8. In Bronsted-Lowry concept acid is  
(a) proton donor  
(b) electron donor  
(c) proton acceptor  
(d) electron acceptor
9. HSAB categorizes acids and bases according to properties of  
(a) size (b) charge  
(c) polarizability (d) all of these
10. Hard bases have  
(a) high electropositive  
(b) low electronegative  
(c) both the above  
(d) none of the above
11. Example of strong acid is  
(a)  $\text{Ca}^{2+}$  (b)  $\text{Hg}^+$   
(c)  $\text{I}^+$  (d)  $\text{Cu}^+$
12. Pharmaceutical buffer system could be categorizes into  
(a) 1 (b) 2  
(c) 3 (d) none of these
13. Topical agent depending upon their action or used divided into  
(a) protective (b) antimicroliol  
(c) astringent (d) all of these
14. ZnO is used as  
(a) protective (b) astringent  
(c) both (a) & (b) (d) antidote
15. Inorganic antimicrobial agent can be divided into  
(a) oxidation  
(b) halogenation  
(c) protein precipitate  
(d) all of the above
16. Compounds capable of function as antimicrobial agent through oxidative mechanism are  
(a)  $\text{H}_2\text{O}_2$  (b) halogen  
(c)  $\text{KMnO}_4$  (d) all of these
17. Halogenation mechanism occurring with antiseptic are  
(a) hypohalite (b) sulphhydryl  
(c) halogens (c) none
18. Hydrogen peroxide is used as  
(a) antiseptic  
(b) acidifying agent  
(c) protective  
(d) antioxidant
19.  $\text{KMnO}_4$  solutions are used for  
(a) antibacterial  
(b) antifungal  
(c) both the above  
(d) none of these
20.  $\text{AgNO}_3$  is categorizes into  
(a) oxidative antimicrobial agent  
(b) halogenated antimicrobial agent  
(c) protein ppt. antimicrobial agent  
(d) all of the above
21. Fluoride inhibits caries formation via  
(a) ↓ acid solubility of enamel  
(b) bacterial inhibition  
(c) both the above  
(d) ↑ acid solubility of enamel

22. Hydroxyapatite is mixture  $\text{Ca}^{2+}$  salt of  
 (a)  $\text{CO}_3^-$  (b)  $\text{PO}_4^-$   
 (c) OH (d) all of these

## II. Fill in the Blanks

Fill in the blanks to make the following statements complete and correct:

23. Limit test are *qualitative* ..... test designed to identify and control small quantities of impurities.
24. Limit test for chloride has been based open Rx b/w..... and ..... to obtain silver chloride.
25. Limit test for sulphate has been based upon the ppt of sulphate with ..... in the presence of ..... .
26. In limit test for sulphate to prevent the supersaturation of  $\text{BaSO}_4$  a small amount of .....has been added in the reagent.
27. In limit test for chloride ..... prevent production of opalescence due to presence of  $\text{Ag}_2\text{CO}_3$ ,  $\text{CO}_2$ .
28. Limit test for iron is based upon reaction of Fe with ..... in of a solution buffered with ammonium citrate.
29. Limit test for iron purple color is due to formation of ..... .
30. In limit test for iron ..... prevent the precipitate of iron as  $\text{Fe}(\text{OH})_3\text{NH}_3$  solution.
31. In limit test for iron Ferrous thioglycolate has stable pink to reddish purple colour in ..... medium.
32. Limit test for Pb has been based upon Rxn b/w ..... and ..... to form complex.
33. The structure of dithiazone ..... .
34. The limit test for Arsenic is based upon ..... test.
35. In limit test for Arsenic ..... is converted into Arsenous acid/Arsinegas.
36. Arsine gas is carried and comes into contact with ..... in produces a yellow or brown stain.
37. In limit test for Arsenic, temp. should be maintained ..... .
38. The function of granulated Zn in limit test for Arsenic is ..... .
39. In limit test for heavy metals ..... A is used for clear colorless/turbid colored solution.
40. The use of oxygen at increase pressure is know as ..... .
41. The laughing gas is known ..... .
42. Which inorganic gas used as anesthetic ..... .
43. A mix. of oxygen and nitrous oxide 50 : 50 can safely be used for relief of pain in ..... .
44. When sterility is necessary in ..... or deionized water is used.
45. Glass may be considered as ..... .
46. According to HSAB hard acids are ..... .
47. When orthophosphoric acid is heated to 200 °C to from ..... .
48. Phosphoric acid as a solvent in preparation of ..... .
49. In borate buffer system Feldman's pH ranges is ..... .
50. In borate buffer system Atkins and Pantin pH ..... .
51. Giffords pH range is ..... .
52. Protective are substance which may be applied to ..... .
53. Protective are ..... and ..... .
54. Protective and adsorbent substance are available for use internally for ..... .
55. Talc is hydrated ..... .
56. Talc has low adsorptive properties so it is a useful is ..... .
57. Due to non-adsorptive character of talc it is used as ..... .

58. Calamine has Chemical formula ..... .
59. Phenolated calamine lotion used as ..... .
60. Titanium dioxide also known as ..... .
61. Kaolin is ..... .
62.  $ZnSO_4$  is externally ..... and ophthalmic ..... .
63. An astringent is a drug which causes all shrivel by ..... from their surfaces.
64. Protein precipitate involve the interaction of protein with metallic ion have ..... .
65.  $KMnO_4$  can be used as an ..... .
66.  $KMnO_4$  is ..... Reducing agent.
67. Povidone-Iodine is a member of class of compound referred to as ..... .
68. Povidone iodine is ..... .
69. 0.5% aq. solution of  $AgNO_3$  is used in ..... .
70. 1% solution of  $AgNO_3$  solution is used in ..... .
71. Dentrifices are the compounds that are used for ..... .
72. The cleaning action of dentifrices depends on their ..... .
73. In limit test the change in ..... is compared with fixed standard in the Pharmacopieas.
74. If the test solution color, turbidity or opalescence is less than the standard solution it ..... the limit test.
75. The main sources of ..... impurities are sulphuric acid and lead apparatus.
76. The standard and test solution used for limit test are prepared in ..... .
77. The principle of the limit test for chlorides test involves the reaction of ..... from the ppt. of silver chloride, *i.e.*, insoluble in ..... .
78. The limit test for sulphates is performed on the reaction between ..... and ..... in the presence of dilute HCl to form the ppt. of ..... .
79. .... are a broad range of drugs in the form of gases aerosols or solvents.
80. CO poisoning gas gangrene and decompression sickness are treated by using ..... .
81. Oxygen toxicity usually begins to occur at partial pressure more than ..... the normal sea level.
82. .... are the drug that brings about a reversible loss of consciousness.
83. General anesthesia are either given as ..... and ..... .
84. Traditionally Nitrous Oxide is made by thermal decomposition of ..... temperature between ..... .
85. WFI stands for ..... .
86. .... are bacterial endotoxins, they causes elevation in temperature when reaches the blood circulation.
87. Glass is mainly composed of ..... .
88. According Bronsted and Lowry an acid is a substance which ..... in solution while base ..... in solution.
89. Phosphoric acid also known as ..... acid, has the chemical formula ..... .
90. Protective agents are those, which are applied to skin to protect certain areas from ..... .
91. Calamine is a topical ..... and has a mild ..... action on the skin.
92. Titanium dioxide is prepared commercially by treating the mineral ..... .
93. Talc is a mineral composed of ..... with the chemical formula ..... .
94. When Talc is heated to red heat (850 – 1000°C, it loses water and the natural mineral ..... is formed.

95. Commercially ..... is prepared by heating metallic Zinc to bright redness in the presence of preheated air (French Process).
96. .... include antiseptic, germicide and disinfectant agent as well as sterilization process.
97. The chemical formula for Borax is .....
98. Diluted Hydrogen Peroxide (3% and 12%) is used to bleach human hair when mixed with Ammonia, and is called as .....
99. .... gives rise to Hypothyroidism, symptoms of which are extreme fatigue, goiter.
100. Potassium permanganate is manufactured on a large scale by heating ..... in the presence of air or an oxidizing agent, such as .....
101. The Silver protein solutions are ..... in properties due to the presence of low concentration of ionized silver.
102. To prevent dental caries toothpaste containing ..... should be used.
103. In USP or I.P water for injection is stored at temperature below ..... or ..... above .....

### III. True/False Statements

Write (T) for True and (F) for False statement.

104. Purified water is used for parenteral.
105. Water for injection purified by distillation.

## ANSWERS

### I. Multiple Choice Questions

1. (d)
2. (d)
3. (c)
4. (d)
5. (d)
6. (c)
7. treated sodalime glass
8. proton donor
9. (d)
10. high electropositive
11.  $\text{Ca}^{2+}$
12. 2
13. (d)
14. (c)
15. (d)
16. (d)
17. Hypohalite
18. Antiseptic
19. (c)

20. protein ppt.

21. (c)

22. (d)

### II. Fill in the Blanks

23. Quantitative
24.  $\text{AgNO}_3$  soluble chloride
25.  $\text{BaCl}_2$  and HCl
26. Alcohol
27.  $\text{HNO}_3$
28. Thioglycolic
29. Ferrous mercaptoacetate
30. Citric acid
31. Alkaline
32. Pb and dithione
33. structure
34. Guizet test
35. Arsine
36. Mercuric chloride
37. 40 degree

38. slow and prolonged evolution of Nascent  $H_2$  gas
39. Clean and colourless
40. Hypertonic
41.  $N_2O$
42.  $N_2O$
43. Child birth
44. Distilled
45. Sodium silicate
46. Electron acceptor
47. Pyrophoric acid
48. Anileridine injection
49. pH 7–8.2
50. 7.6
51. 6–7.8
52. Skin
53. insoluble and inert
54. Git irritation
55. Magnesium silicate
56. Lubricating, protective dusting powder
57. Filter Aid
58.  $ZnO \cdot xFe_2O_3$
59. Local anesthetic
60. Pigment white
61. Hydrated aluminium silicate
62. Antiseptic, astringent
63. Precipitate proteins
64. large charge/radius
65. The common oxidation states of manganese are +2, +3, +4, +6 and +7. Manganese compound such as permanganic acid in oxidation state +7 are powerful oxidizing agent when reduced to +2 and to +4 (in alkaline solution). Permanganic acid finds application as a antiseptic and a disinfectant. Permanganic acid ( $HMnO_4$ ) is an unstable, existing only in aqueous solution and its salts called permanganates which has a deep purple color in aqueous solution. Usually manganate(VII) compounds are deep purple—colored and  $Mn^{+2}$  compounds are pink colored. Permanganates have the  $MnO_4^-$  anion and used as strong oxidizing agents. Sodium permanganate ( $MnNaO_4$ ) and potassium permanganate ( $MnKO_4$ ) are the sodium and potassium salt of permanganic acid respectively. Permanganate salts have bactericidal, fungicidal, astringent, and oxidizing properties. They are used as disinfectant in solution as a topical anti-infective. It is also used as an antidote for certain poisons (phosphorus). They are used as deodorizers and to treat some parasitic diseases of fish, and used in treatment of drinking water.
66. Strong oxidizing agent
67. Iodophors
68. poly vinyl pyrrolidone
69. third degree burn
70. ophthalmic solutions
71. cleaning teeth and gums
72. abrasive
73. colour, turbidity
74. passes, fail
75. lead
76. nessler cylinder
77. silver nitrate with soluble chlorides, dilute nitric acid
78. barium chloride, soluble sulphate,  $BaSO_4$
79. inhalants, lungs
80. oxygen
81. 50 kilopascal or 2.5 times more
82. anaesthetic
83. inhalational anaesthetics, injections anaesthetics
84. ammonium nitrate, 170–260 °C

85. water for injection
86. pyrogens
87. silicates
88. proton donor, proton acceptor
89. orthophosphoric acid,  $\text{H}_3\text{PO}_4$
90. Irritation and itching
91. protectant, astringent
92. iliminite with hydrogen chloride
93. hydrated magnesium silicate,  
 $\text{H}_2\text{Mg}_3(\text{SiO}_3)_4$
94. enstatite
95. zinc oxide
96. antimicrobial
97.  $\text{Na}_2\text{B}_4\text{O}_7$
98. peroxide blonde
99. iodine deficiency
100. potassium hydroxide with manganese dioxide, potassium nitrate
101. antibacterial
102. sodium fluoride
103. 4 degree celsius or above 37 degree celsius

### III. True/False

104. False
105. True



## GASTROINTESTINAL AGENTS

## CONTENTS

Acidifying agents (Dilute Hydrochloric acid), antacids (Bismuth subcarbonate, Aluminium hydroxide, Calcium carbonate, Magnesium hydroxide, Magnesium oxide {light and heavy}, Magnesium carbonate {light and heavy}, Magnesium trisilicate, cathartics (disodium hydrogen phosphate, Magnesium

sulphate and other Magnesium compounds), protective and adsorbents (Activated Charcoal, Light Kaolin, Aluminium sulphate). **Miscellaneous Agents:** Expectorants (Ammonium chloride, Potassium Iodide), antioxidants (Sodium metabisulphite).

## OBJECTIVE TYPE QUESTIONS

## I. Multiple Choice Questions

Each of the following questions have four alternatives. Only one of them is correct. Choose the correct answer.

- Inorganic agent used to treat GIT agent
  - products for altering gastric pH
  - productives for instinal inflammation
  - adsorbents for intestinal toxins.
  - all of the above
- The goal of antacid therapy.
  - ↓ Concentration of acid in gastric juice
  - Gastic pH 3.5 and 7
  - ↑ Concentration of acid
  - Both (a) and (b)
- Symptoms of *achlohydria*.
  - Mild diarrhoea
  - Frequent bowel movement

- Epigastric pain
  - All of the above
- Side effect of antacid therapy.
    - Acid rebound
    - Systemic allealopsis
    - Na content of antacid
    - All of the above
  - Al(OH)<sub>3</sub> gel is used in
    - dentrifices
    - radioactivite agent
    - raptic ulcan
    - all of the above
  - Calcium contaning antacid differ from aluminium containing antacid
    - depend upon their basic property
    - do not have any amphoteric effect
    - do not cause systemic alkalosis
    - all of the above

7. Side effect of Ca containing antacid.
- (a) Renal failure
  - (b) Mille alkali syndromes
  - (c) Hyperphosphatemia
  - (d) All of the above
8. Stimulant laxative act by
- (a) local irritation of intestinal trad
  - (b)  $\uparrow$  bulk stimulating peristalsis
  - (c)  $\downarrow$  omatic load
  - (d) all of the above
9. Expectorant are used in treatment of respiratory tract by
- (a)  $\uparrow$  viscosity of bronchial sec
  - (b)  $\downarrow$  viscosity of bronchial sec
  - (c)  $\uparrow$  amount of refractory tract fluid a demulcent action is extract
  - (d) both (b) and (c)
10. Ammonium chloride is used as
- (a) expectorant
  - (b) diuretic
  - (c) systemic acidifier
  - (d) all of the above
11. The acid neutralizing capacity of an antacid plane at least
- (a) 5 meq. of HCl per dosage unit
  - (b) 7 meq. of HCl per dosage unit
  - (c) 8 meq. of HCl per dosage unit
  - (d) 10 meq. of HCl per dosage unit
12. Simethicone is
- (a) antacid
  - (b) defoaming agents
  - (c) astringents
  - (d) none of the above
13. Dried aluminium hydroxide gel contains
- (a) hydrated aluminium oxide
  - (b) small quantities of basic aluminium n carbonate and bicarbonate
  - (c) both (a) and (b)
  - (d) none of the above
14. Cathartics are the drugs used to
- (a) relieve acidity
  - (b) relieve constipation
  - (c) reduce gastrointestinal irritations
  - (d) all of the above
15. Which of the following is an example of inorganic saline expectorant?
- (a) Ammonium chloride
  - (b) Potassium iodide
  - (c) Antimony potassium tartarate
  - (d) All of the above
16. The antioxidants action of sodium metabisulphite is due to
- (a) release of sodium ions
  - (b) release of  $\text{SO}_2$
  - (c) release of  $\text{O}_2$
  - (d) all of the above
17. Antacid acts by
- (a) decreasing the volume of HCl in stomach
  - (b) neutralizing the gastric HCl contents
  - (c) through H/K ATPase pump
  - (d) all of the above
18. What should be ideal property for an antacid prepration?
- (a) It should not be absorbable
  - (b) Not causes systemic alkalosis
  - (c) Should buffer in the pH range 4–6
  - (d) All of the above
19. Antiflatulents are generally included in antacid formulation. They act by
- (a) reducing the surface tension of bubbles in the stomach
  - (b) avoid absorption of antacid
  - (c) prevent the formation of HCl
  - (d) all of the above

- 20.** Saline cathartics should not be given to  
 (a) patients with cardiovascular disorders  
 (b) patients with history of convulsions  
 (c) patients with low sodium diet  
 (d) patients with muscular disorders
- 21.** Excess use of magnesium sulphate leads to  
 (a) hypermagnesaemia  
 (b) gastrointestinal irritations  
 (c) watery diarrhoea  
 (d) all of the above
- 22.** Combination of antacid are prepared because  
 (a) to attain synergistic effect  
 (b) to enhance antacid effect  
 (c) an attempt to balance the constipative effect of calcium and aluminium with the laxative effect of magnesium  
 (d) all of the above
- 23.** The major side effect associated with saline cathartics is  
 (a) excessive loss of body fluids in form of watery stools  
 (b) convulsions  
 (c) cardiac disorder  
 (d) constipation
- 24.** Burnett syndrome is associated with the prolonged uses of  
 (a) calcium containing antacids  
 (b) magnesium containing antacid  
 (c) aluminium containing antacid  
 (d) all of the above
- 25.** Achlorhydria is the ..... of HCl.
- 26.** Magnesium trisilicate has composition .....
- 27.** ..... and ..... of GIT is commonly used for treatment of mild diarrhoea.
- 28.** Heavy  $MgCO_3$  differ from light  $MgCO_3$ , by .....
- 29.** The antacid properties of  $MgCO_3$  are due to ..... and ..... anion reacting with gastric HCl.
- 30.** Acute diarrhoea can be caused by .....
- 31.** The adsorbent proactive adsorb ..... along providing ..... coating of internal mucosa.
- 32.** Example of adsorbent and protective are .....
- 33.** Bismuth subnitrate is used as .....
- 34.** Cathartic are agents .....
- 35.** Laxative are mild .....
- 36.** Kaolin is .....
- 37.** The type of laxative are .....
- 38.** Example of stimulant laxative .....
- 39.** Example of Bulk forming laxative .....
- 40.** Mineral oil is ..... laxative.
- 41.**  $MgSO_4$  is used orally as ..... and ..... parent rally .....
- 42.** Disodium hydrogen phosphate act as ..... due to .....
- 43.** Kaolin is used as .....
- 44.** Expectorant are drug used in treatment of .....
- 45.** Gastric acid is produced by ..... in the stomach. The pH of gastric acid is ..... in the human stomach.
- 46.** The Gastric HCl promoted formation of ....., a protiolitic enzyme, soften fibrous food and destroy the bacteria in ingested food materials.

## II. Fill in the Blanks

*Fill in the blanks to make the following statements complete and correct:*

- 25.** Achlorhydria is the ..... of HCl.

47. Magnesium hydroxide can be precipitated by the metathesis reaction between Magnesium salt and .....
48. .... prepared by precipitation from solution of Magnesium Sulphate and Sodium Silicate.
49. The molecular formula of Disodium Hydrogen phosphate is .....
50. Aluminium Sulphate may be made by dissolving .....
51. The molecular formula for Kaolin is .....
52. An expectorant ..... bronchial secretions and nucleolytics help ..... thick bronchial secretion.
53. Aluminium Chloride is prepared commercially by reacting ..... with .....
54. The substances, which inhibit oxidation of free radicals are called as .....
55. Sodium Meta-bisulphite is used as an ..... in oral, parenteral, and topical pharmaceutical formulation ..... at concentrations of ..... W/V.
56. The chief indication for administering an antacid is ..... excess HCl.
57. Antacid are ..... used to neutralise gastric HCl.

### III. True/False Statements

Write (T) for True and (F) for False statement.

58. Systemic antacid is soluble, readily absorbed.
59. Non-systemic antacid do not exert any systemic effect.
60.  $\text{NaHCO}_3$  is systemic antacid.
61. Aluminium containing antacid has constipating effect.
62. Ca containing antacid tend to be constipating and usually found in combination with Magnesium antacid.
63. Saline cathartic act by increasing the osmotic load of GIT.
64. Saline cathartics are water soluble.
65.  $\text{Al}(\text{OH})_3$  is systemic Aluminium hydroxide or non-systemic antacid.
66. What do you mean by expectorants?

## ANSWERS

### I. Multiple Choice Questions

1. (d)                      2. (d)  
 3. (d)                      4. (d)  
 5. (d)                      6. (d)  
 7. (d)  
 8. Local irritation of intestinal tract  
 9. (d)  
 10. (d)  
 11. at least 5 meq of HCl per dosage unit  
 12. antacid                13. (c)  
 14. relieve constipation  
 15. (d)                      16. release of  $\text{SO}_2$   
 17. neutralizing the gastric HCl content

18. (d)  
 19. reducing the surface tension of bubbles in the stomach  
 20. patients with low sodium diet  
 21. (d)  
 22. an attempt to balance the constipative effect of calcium and aluminium with the Laxative effect of magnesium  
 23. excessive loss of body fluid in the form of watery stools  
 24. calcium containing antacids

### II. Fill in the Blanks

25. Absence

26. MgO and SiO<sub>2</sub>
27. Protective, adsorbants
28. Dentrifices
29. CO<sub>3</sub><sup>-2</sup>, OH
30. Bacterial toxin, chemical poison, drugs, allergy diseases
31. Toxins, protectives
32. Bisalts, Clays, charcoal
33. Adsorbants, X-ray shielding
34. That quickens and increases evacuation of bowel
35. Cathartic
36. Native hydrated aluminium silicate
37. (i) stimulant, (ii) bulk forming, (iii) emollient, (iv) saline
38. Phenophthalein, bisacodyl, castoroil, oxyphenisatin
39. Methyl cellulose, isabgol, karageenen
40. Lubricant or emollient
41. Cathartic, anticonvulsant
42. Cathartic, poor absorption of HPO<sub>4</sub>
43. Adsorbants
44. Cough
45. Parietal cell, 2-3
46. Pepsin
47. Sodium, potassium or ammonium hydroxide
48. Magnesium trisilicate
49. Na<sub>2</sub>HPO<sub>4</sub>·12H<sub>2</sub>O
50. Aluminium hydroxide in sulphuric acid
51. Al<sub>2</sub>Si<sub>2</sub>O<sub>5</sub>(OH)<sub>4</sub>
52. Increase, loosen

53. Ammonia, hydrogen chloride
54. Antioxidants
55. Na<sub>2</sub>S<sub>2</sub>O<sub>5</sub>
56. Neutralize
57. Alkaline bases

### III. True/False

- |  |       |       |
|--|-------|-------|
| 58. T  | 59. T | 60. T |
| 61. T  | 62. T | 63. T |
| 64. T  |       |       |
| 65. Nonsystemic  |       |       |
| 66. A mucolytic agent or expectorant is any agent which dissolves thick <i>mucus</i> and is usually used to help relieve respiratory difficulties. It does so by hydrolyzing glycosaminoglycans, tending to break down/lower the viscosity of mucin—containing body secretions/components. The viscosity of mucous secretions in the <i>lungs</i> is dependent upon the concentrations of mucoprotein, the presence of disulfide bonds between these macromolecules and <i>DNA</i> . An expectorant (from the Latin <i>expectorare</i> , to expel from the chest) is a medication that helps bring up mucus and other material from the lungs, <i>bronchi</i> , and <i>trachea</i> . An example of an expectorant is <i>guaifenesin</i> which promotes drainage of mucus from the lungs by thinning the mucus and lubricating the irritated respiratory tract. Sometimes the term 'expectorant' is incorrectly extended to any cough medicine. |       |       |



# MAJOR INTRA- AND EXTRA-CELLULAR ELECTROLYTES

## KEY FACTS

Physiological ions, Electrolytes used for replacement therapy, acid-base balance and combination therapy (Calcium chloride, Calcium gluconate, Calcium lactate, Calcium levulinate, Sodium dihydrogen phosphate,

sodium acetate, sodium bicarbonate, sodium chloride, potassium chloride, magnesium chloride). Cationic and anionic components of inorganic drugs useful for systemic effects.

## OBJECTIVE TYPE QUESTIONS

### I. Multiple Choice Questions

Each of the following questions have four alternatives. Only one of them is correct. Choose the correct answer.

- Hypochloremia can be caused by
  - salt losing nephritis
  - metabolic acidosis
  - both (a) and (b)
  - metabolic alkalosis
- Condition causing hyponatremia
  - extreme unne loss
  - metabolic acidosis
  - addison disease
  - all the above
- KCl is indicated in treatment of
  - menieres syndrome
  - antidote in digitals intoxication
  - myastheniagravis
  - all of the above
- Potassium therapy is contraindicated in patient
  - impaired renal fxn
  - acute dehychation
  - myotonia* congenital
  - all of the above
- In physiological acid-base imbalance K excretion will be decreased
  - the amount of Na reaching distal tubule is low
  - the proton secretion by kidney tubule is increased
  - both (a) and (b)
  - none of the above
- When total K is high there is passage of proton from cells into extracellular fluid causing
  - intracellular alkalosis
  - intracellular acidosis

- (c) extracellular acidosis  
(d) both (a) and (b)
- 7.** When total body K is low the intracellular fluid is acidic due to passage of protons into K depleted cell resulting in  
(a) intracellular acidosis  
(b) extracellular alkalosis  
(c) both (a) and (b)  
(d) intracellular alkalosis
- 8.** In metabolic acidosis  
(a)  $\text{HCO}_3$  excess  
(b)  $\text{CO}_2$  decreased  
(c)  $\text{HCO}_3$  deficit  
(d) all of the above
- 9.** Condition occur in metabolic acidosis is  
(a) diabetic acidosis  
(b) renal failure  
(c) diarrhoea  
(d) all the above
- 10.** When metabolic acidosis is acute, the treatment is  
(a)  $\text{NaHCO}_3$       (b)  $\text{NaCl}$   
(c)  $\text{KCl}$       (d)  $\text{CaCl}_2$
- 11.** In metabolic alkalosis  
(a) increase  $\text{HCO}_3$   
(b) loss of  $\text{H}^+$   
(c) both (a) and (b)  
(d) decrease  $\text{HCO}_3$
- 12.** Acute metabolic alkalosis may be corrected by  
(a)  $\text{KCl}$       (b)  $\text{NaHCO}_3$   
(c)  $\text{NaCl}$       (d)  $\text{CaCl}_2$
- 13.** In metabolic acidosis, renal function has  
(a) increase acid excretion by  $\text{NaH}$  exchange  
(b) increase  $\text{NH}_3$  formation  
(c)  $\text{HCO}_3$  reabsorption  
(d) all of the above
- 14.** The advantage of sodium lactate over sodium bicarbonate  
(a) rapidly metabolized  
(b) it may be sterilized by boiling  
(c) both of the above  
(d) none of the above
- 15.** Replacement therapy is needed  
(a) heavy loss of water  
(b) prolonged fever  
(c) diarrhoea  
(d) all of the above
- 16.** ORS has composition  
(a)  $\text{NaCl}$       (b)  $\text{KCl}$   
(c) sodium citrate  
(d) sodium bicarbonate  
(e) glucose  
(i) a, b, c, d      (ii) a, b, d, e  
(iii) a, b, c, e      (iv) b, c, d, e
- 17.** Calcium gluconate is prepared by  
(a) lactic acid and  $\text{CaCO}_3$   
(b) oxalic acid and  $\text{CaCO}_3$   
(c) gluconic acid and  $\text{CaCO}_3$   
(d) gluconic acid and  $\text{Ca(OH)}_2$
- 18.** The category of calcium gluconate is  
(a) antacid  
(b) calcium replenished  
(c) antioxidant  
(d) radiopharmaceuticals
- 19.** The category of sodium dihydrogen phosphate dehydrate is  
(a) antacid  
(b) calcium replenisher  
(c) urinary acidifier  
(d) respiratory stimulant
- 20.** Sodium acetate is used as  
(a) urinary acidifier  
(b) calcium replenisher  
(c) for peritoneal dialysis fluids  
(d) antioxidant

21. Which one of the followings is used as systemic alkalizer?  
 (a) Sodium chloride  
 (b) Sodium bicarbonate  
 (c) Sodium sulphate  
 (d) Sodium acetate
22. If there is excessive excretion of  $\text{CO}_2$  which of the following condition develop  
 (a) alkalosis (b) acidosis  
 (c) both (d) none
23. Calcium levulinate is used as calcium replenisher, chemically it is  
 (a) calcium-2-oxo pentanoate dehydrate  
 (b) calcium-3-oxo pentanoate dehydrate  
 (c) calcium-4-oxo pentanoate dehydrate  
 (d) calcium-5-oxo pentanoate dehydrate
24. Sodium chloride is used for  
 (a) pharmaceutical aid  
 (b) toxicity agents  
 (c) fluid and electrolyte replenisher  
 (d) all of the above
25. The category of magnesium chloride is  
 (a) urinary alkaliser  
 (b) magnesium replenisher  
 (c) constituent of peritoneal dialysis solution  
 (d) both (b) and (c)
26. The maintenance of constant environment in various cells, tissue and body fluids physically as well as chemically is known as  
 (a) electrolyte balance  
 (b) homeostasis  
 (c) hemostasis  
 (d) none of the above
27. Clinical manifestation associated with potassium is  
 (a) hypertension  
 (b) acidosis  
 (c) renal damage  
 (d) both (a) and (b)
28. The principle function of chloride is  
 (a) maintenance of proper hydration  
 (b) maintenance of osmotic pressure  
 (c) normal electrolytic balance  
 (d) all of the above
29. Calcium is essential for  
 (a) blood pontification to whaler bone  
 (b) blood clotting  
 (c) all of the above

## II. Fill in the Blanks

Fill in the blanks to make the following statements complete and correct:

30. .... and ..... are found in plasma and interstitial fluid.
31. .... are found in intracellular fluid.
32. Hypopotassemia causes change in .....
33. Calcium absorbed from .....
34. Calcium absorption and distribution are under a complex hormonal central ..... and .....
35. Hypocalcaemia can be caused by .....
36. Ioniar salt solution should be .....
37. Basic objective of replacement therapy is .....
38. Calcium chloride is used as .....
39. Calcium gluconate is considered by many to be treated of choice for .....
40. Major buffer systems in body ..... found in plasma and kidney.
41. Sodium acetate is useful in patients suffering from ..... and .....
42. The ICF constitute ..... % of body weight, while ECF constitute ..... % of body weight.

43. Electrolytic solution can be given by ..... and ..... .
44. .... is the principle anion of ICF.
45. ORT stands for ..... .
46. ORS stands for ..... .
47. Home made ORS constitutes of ..... .
48. .... NaCl while ..... dextrose solution are isotonic with blood plasma.
49. The concentration of electrolytes is expressed in ..... .
50. Extracellular fluid includes ..... .
- 51. Match the Following:**
- |                 |                                     |
|-----------------|-------------------------------------|
| (a) ICF         | (1) Due to concentration difference |
| (b) Anion Gap   | (2) K Mg and $PO_4$                 |
| (c) Sodium ions | (3) Inside the cell                 |
| (d) K ion       | (4) Outside the cell                |
- 52. Match the Following:**
- |                 |                         |
|-----------------|-------------------------|
| (a) Cu          | (1) Cation anion gap    |
| (b) Iodine      | (2) Utilization of Iron |
| (c) Chlorine    | (3) Thyroid Gland       |
| (d) Bicarbonate | (4) ECF                 |
| (e) KCl         | (5) Water               |
| (f) NaCl        | (6) Carnallite          |
53. Which element is essential component of many of enzymes involving phosphate metabolism and ATP.
54. *Hypotonic or Hypertonic* solution are administered for maintenance therapy when patient are suffering from dehydration.

## ANSWERS

### I. Multiple Choice Questions

- |                                       |         |
|---------------------------------------|---------|
| 1. (c)                                | 2. (d)  |
| 3. (d)                                | 4. (d)  |
| 5. (c)                                | 6. (d)  |
| 7. (c)                                |         |
| 8. $HCO_3$ – deficit                  | 9. (d)  |
| 10. $NaHCO_3$                         | 11. (c) |
| 12. NaCl                              | 13. (d) |
| 14. both (a) and (b)                  | 15. (d) |
| 16. (a), (b), (c), (e)                |         |
| 17. glyconic acid and $CaCO_3$        |         |
| 18. calcium replenisher               |         |
| 19. urinary acidifier                 |         |
| 20. for peritoneal dialysis fluids    |         |
| 21. Sodium bicarbonate                |         |
| 22. acidosis                          |         |
| 23. calcium-2-oxopentanoate dehydrate |         |
| 24. (d)                               | 25. (d) |

- |                 |                    |
|-----------------|--------------------|
| 26. homeostasis | 27. (d)            |
| 28. (d)         | 29. blood clotting |

### II. Fill in the Blanks

30. Na, Cl
31. K, Mg,  $PO_4$ .
32. Myocardial, flaccid muscle
33. upper part of small intestine
34. Paratharmone and calcitonin
35. Hypothyroidism, cushing syndrome
36. 0.9% w/v
37. to restore the volume and composition of body fluid
38. Electrolyte replenisher
39. Hypocalcemia
40. Bicarbonate/carbonic acid
41. Metabolic Acidosis and acute cholera
42. 40, 20

- 43. oral, iv
- 44. phosphate
- 45. oral rehydration therapy
- 46. oral rehydration salt
- 47. one teaspoonful of salt, eight teaspoonful of sugar in 1 litre of water
- 48. 0.9, 5.4

- 49. milliequivalents per litre
- 50. Intestinal and vascular fluid

**Match the Following:**

- 51. (a) 2, (b) 1, (c) 4, (d) 3
- 52. (a) 2, (b) 3, (c) 1, (d) 4, (e) 6, (f) 5
- 53. Mg
- 54. Hypotonic



## Unit IV

# ESSENTIAL AND TRACE ELEMENTS

### KEY FACTS

**Essential and Trace Elements:** Transition elements and their compounds of pharmaceutical importance. Iron and haematinics (Ferrous fumarate, Ferrous gluconate, Ferrous sulphate, Ferric ammonium citrate), mineral supplements

(Cu, Zn, Cr, Mn, Sb, S, I).

**Coordination compounds and complexation:** Study of such compounds used in therapy including poison antidotes (Calcium folinate, Sodium thiosulphate).

### OBJECTIVE TYPE QUESTIONS

#### I. Multiple Choice Questions

*Each of the following questions have four alternatives. Only one of them is correct. Choose the correct answer.*

1. Essential element called essential

- (a) It must occur in all healthy tissue
- (b) Facilitate a great many essential life process
- (c) It must cause reproducible life processes
- (d) All of the above

2. Anaemia can be caused by

- (a) excessive blood loss.
- (b) excessive blood formation.
- (c) both (a) and (b)
- (d) none of the above

3. Copper has role in

- (a) Hb formation
- (b) ATP production by reformation

(c) formation of fibres elastic

(d) all of the above

4. Cu deficiency can lead to

- (a) Leucopenia
- (b) Ganulocytopenia
- (c) Anemia
- (d) All of the above

5. In Wilson disease a condition of excess storage of

- (a) Fe
- (b) Zn
- (c) Cu
- (d) I

6.  $\text{CuSO}_4$  is essential component of

- (a) Fehling solution
- (b) Benedict solution
- (c) Tolland reagent
- (d) Both (a) and (b)

7. Zinc deficiency is associated

- (a) Impaired growth
- (b) Parakeratosis

- (c) Retired sexual motivation  
(d) All of the above
8. Iodine has been used therapeutically as  
(a) ameliorating agent in hyperthyroidism  
(b) fibrocystic agent in syphilis  
(c) expectorant  
(d) all of the above
9. Sulfur has been used therapeutically  
(a) cathartic action  
(b) simulate in allopathic  
(c) fumigation  
(d) all of the above
10. The mechanism of antidotal action  
(a) by counteracting the effect of person  
(b) by changing chemical nature of poison  
(c) by preventing absorption of poison into the body.  
(d) all of the above
11. Sodium nitrite is classified as  
(a) chemical antidote  
(b) physiological antidote  
(c) mechanical antidote  
(d) all the above
12. Anemic is general term for a condition in which ..... are deficient in number.
13. Orally administered..... is treatment of choice for iron deficiency.
14. Ferrous gluconate which contains ..... iron.
15. Parenteral administration of iron is indicated in .....
16. Ferrous gluconate is used as .....
17. .... is also a component of tyrosines.
18. .... is only transition metal blero the first series that is known to be essential in living system.
19. Manganese containing protein called .....
20. .... found in photosynthetic apparatus chloroplast.
21. .... toxicity can lead to symptoms like parleinscns disease.
22. Iodine is essential constituent of ..... hormone.
23. Antidote is an agent that counteract .....
24. Sodium nitrate which concert  $H_6$  into .....to bind cyanide.
25. .... produced as a byproduct of Solvey process.
26. Chemical formulae of calcium gluconate is .....
27. .... is a cardioprotective agent in Hyperkalemia.
28. Chemical formulae of calcium levulinate is .....
29. Two official compounds of calcium is .....
30. .... is the major source of industrial chloride.
31. .... is occasionally known as 'Muriate of Potash'.
32. The transition elements are characterized by ..... M.P and they are ..... compounds.
33. Substances which increases the quantity of Blood Corpuscles and Haemoglobin in the body are called as .....
34. The molecular formulae of ferrous fumerate is .....
35. .... is prepared by double decomposition of barium gluconate and ferrous sulphate.

## II. Fill in the Blanks:

Fill in the blanks to make the following statements complete and correct:

12. Anemic is general term for a condition in which ..... are deficient in number.
13. Orally administered..... is treatment of choice for iron deficiency.
14. Ferrous gluconate which contains ..... iron.
15. Parenteral administration of iron is indicated in .....
16. Ferrous gluconate is used as .....
17. .... is also a component of tyrosines.
18. .... is only transition metal blero the first series that is known to be essential in living system.
19. Manganese containing protein called .....
20. .... found in photosynthetic apparatus chloroplast.
21. .... toxicity can lead to symptoms like parleinscns disease.
22. Iodine is essential constituent of ..... hormone.
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28. Chemical formulae of calcium levulinate is .....
29. Two official compounds of calcium is .....
30. .... is the major source of industrial chloride.
31. .... is occasionally known as 'Muriate of Potash'.
32. The transition elements are characterized by ..... M.P and they are ..... compounds.
33. Substances which increases the quantity of Blood Corpuscles and Haemoglobin in the body are called as .....
34. The molecular formulae of ferrous fumerate is .....
35. .... is prepared by double decomposition of barium gluconate and ferrous sulphate.

36. .... is an Ore of  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$  and is ..... in colour.
37. On Heating  $\text{FeSO}_4$  it decomposes to ....., ..... and .....
38. The Vital important micronutrient needed by body are called as .....
39. Copper is required for the formation of .....
40. Both ..... and ..... are required for the normal and adequate formation of RBC's.
41. .... is needed for the healthy immune system.
42. GTF stands for .....
43. Goitre is caused by the deficiency of .....
44. .... is an essential nutrient required for the normal sugar and Fat metabolism and works primarily by potentiating the action of Insulin.
45. .... helps the body to utilize Vitamin C, B1, Biotin as well as Choline.
46. .... is used to detoxify the body, boost the ..... which help fight the effects of Ageing.
47. .... is used in the production of hormones (such as thyroxin). produced by the .....
48. A ..... is the product of a Lewis acid-base reaction in which neutral molecules or Anions (Called Ligands) bonds to a central metal atom (or ion) by coordinate covalent bonds.
49. Initial management of all poisoning includes ensuring adequate cardiopulmonary function and providing treatment of any system such as .....
50. .... is the treatment of choice to prevent absorption of Poison.
51. .... also known as stomach pump, is the insertion of tube into the stomach, followed by administration of water or saline down the tube.
52. An ..... is a substance which can counteract a form of poisoning.
53. Cyanide has a special affinity for the Ferric ions that occur in ....., the terminal oxidative respiratory enzyme found in .....
54. The Major route of Detoxification of cyanide in the body is conversion to ..... and this is achieved with the help of ..... (divalent sulfur bonded to another sulfur) and is catalyzed by .....
55. Injectable thiosulphate should be stored in ampoules between .....
56. Haemoproteins are iron containing protein responsible for .....

### III. True/False Statements:

Write (T) for True and (F) for False statement.

57. Iron found in body is associated with two types of protein.
58. Ferritin and Hemosiderin are iron storage protein found in liver, spleen and bone marrow.
59. Ferritin is water insoluble crystalline iron protein.
60. Ferritin is made from apoferritin and micelles of colloidal ferric hydroxide phosphate complex.
61. Hemosiderin is water insoluble and considered as dehydrated ferritin.
62. Iron dextran injection is a complex of ferricoxy hydrochloride with partially hydrolyzed dextral.
63. Ferrous fumarate has useful attributes is its resistance to oxidation on exposure to air.
64. Ferrous gluconate has more bioavailability than ferrous fumarate.
65. Cupric sulphate is an antidote for phosphorus poisoning.
66.  $\text{ZnSO}_4$  is used for wound healing.
67.  $\text{ZnSO}_4$  is official as a topical astringent.

68. Molybdenum and  $\text{FeSO}_4$  both are used as hematinic preparation.
69. Lack of iodine in diet results in an enlargement of thyroid gland.
70. The size of thyroid gland is inversely proportional to iodine content of gland
71. Which element is biochemically associated with certain metalloenzymes.
- (1) Paracetamol (a) N-acetyl cysteine  
 (2) Cyanide (b) Sodium Nitrite and sodium thio-sulphate  
 (3) Beta blockers (c) Calcium gluconate and Glucagon  
 (4) Opioids (d) Nalaxone

**72. Match the Following**

Poison / Drug      Antidote

<b>ANSWERS</b>
----------------

**I. Multiple Choice Questions**

1. (d)      2. both      3. (d)  
 4. (d)      5. Cu      6. (d)  
 7. (d)      8. (d)      9. (d)  
 10. (d)      11. Physiological antidote

**II. Fill in the Blanks**

12. RBC  
 13.  $\text{FeSO}_4$   
 14. 12%  
 15. Emergency surgery  
 16. Haematinic  
 17. Copper  
 18. Molybednum  
 19. Lectins  
 20. Manganese  
 21. Mn  
 22. Thyroid  
 23. Poison  
 24. Methmoglobin  
 25. Calcium chloride  
 26.  $\text{CaC}_{12}\text{H}_{22}\text{O}_{14}$ ,  $\text{H}_2\text{O}$   
 27. Calcium gluconate  
 28.  $(\text{CH}_2\text{COCH}_2\text{COO})_2 \text{Ca}_2 + 2\text{H}_2\text{O}$   
 29. Calcium Carbonate tablet. I.P, U.S.P, B.P. and Calcium chloride Injection I.P,  
 U.S.P, B.P.
30. Sodium Chloride  
 31. KCl  
 32. Increase  
 33. Haematinics  
 34.  $\text{C}_2\text{H}_4\text{FeO}_4$   
 35. Ferrous Gluconate  
 36. Malenterite, Blue  
 37. Ferric Oxide,  $\text{SO}_2$ ,  $\text{SO}_3$   
 38. Trace  
 39. Haemoglobin  
 40. Cu, Fe  
 41. Zn  
 42. Glucose tolerance factor  
 43. Iodine  
 44. Cromium  
 45. Manganese  
 46. Sulphur, Immune system  
 47. Iodine, Thyroid gland  
 48. coordination complex  
 49. seizures and shock and pain  
 50. activated charcoal  
 51. gastric lavage  
 52. antidote  
 53. cytochrome oxidase, mitochondria

54. thiocyanate, sulphane sulphur, sulphur transferase

55. 15 and 30 degree centigrade

56. Respiration

### III. True/False

57. T

58. T

59. F

60. T

61. T

62. T

63. T

66. T

68. T

69. Iodine

70. True

71. Zn

72. 1. (a), 2. (b), 3. (c), 4. (d)

64. T

67. T

65. T



# INORGANIC RADIO PHARMACEUTICAL

## KEY FACTS

Nuclear radio pharmaceuticals, nomenclature, methods of obtaining, standards and units of activity, measurement of activity, clinical application and dosage, hazards and precautions.

## OBJECTIVE TYPE QUESTIONS

### I. Multiple Choice Questions

Each of the following questions have four alternatives. Only one of them is correct. Choose the correct answer.

- Measurement of radioactivity by
  - those depend on collection of ions.
  - those depend on collection of photon.
  - both of the above
  - none of the above
- Measurement of radioactivity is termed as
  - radiation
  - radiation dosimetry
  - both (a) and (b)
  - none of the above
- The use of sodium rose Bengal (I-131) in
  - study of K ion exchange
  - liver scan
  - plasma volume determination
  - brain scanning
- The radiation is measured in terms of
  - curie
  - microcurie
  - millicurie
  - all of these
- In a radiation change a nucleus usually losses just one particle of  $\alpha$  and  $\beta$ , it is frequently accompanied by
  - X-ray
  - gamma ray
  - both of the above
  - none of the above
- Which of the following is not a type of gas filled detector?
  - Proportional counter
  - G.M counter
  - Semiconductor detector
  - Ionization chamber
- 1 Roentgen is equivalent to
  - $2.58 \times 10^{-5} \text{ CKg}^{-1}$
  - $2.58 \times 10^{-3} \text{ CKg}^{-1}$
  - $2.58 \times 10^{-8} \text{ CKg}^{-1}$
  - $2.58 \times 10^{-4} \text{ CKg}^{-1}$

8. Beta particles penetrate tissue up to  
(a) 100 cm (b) 1000 cm  
(c) 1 cm (d) 10 cm
9. 1 Becquerel is equivalent to  
(a)  $2.7 \times 10^{-11}$  curie  
(b)  $2.7 \times 10^{-10}$  curie  
(c)  $2.7 \times 10^{-8}$  curie  
(d)  $2.7 \times 10^{-5}$  curie
10. 1 rad is equivalent to  
(a)  $10^{-3} \text{ JKg}^{-1}$  (b)  $10^{-5} \text{ JKg}^{-1}$   
(c)  $10^{-2} \text{ JKg}^{-1}$  (d)  $10^{-8} \text{ JKg}^{-1}$
11. Gamma rays are electromagnetic radiations with a wave length  
(a) much larger than those of light  
(b) much shorter than those of light  
(c) equal to light  
(d) none of the above
12. Each radionuclide is characterized by an invariable half-life expressed in units of time and by the nature and energy of its radiation the energy is expressed in  
(a) electron volt  
(b) kilo electron volt  
(c) mega electron volt  
(d) all of the above
13. The effect of radioactive particles passing through biological tissue depends upon  
(a) the ability of the radiation to penetrate tissue  
(b) the energy of radiation  
(c) the dose rate of the radiation  
(d) all of the above
14. Calcium 47 is supplied as calcium chloride in the form of an injection. It is used as  
(a) in the diagnosis of pernicious anaemia  
(b) as a urinary and faecal marker  
(c) for pancreatic scintigraphy  
(d) none of the above
15. Chromium 51 is supplied as sodium chromate solution or injection it is used for  
(a) to label rbc  
(b) diagnosis of various infections  
(c) cisternography  
(d) ventriculography
16. Gold-198 used in the treatment of  
(a) pernicious anaemia  
(b) rheumatoid arthritis  
(c) detection of tumours  
(d) thyroid functioning
17. I-125 is used as  
(a) thyroid functioning  
(b) to detect and estimate drugs hormones in the body fluid  
(c) both (a) and (b)  
(d) none of the above
18. Which statement is correct regarding the handling and storage of radioactive materials?  
(a) Radioactive materials never be touched with hand  
(b) Sufficient protective clothing must be used while handling the materials  
(c) Kept in suitable labeled container  
(d) All of the above

## II. Fill in the Blanks

Fill in the blanks to make the following statements complete and correct:

19. Radioactivity was first noticed by .....
20. The nature of radiations emitted by radioactive elements was investigated by .....

21.  $\alpha$  Rays are now known as .....
22.  $\beta$  Radiation are .....
23.  $\gamma$  Rays have ..... Mass ..... change.
24. The unit of radioactivity called .....
25. 1 curie..... D.P.S.
26. Half-life of any radioactivity substance .....
27. Half-life is depend only on .....
28. Radiofrequency media are chemical compound containing element of ..... high/low atomic no.
29. Geiger muller counter is efficient for.....
30. An atom having same number of protons but different number of neutrons are called as .....
31. The amount of radiation used in radiation therapy is measured in .....
32. A dose of 1 rad means .....
33. A dose of 1 gray means .....
34. What are Isobars?
35. What are Isotones?
36. Explain in short the working of Gieger-Muller counter.
37. Write short note on ionizing radiation unit.
38. Write short note on radioactive contamination.
39. Write Short note on radioactive hazards.

## ANSWERS

### I. Multiple Choice Questions

1. (c)
2. both (a) and (b)
3. liver scan
4. (d)
5. (c)
6. G.M. Counter
7.  $2.58 \times 10^{-4} \text{ C kg}^{-1}$
8. 1 cm
9.  $2.7 \times 10^{-11}$  curie
10.  $10^{-2} \text{ J kg}^{-1}$
11. much shorter than those of light
12. (d)
13. (d)
14. as a urinary and feacal marker
15. to label rbc
16. rheumatoid arthritis
17. (c)
18. (d)

### II. Fill in the Blanks

19. Bacequerel
20. Rutherford
21. Helium ions
22. Fast moving electrons
23. No mass, no charge
24. Curie
25.  $3.7 \times 10^{10}$  per second
26. 0.693/Lambda
27. Disintegration constant
28. as
29. Beta rays
30. Isotopes (**Isotopes** are different types of atoms (**nuclides**) of the same **chemical element**, each having a different number of **neutrons**. Correspondingly, isotopes differ in **mass number** but not in **atomic number**.<sup>[1]</sup> The difference in the number of nucleons comes from a difference how many **neutrons** are in the **atomic**

**nucleus.** The number of **protons** (the **atomic number**) is the same because that is what characterizes a chemical element. For example, **carbon-12**, **carbon-13** and **carbon-14** are three isotopes of the element carbon with mass numbers 12, 13 and 14, respectively. The **atomic number** of carbon is 6, so the **neutron numbers** in these isotopes of carbon are therefore  $12 - 6 = 6$ ,  $13 - 6 = 7$ , and  $14 - 6 = 8$ , respectively.)

- 31.** The amount of radiation used in radiation therapy is measured in gray (Gy), and varies depending on the type and stage of cancer being treated. For curative cases, the typical dose for a solid epithelial tumor ranges from 60 to 80 Gy, while lymphomas are treated with 20 to 40 Gy.
- 32.** A dose of 1 **rad** means the absorption of 100 **ergs** of radiation energy per gram of absorbing material
- 33.** SI units: A dose of 1 **gray** means the absorption of 1 **joule** of radiation energy per kilogram of absorbing material  
conversion:  
1 Gy = 100 rad  
1 rad = 0.01 Gy  
1 roentgen (R) = 258 microcoulomb/kg  
( $\mu\text{C}/\text{kg}$ )  
1 millicoulomb/kg mC/kg  
= 3876 milliroentgen (mR)
- 34.** Isobars are elements, which are chemically different but physically the same. So, isobars are atoms of different elements having the same atomic mass but different atomic number. Since their number of electrons is different, their chemical properties are different. The light nuclei have unstable isobars. Heavy nuclei have stable isobars and these occur in pairs. Suppose the number of protons of one isobar matches

with that of another they are called as mirror-nuclides of each other.

- 35.** Two **nuclides** are isotones if they have the same **neutron number** N. For example, Boron-12 and Carbon-13 both have 7 **neutrons**; S-36, Cl-37, Ar-38, K-39, Ca-40, these nuclei contain 20 neutrons each, etc. Isotones have a different number of protons.
- 36.** Geiger counters are used to detect ionizing radiation (usually **beta particles** and **gamma rays**, but certain models can detect **alpha particles**). An inert gas-filled tube (usually **helium**, **neon** or **argon** with **halogens** are **added at low pressure**) briefly conducts electricity when a **particle or photon** of radiation makes the gas conductive. The tube amplifies this conduction by a **cascade** effect and outputs a current pulse, which is then often displayed by a needle or lamp and/or audible **clicks**. Modern instruments can report radioactivity over several orders of magnitude.
- 37.** Ionizing radiation units are standards for measuring ionizing radiation, including units for measuring the activity of radioactive sources, and for quantifying the amount of radiation striking other objects, particularly people. The current SI units replace older conventional ones.  
Conventional unit: 1 curie = 37 billion disintegrations per second.  
SI unit:  
1 becquerel = 1 disintegration per second conversions  
1 curie (Ci) = 37 gigabecquerel (GBq)  
1 gigabecquerel (GBq) = 27 millicurie (mCi)
- 38.** Radioactive contamination is typically the result of a spill or accident during the production or use of **radionuclides**

(radioisotopes), an unstable nucleus which has excessive energy. Contamination may occur from radioactive gases, liquids or particles. For example, if a radionuclide used in **nuclear medicine** is accidentally spilled, the material could be spread by people as they walk around. Radioactive contamination may also be an inevitable result of certain processes, such as the release of radioactive **xenon in nuclear fuel reprocessing**. In cases that radioactive material cannot be contained, it may be diluted to safe concentrations.

- 39.** The hazards to people and the environment from radioactive contamination depend on the nature of the radioactive contaminant, the level of contamination, and the extent of the spread of contamination. Low levels of radioactive contamination pose little risk, but can still be detected by radiation instrumentation. In the case

of low-level contamination by isotopes with a short half-life, the best course of action may be to simply allow the material to naturally **decay**. Longer-lived isotopes should be cleaned up and properly disposed of, because even a very low level of radiation can be life-threatening when in long exposure to it.

#### **High level contamination**

High levels of contamination may pose major risks to people and the environment. People can be exposed to potentially lethal radiation levels, both externally and internally, from the spread of contamination following an **accident** (or a **deliberate initiation**) involving large quantities of radioactive material. The **biological effects of external exposure** to radioactive contamination are generally the same as those from an external radiation source not involving radioactive materials, such as **X-ray** machines, and are dependent on the **absorbed dose**.

