16 Chemistry in Everyday Life

LESSON AT A GLANCE

- **Drug:** A drug is a chemical agent which affects human metabolism and provides cure from ailment.
- **Drugs as target molecules:** Drugs usually interact with biological macromolecules such as carbohydrates, proteins, lipids and nucleic acids. These are called target molecules.
- **Food additives:** Preservatives, sweetening agents, flavours, antioxidants, edible colours and nutritional supplements are added to the food to make it attractive/ palatable and add nutritive value.
- **Detergents:** A cleansing agent classified into three types:
  (*i*) Anionic detergent
  (*ii*) Cationic detergent
  (*iii*) Non-ionic detergent.
  Each category has its specific use.
- **Medicines:** Chemical substances used for diagnosis, prevention and treatment of diseases are called medicines.
- **Chemotherapy:** The branch of chemistry which deals with the treatment of diseases using suitable chemicals is known as chemotherapy.

TEXTBOOK QUESTIONS SOLVED

16.1 *Why do we need to classify drugs in different ways?*

Ans. Drugs are classified in different ways because each type of grouping helps in a particular way. For example, classification on the basis of pharmacological activity is useful for doctors because it provides them the whole range of drugs available for a particular disease. Similarly, classification on the basis of chemical structure helps in the

synthesis of new drugs which are more effective and less toxic.

16.2 *Explain the term, target molecules or drug targets as used in medicinal chemistry.*

Ans. Biomolecules such as carbohydrates, lipids, proteins and nucleic acids are called drug targets or target molecules because drugs usually interact with these molecules.

16.3 *Name the macromolecules that are chosen as drug targets.*

Ans. Macromolecules, that are chosen as drug targets are proteins, carbohydrates, lipids and nucleic acids.

16.4 *Why should not medicines be taken without consulting doctors?*

Ans. Medicines should not be taken without consulting doctors because many drugs might cause some side effects. Secondly, the proper dose of a drug is also important which is decided by the doctor on the basis of the age and weight of the patient.

16.5 *Define the term chemotherapy.*

Ans. The process of treatment of any disease using some chemicals is known as chemotherapy.

16.6 *Which forces are involved in holding the drugs to the active site of enzymes?*

Ans. The forces involved in holding a drug to the active site of enzyme are hydrogen bonding, ionic bonding, dipole-dipole interactions and van der Waals' interactions.

16.7 *While antacids and antiallergic drugs interfere with the function of histamines, why do these not interfere with the function of each other?*

Ans. Antacids and antiallergic drugs do not interfere with the functions of each other because they work on different receptors.

16.8 *Low level of noradrenaline is the cause of depression. What type of drugs are needed to cure this problem? Name two drugs.*

Ans. Antidepressant drugs are required to cure the problem of depression. These drugs inhibit the enzyme which catalyse the degradation of noradrenaline. Two examples of this category of drugs are iproniazid and phenelzine.

16.9 *What is meant by the term 'Broad spectrum antibiotics'? Explain.*

Ans. An antibiotic which is effective in inhibiting the growth of several types of micro-organisms is called a broad-spectrum antibiotic.

16.10 *How do antiseptics differ from disinfectants? Give one example of each.*

Ans. Chemical substances which prevent the growth of micro-organisms and are not harmful to human beings are called antiseptics. They can be applied on living tissues. An example of commonly used antiseptic is bithional.

Disinfectants are chemical substances which also kill micro-organisms but are not safe for living tissues. They are applied to objects like utensils, clothes, drainage, etc. Cresols and hydrogen peroxides are commonly used disinfectants.

16.11 *Why are cimetidine and ranitidine better antacids than sodium hydrogencarbonate or magnesium or aluminium hydroxide?*

Ans. Compounds like sodium hydrogencarbonate, magnesium hydroxide or aluminium hydroxide neutralise the HCl in stomach and control the symptoms only. Whereas drugs like cimetidine and ranitidine prevent the interaction of histamine with the receptors in the stomach wall which results in the release of lesser amount of HCl.

16.12 *Name a substance which can be used as an antiseptic as well as disinfectant.*

Ans. Phenol acts as an antiseptic as 0.2% solution and as disinfectant as 1% solution.

16.13 *What are the main constituents of dettol?*

Ans. Dettol contains a mixture of chloroxylenol and α-terpineol in ethanol as solvent.

16.14 *What is tincture of iodine? What is its use?*

Ans. A solution of iodine in alcohol (2–3% w/v) is called tincture of iodine. It is used as an antiseptic.

16.15 *What are food preservatives?*

Ans. Food preservatives are the substances used to prevent spoilage of food due to microbial growth during storage. Salt, sugar and oils also act as food preservatives and have been used for many years.

16.16 *Why is use of aspartame limited to cold foods and drinks?*

Ans. Aspartame is used in cold foods and drinks because it decomposes on heating.

16.17 *What are artificial sweetening agents? Give two examples.*

Ans. Artificial sweeteners are the chemical substances which are used to create the sweet taste in food items in place of cane sugar. Most commonly used sweeteners are saccharin and aspartame.

16.18 *Name the sweetening agent used in the preparation of sweets for a diabetic patient.*

Ans. Saccharin and sucralose are generally used in preparation of sweets for diabetic patients.

16.19 *What problem arises in using alitame as artificial sweetener?*

Ans. Alitame is a high potency sweetener and it becomes difficult to control the sweetness of the food to which it is added.

16.20 *How are synthetic detergents better than soaps?*

Ans. Synthetic detergents are preferred over soaps due to the following reasons:

(*i*) They can be used in hard water.

(*ii*) They can be used in acidic medium.

(*iii*) They have a stronger cleansing power than soap.

16.21 *Explain the following terms with suitable examples:*

(*i*) *anionic detergents and*

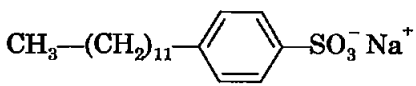
(*ii*) *cationic detergents*

(*iii*) *non-ionic detergents.*

Ans. (*i*) **Anionic detergents.** These are so called because a large part of their molecules are anions. These are of two types:

(*a*) *Sodium alkyl sulphates.* For example, sodium lauryl sulphate, $C_{11}H_{23}CH_2OSO_3Na$.

(*b*) *Sodium alkylbenzenesulphonates.* The most widely used domestic detergent in sodium in 4-(1-dodecyl) benzenesulphonate (SDS).



Sodium 4-(1-dodecyl) benzenesulphonate

(*ii*) **Cationic detergents.** These are quaternary ammonium salts. For example, cetyltrimethylammonium chloride.

$$\left[CH_3(CH_2)_{15}\overset{+}{N}(CH_3)_3\right] Cl^-$$

Cetyltrimethylammonium chloride

(*iii*) **Neutral or Non-ionic detergents.** These are esters of high molecular mass alcohols with fatty acids. For example, polyethylene glycol stearate.

$$CH_3(CH_2)_{16}COO(CH_2CH_2O)_n\ CH_2CH_2OH$$

Polyethylene glycol stearate

16.22 *What are biodegradable and non-biodegradable detergents? Give one example of each.*

Ans. Detergents which are degraded by bacterial decay in nature are known as biodegradable detergents and which are not degraded by bacterial attack are called non-biodegradable detergents. It has been observed that detergents having branched hydrocarbon side chain are non-biodegradable. Example of biodegradable detergents is sodium lauryl sulphate and an example of non-biodegradable detergents is sodium 4-(1,3,5,7-tetramethyloctyl) benzenesulphonate.

16.23 *Why do soaps not work in hard water?*

Ans. Hardness of water is due to the presence of calcium and magnesium ions. These ions form insoluble calcium and magnesium salts of soaps and separate as scum. So soaps cannot be used in hard water.

16.24 *Can you use soaps and synthetic detergents to check the hardness of water?*

Ans. Soaps can be used to check the hardness of water. An insoluble mass separates when soap is mixed with hard water. Synthetic detergents cannot be used for this purpose.

16.25 *Explain the cleansing action of soaps.*

Ans. Soaps contain chemical substances which concentrate at the surface of the solution or interfaces, from surface films, reduce surface tension of the solution and help in removing dirt and dust by emulsifying grease are called surface

active agents or surfactants. The molecule of surfactants contains two characteristic groups of which one is water soluble (hydrophilic part) and other is oil soluble (hydrophobic part).

16.26 *If water contains dissolved calcium hydrogen-carbonate, out of soaps and synthetic detergents, which one will you use for cleaning clothes?*

Ans. Synthetic detergent will be used for cleaning clothes if water contains dissolved calcium hydrogencarbonate.

Soap cannot be used because it will form the scum on reaction with calcium ions.

16.27 *Label the hydrophilic and hydrophobic parts in the following compounds:*

(i) $CH_3(CH_2)_{10}CH_2OSO_3^-Na^+$

(ii) $CH_3(CH_2)_{15}N^+(CH_3)_3Br^-$

(iii) $CH_3(CH_2)_{16}COO(CH_2CH_2O)_nCH_2CH_2OH$

Ans. (i) $\underbrace{CH_3(CH_2)_{10}CH_2}_{\text{Hydrophobic part}}\underbrace{—OSO_3^-Na^+}_{\text{Hydrophilic part}}$

(ii) $\underbrace{CH_3(CH_2)_{15}}_{\text{Hydrophobic part}}\underbrace{—N^+(CH_3)_3Br^-}_{\text{Hydrophilic part}}$

(iii) $\underbrace{CH_3(CH_2)_{16}}_{\text{Hydrophobic part}}\underbrace{COO(CH_2CH_2O)_nCH_2CH_2OH}_{\text{Hydrophilic part}}$

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