

1. Why do we need to classify drugs in different ways?

Sol. Drugs are classified in the following different ways:

- Based on pharmacological effect.
- Based on action on a particular biochemical process.
- Based on chemical structure.
- Based on molecular targets.

Each classification has its own usefulness.

- Classification based on pharmacological effect is useful for doctors because it provides them the whole range of drugs available for the treatment of a particular disease.
- Classification based on action on a particular biochemical process is useful for choosing the correct lead compound for designing the synthesis of a desired drug.
- Classification based on chemical structure helps us to design the synthesis of a number of structurally similar compounds having different substituents and then choosing the drug having least toxicity.
- Classification on the basis of molecular targets is useful for medical chemists so that they can design a drug which is most effective for a particular receptor site.

2. Explain the following term, targets molecule or drug targets.

Sol. Drugs interact with macromolecules like proteins, carbohydrates, lipids and nucleic acids and hence these are called drug targets. Proteins perform several roles in the body. Proteins which act as biological catalysts are called enzymes, those which are involved in communication system are called receptors. Carrier proteins carry polar molecules across the cell membrane. Nucleic acids have coded genetic information in the cell and lipids and carbohydrates form structural part of cell membranes.

3. Name macromolecules which are chosen as drug targets.

Sol. Proteins, carbohydrates, lipids and nucleic acids are chosen as drug targets.

4. Why should not the medicines be taken without consulting the doctors?

Sol. Some drugs can cause side effects when drug binds to more than one receptor site. Therefore, doctor's consultation is must to choose the right drug that has the maximum affinity for a particular receptor site to have desired effect. Also, dose of the drug taken at a time is also crucial because some drugs like opiates in higher doses act as poisons and may cause death.

5. Define the term chemotherapy.
- Sol.** It is the branch of chemistry that deals with the treatment of diseases using chemicals.
6. Which forces are involved in holding the drugs to the active site of enzymes?
- Sol.** The following forces are involved in holding the drugs to the active site of enzymes:
- (a) Hydrogen bonding (b) Ionic bonding
(c) Dipole-dipole interactions (d) Van der Waals interactions.
7. Antacids and anti-allergic drugs interfere with the function of histamines but why do these not interfere with the function of each other?
- Sol.** Drugs designed to cure some ailment in one organ in the body do not affect the other because they work on different receptors. For example, secretion of histamine causes allergy. It also causes acidity due to release of hydrochloric acid in the stomach. Since anti-allergic and antacids drugs work on different receptors, therefore, antihistamines remove allergy while antacids remove acidity.
8. Low level of noradrenaline is the cause of depression. What type of drugs are needed to cure this problem? Name two drugs.
- Sol.** In the event of low level of neurotransmitter, noradrenaline, anti-depressant drugs are required. These drugs inhibit the enzymes which catalyse the degradation of noradrenaline. If the enzyme is inhibited, noradrenaline is slowly metabolised and hence activates its receptor for longer periods of time thereby reducing depression. Two important drugs are iproniazid and phenelzine.
9. What is meant by the term broad spectrum antibiotics? Explain.
- Sol.** Broad spectrum antibiotics are effective against several different types of harmful bacteria. For example, tetracycline, chloramphenicol and ofloxacin. Chloramphenicol can be used in case of typhoid, dysentery, acute fever, urinary infections, meningitis and pneumonia.
10. How do antiseptics differ from disinfectants? Give one example of each.
- Sol.** Antiseptics are chemical substances which prevent the growth of microorganisms and may even kill them but not harmful to human or animal tissue. For example, Dettol and Savlon. They are generally applied on wounds, cuts, ulcers and diseased skin surfaces. Furacin and soframycin are well known antiseptic creams.
- Disinfectants are chemical substances which kill microorganisms but are not safe to be applied to the living tissues. These are generally used to kill

microorganisms present in the drains toilets, floors, etc. Some common examples of disinfectants are phenol (1% solution) and chlorine (0.2 to 0.4 ppm).

11. Why are cimetidine and ranitidine better antacids than sodium bicarbonate or magnesium or aluminium hydroxide?

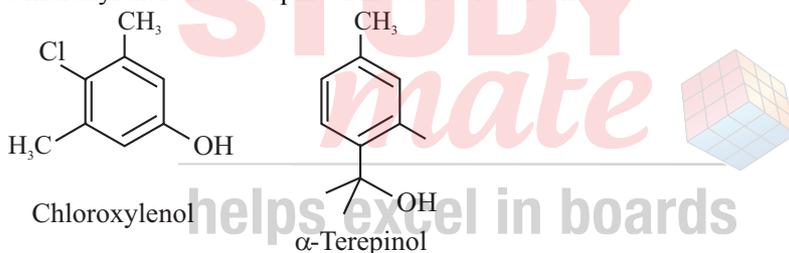
Sol. If excess of NaHCO_3 or Mg(OH)_2 or Al(OH)_3 is used, it makes the stomach alkaline and thus triggers the release of even more HCl which may cause ulcers in the stomach. In contrast, cimetidine and ranitidine prevent the interaction of histamine with the receptors cells in the stomach wall and thus release lesser amount of HCl.

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

Sol. 0.2% solution of phenol acts as antiseptics while 1% solution acts as a disinfectant.

13. What are the main constituents of Dettol?

Sol. Chloroxylenol and α -terpineol in a suitable solvent.



14. What is tincture of iodine? What is its use?

Sol. 2–3% solution of iodine in alcohol and water is called tincture of iodine. It is a powerful antiseptic. It is applied on wounds.

15. What are food preservatives?

Sol. Chemical substances which are used to protect food against bacteria, yeasts and moulds are called preservatives. For example, sodium benzoate and sodium metabisulphite.

16. Why is the use of aspartame limited to cold foods and drinks?

Sol. This is because it decomposes at baking or cooking temperatures and hence can be used only in cold foods and drinks.

17. What are the artificial sweetening agents? Give two examples.

Sol. Artificial sweeteners are chemical substances which are sweet is taste but do not add any calories to our body. They are excreted as such through urine. For example, saccharin, aspartame and alitame.

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

Sol. Saccharine, aspartame or alitame may be used in the preparation of sweets for a diabetic patient.

19. What problem arises in using alitame as artificial sweetener?

Sol. Alitame is a high potency artificial sweetener. Therefore, it is difficult to control the sweetness of the food to which it is added.

20. How are synthetic detergents better than soaps?

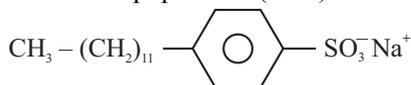
Sol. They can be used in hard water as well as in acidic solution. The reason being that sulphonic acids and their calcium and magnesium salts are soluble in water but soaps of fatty acids and their calcium and magnesium salts are insoluble.

21. Explain the following terms with suitable examples:

- (a) Cationic detergents (b) Anionic detergents
(c) Neutral detergents.

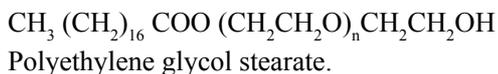
Sol. (a) Anionic detergents are called so because a large part of their molecules are anions. These are of two types:

- (i) Sodium alkyl sulphates: For example, sodium lauryl sulphate, $C_{11}H_{23}CH_2OSO_3Na$.
(ii) Sodium alkylbenzene sulphonates. The most widely used domestic detergent is sodium 4-(1-dodecyl) benzenesulphonate (SDS).



Sodium-4-(1-dodecyl) benzenesulphonate.

- (b) Cationic detergents: These are quaternary ammonium salts. For example, cetyltrimethylammonium chloride.
(c) Neutral or non-ionic detergents: These are esters of high molecular mass alcohols with fatty acids. For example, polyethylene glycol stearate,



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

Sol. Detergents having straight hydrocarbon chains are easily degraded (or decomposed) by microorganism and hence are called biodegradable

detergents while detergents containing branched hydrocarbon chains are not easily degraded by the microorganisms and hence are called non-biodegradable detergents. Consequently, non-biodegradable detergents accumulate in rivers and water ways thereby causing severe water pollution. Examples of biodegradable detergents are sodium lauryl sulphate, sodium 4-(1-dodecyl) benzene sulphonate and sodium 4-(2-dodecyl)-benzene sulphonate.

Example of non-biodegradable detergents is sodium 4(1,3,5,7-tetramethyloctyl) benzene sulphonate.

23. Why soaps do not work in hard water?

Sol. Hard water contains calcium and magnesium salts. Therefore, in hard water soaps get precipitated as calcium and magnesium soaps which being insoluble stick to the clothes as gummy mass.

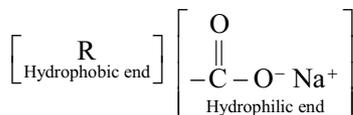
24. Can you use soaps and synthetic detergents to check the hardness of water?

Sol. Soaps get precipitated as insoluble calcium and magnesium soaps in hard water but detergents do not. Therefore, soaps but not synthetic detergents can be used to check the hardness of water.

25. Explain the cleansing action of soaps.

Sol. Soap solution is colloidal in nature. It removes the dirt particles either by adsorption or by emulsifying the greasy matter sticking to cloth.

Soap is sodium stearate ($C_{17}H_{35}COONa$) which may be simply written as $RCOONa$ or as



Soap acts as an emulsifying agent and brings dirt into dispersion medium. Hydrophobic ends (hydrocarbon part R) attack themselves while dirty and begin to lift it, and surround the dirt and hold out in the form of oil in water emulsion form and it is easily washed away.

26. If water contains dissolved calcium bicarbonate, out of soaps and synthetic detergent, which one will you use for cleaning clothes?

Sol. Calcium bicarbonate makes water hard. Therefore, soap cannot be used because it gets precipitated in hard water. On the other hand, a synthetic detergent does not precipitate in hard water because its calcium salt is also soluble in water. Therefore, synthetic detergents can be used for cleaning clothes in hard water.

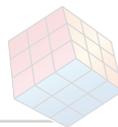
27. Label the hydrophilic and hydrophobic parts in the following compounds:

- (a) $\text{CH}_2(\text{CH}_2)_{10}\text{CH}_2\text{OSO}_3^-\text{Na}^+$
 (b) $\text{CH}_3(\text{CH}_2)_{15}-\text{N}^+(\text{CH}_3)_3\text{Br}^-$
 (c) $\text{CH}_3(\text{CH}_2)_6\text{COO}(\text{CH}_2\text{CH}_2\text{O})_n\text{CH}_2\text{CH}_2\text{OH}$.

Sol.

- (a) $\text{CH}_3(\text{CH}_2)_{10} \left\{ \begin{array}{l} \text{Hydrophobic part} \\ \text{Hydrophilic part} \end{array} \right\} - \text{OSO}_3^-\text{Na}^+$
 (b) $\text{CH}_3(\text{CH}_2)_{15} \left\{ \begin{array}{l} \text{Hydrophobic part} \\ \text{Hydrophilic part} \end{array} \right\} - \text{N}^+(\text{CH}_3)_3\text{Br}^-$
 (c) $\text{CH}_3(\text{CH}_2)_6 \left\{ \begin{array}{l} \text{Hydrophobic part} \\ \text{Hydrophilic part} \end{array} \right\} - \text{COO}(\text{CH}_2\text{CH}_2\text{O})_n\text{CH}_2\text{CH}_2\text{OH}$.

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NCERT TEXTUAL EXERCISE (SOLVED)