16

Chemistry Everyday Life

Multiple Choice Questions (MCQs)

Q. 1 Which of the following statements is not correct?

(a) Some antiseptics can be added to soaps

(b) Dilute solutions of some disinfectants can be used as antiseptic

(c) Disinfectants are antimicrobial drugs

(d) Antiseptic medicines can be ingested

Ans. *(d)* An antiseptic is an antimicrobial drug. It tends to destroy/prevent development or inhibit the pathogenic action of microbes. Antiseptics are applied to the living tissues such as wounds, cuts, ulcers and diseased skin surfaces *e.g.,* soframicine.

Bithionol the compound is also called bithional is added to soaps to impart antiseptic properties.

Dilute solutions of some disinfectants can be used as antiseptic *e.g.,* 0.2 per cent solution of phenol is an antiseptic while its one per cent solution is disinfectant. But, antiseptic medicines can not be ingested like antibiotics.

Q. 2 Which is the correct statement about birth control pills?

(a) Contain estrogen only

(b) Contain progesterone only

(c) Contain a mixture of estrogen and progesterone derivatives

(d) Progesterone enhances ovulation

Ans. *(c)* Chemical substances which are used to check pregnancy in women are called birth control pills. Birth control pills essentially contain a mixture of synthetic estrogen and progesterone derivatives, both of these are sex hormones. It is known that progesterone suppresses ovulation and estrogen control the menstrual cycle.

Some of the commonly used pills contain a mixture of norethindrone (a progesterone derivative) and novestrol (an estrogen).

Q. 3 Which statement about aspirin is not true?

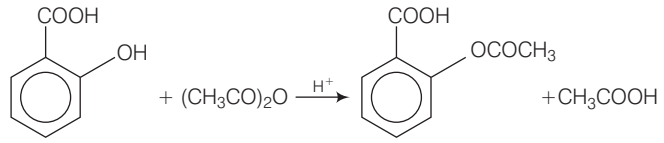
(a) Aspirin belongs to narcotic analgesics

(b) It is effective in relieving pain

(c) It has antiblood clotting action

(d) It is a neurologically active drug

Ans. ***(a)*** Aspirin can be prepared as follows



Salicylic acid — 2-acetoxybenzoic acid (Aspirin)

Aspirin inhibits the synthesis of compounds known as prostaglandins which stimulate inflammation in the tissues and cause pain. So, it is effective in relieving pain.

Beside this, aspirin has many other effects such as reducing fever (antipyretic) and preventing blood platelet coagulation. Because of this anti-blood clotting action, it is widely used to prevent heart attacks. It does not make a person addictive as it is non-narcotic drug.

Q. 4 The most useful classification of drugs for medicinal chemists is .....

(a) on the basis of chemical structure

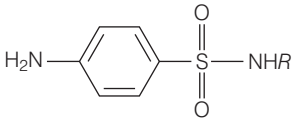
(b) on the basis of drug action

(c) on the basis of molecular targets

(d) on the basis of pharmacological effect

Ans. ***(c)*** *Drugs can be classified in the following ways*

(a) **On the basis of chemical structure** Drugs have been classified on the basis of their chemical structures because drugs having common structural features often have similar pharmacological activity. *e.g.,* all sulphonamides having the common structural feature as given below are mostly antibacterial.



Structural feature of sulphonamide

(b) **On the basis of drug action** This classification is based on the action of a drug on a particular biochemical process.

(c) **On the basis of molecular target** Drugs usually interact with the biomolecules or biological macromolecules such as proteins, nucleic acids and lipids. These are called drug targets.

Drugs possessing some common structural features may have the same mechanism of action on a specific drug target. This classification is most useful for the medicinal chemists.

(d) **On the basis of pharmacological effect** This classification is based upon the pharmacological effects of the drugs. It is more useful for the doctors because it provides them the whole range of drugs available for the treatment of a particular disease. *e.g.,* analgesics reduce or kill pain while antiseptic either kill or arrest the growth of microorganisms.

Q. 5 Which of the following statements is correct?

(a) Some tranquilizers function by inhibiting the enzymes which catalyse the degradation of noradrenaline
(b) Tranquilizers are narcotic drugs
(c) Tranquilizers are chemical compounds that do not affect the message transfer from nerve to receptor
(d) Tranquilizers are chemical compounds that can relieve pain and fever

Ans. ***(a)*** Tranquilizers are used for the treatment of stress, fatigue, mild and severe mental diseases. They relieve anxiety, stress, irritability or excitement by inducing a sense of well-being. Noradrenaline is one of the several neurotransmitters which play an important role in mood changes.

If the level of noradrenaline in the body is low for some reasons, then the message transfer process becomes slow and the person suffer from depression. In such cases, antidepressant drugs are used. These drugs inhibits the enzymes which catalyse the degradation of noradrenaline.

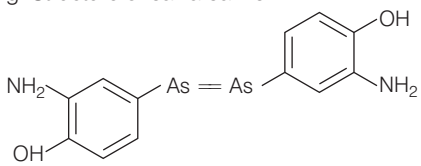
If the enzyme is inhibited, then the neurotransmitter noradrenaline is slowly metabolised and can thus activate the receptor for longer periods there by counteracting the effect of depression. Tranquilizers form an essential component of sleeping pills.

Q. 6 Salvarsan is arsenic containing drug which was first used for the treatment of ..... .

(a) syphilis (b) typhoid (c) meningitis (d) dysentry

Ans. ***(a)*** Syphilis is an acute and chronic infections disease caused by the bacterium *Treponema pallidum*. It is a sexually transmitted infection. The primary route of transmission is through sexual contact but it may also be transmitted from mother to foetus during pregnancy or at birth.

Paul Ehrlich investigated arsenic based structures in order to produce less toxic substances for the treatment of syphilis as he got Nobel prize for medicine in 1908 for this discovery. Salvarsan was the first effective medicine discovered for syphilis. Although salvarsan is toxic to human beings, its effect on bacteria is much greater than on human being. Structure of salvarsan is –



Q. 7 A narrow spectrum antibiotic is active against ..... .

(a) gram positive or gram negative bacteria
(b) gram negative bacteria only
(c) single organism or one disease
(d) both gram positive and gram negative bacteria

Ans. ***(a)*** Antibiotics are now defined as chemical substances which in low concentration, either kill or inhibit the growth of microorganisms by intervening in their metabolic processes. The full range of microorganisms attacked by an antibiotic is called its spectrum.

Broad spectrum antibiotics are effective against several different types of harmful bacteria *i.e.,* a wide range of gram-positive and gram-negative bacteria. These effective mainly against gram-positive or gram-negative bacteria are narrow spectrum antibiotics.

Chloramphenicol is a broad spectrum antibiotic penicillin-G has a narrow spectrum. If an antibiotic is effective against a single organism or disease then it is limited spectrum antibiotic.

Q. 8 The compound that causes general antirepressant action on the central nervous system belongs to the class of.....

(a) analgesics (b) tranquilizers

(c) narcotic analgesics (d) antihistamines

Ans. ***(b)*** Analgesics reduces or abolish pain without causing impairment of consciousness, mental confusion, incordination or paralysis or some other disturbances of nervous system. Analgesics are non-narcotic or narcotic. Narcotic analgesics when administered in small doses relieve pain and produce sleep.

Tranquilisers are a class of chemical compounds used for the treatment of stress, and mild or even severe mental diseases.

Histamine is a substance which on release produce hypersensitivity to dust, some drugs etc (*i.e.,* allergy). Antihistamines are the drugs which interfere with the natural action of histamine by competing with histamine for binding sites of receptor where histamine exerts its effect. They are anti-allergy drugs.

Q. 9 Compound which is added to soap to impart antiseptic properties is .....

(a) sodium laurylsulphate (b) sodium dodecylbenzenesulphonate

(c) rosin (d) bithional

Ans. ***(d)*** Basically, all soaps are made by boiling fats or oils with suitable hydroxide. Variations are made by adding different raw materials. Sodium laurylsulphate and sodium dodecylbenzenesulphonate are anionic detergents.

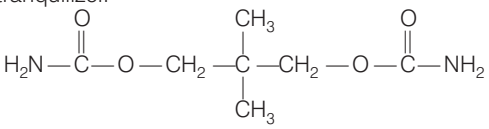
A gum rosin added to soap to make it lather well. Bithional is added to soaps to impart antiseptic properties to soap.

Q. 10 Equanil is .....

(a) artificial sweetener (b) tranquilizer

(c) antihistamine (d) antifertility drug

Ans. ***(b)*** Equanil is a tranquilizer.



Structure of equanil

(*Also, refer to Q.* 5)

Q. 11 Which of the following enhances leathering property of soap?

(a) Sodium carbonate (b) Sodium rosinate

(c) Sodium stearate (d) Trisodium phosphate

Ans. ***(b)*** Shaving soaps contain glycerol to prevent rapid drying. While preparing this soaps, a gum called rosin is added to them. It forms sodium rosinate which lathers well. Laundary soaps contain fillers like sodium rosinate, sodium silicate, borax and sodium carbonate.

Trisodium polyphosphate is an important filler added to detergent powders and liquid detergents.

Q. 12 Glycerol is added to soap. It functions ..... .

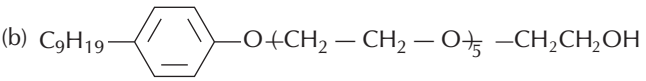
(a) as a filler
(b) to increases leathering
(c) to prevent rapid drying
(d) to make soap granules

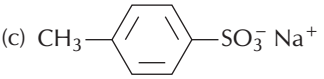
Ans. ***(c)*** Glycerol is added to shaving soap to prevent rapid drying while to enhance the leathering property of soap, a gum called rosin is added to them. It forms sodium rosinate which lathers well. Soap granules are dried miniature soap bubbles.

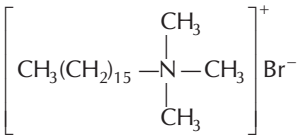
Builders/fillers make the soap act more rapidly. Builder or filler (*e.g.* sodium tripolyphosphate) is added to detergent powder. Its main function is to act as water softener by removing Mg^{2+} and Ca^{2+} ions from hard water by forming stable soluble complexes.

Q. 13 Which of the following is an example of liquid dishwashing detergent?

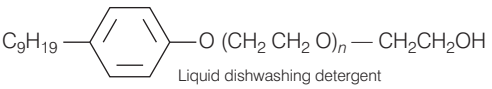
(a) $CH_3(CH_2)_{10}-\ CH_2OSO_3^-\ Na^+$

(b) 

(c) 

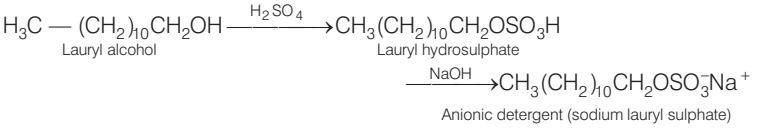
(d) 

Ans. ***(b)*** Liquid dishwashing detergents are non-ionic type. Non-ionic detergents do not contain any ion in their constitution. Mechanism of cleansing action of this type of soaps. These remove grease and oil by micelle formation.



Liquid dishwashing detergent

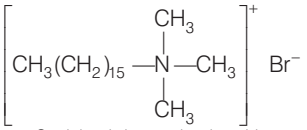
Other two classes of detergents are anionic detergents and cationic detergents. Anionic detergents are sodium salts of sulphonated long chain alcohols or hydrocarbons.



Lauryl alcohol — Lauryl hydrosulphate — Anionic detergent (sodium lauryl sulphate)

They are mostly used for household work.

Cationic detergents are quaternary ammonium salts of amines with acetates, chlorides or bromides as anions. Cetyltrimethylammonium bromide is a popular cationic detergent and is used in hair conditioners.



Cetyltrimethylammonium bromide

Q. 14 Polyethyleneglycols are used in the preparation of which type of detergents?

(a) Cationic detergents (b) Anionic detergents

(c) Non-ionic detergents (d) Soaps

Ans. *(c)* Polyethyleneglycols are used in the preparation of non-ionic detergents. Non-ionic detergents do not contain any ion in their constitution.

Reaction is as follow

$$\underset{\text{Stearic acid}}{CH_3(CH_2)_{16}COOH} + HO(CH_2CH_2O)_n\,\underset{\text{Polyethylene glycol}}{CH_2CH_2OH} \xrightarrow{-H_2O} CH_3(CH_2)_{16}COO(CH_2CH_2O)_n\,CH_2CH_2OH$$

Non-ionic detergent

Q. 15 Which of the following is not a target molecule for drug function in body?

(a) Carbohydrates (b) Lipids (c) Vitamins (d) Proteins

Ans. *(c)* Drugs usually interact with biomolecules such as carbohydrates, lipids, proteins and nucleic acids. These are called drug targets. Vitamins are not a target molecule for drug function in body.

Q. 16 Which of the following statements is not true about enzyme inhibitors?

(a) Inhibit the catalytic activity of the enzyme

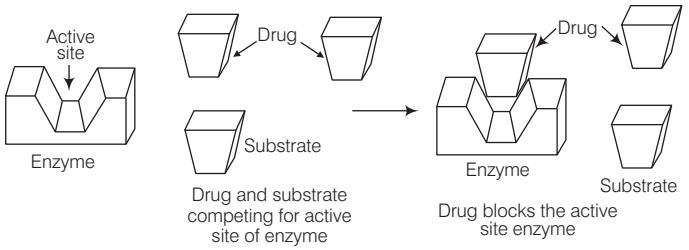
(b) Prevent the binding of substrate

(c) Generally a strong covalent bond is formed between an inhibitor and an enzyme

(d) Inhibitors can be competitive or non-competitive

Ans. *(c)* Drugs can block the binding site of the enzyme and present the binding of substrate, or can inhibit the catalytic activity of the enzyme.Such drugs are called enzyme inhibitors. Drugs inhibit the attachment of substrate on active site of enzyme in two different ways.

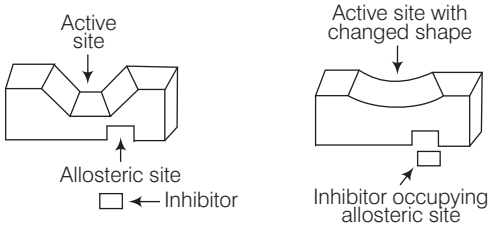
(i) Drugs which compete with natural substrate for their attachment on the active sites of enzymes are called competitive inhibitors.



Competitive inhibitors (Drug and substrate competing for active site)

(ii) However, some drugs do not bind to the active site but bind to a different site of enzyme *i.e.,* allosteric site which changes the shape of the active site of the enzyme in such a way that the natural substrate cannot recognize it. Such enzymes are called non-competitive inhibitors.

Generally, a weak bond such as hydrogen bonding, van der, Waals' interactions etc., is formed between the enzyme and inhibitor.



Non-competitive inhibitor changes the active site of enzyme after binding at allosteric site

Q. 17 Which of the following chemicals can be added for sweetening of food items at cooking temperature and does not provide calories?

(a) Sucrose (b) Glucose

(c) Aspartame (d) Sucralose

Ans. ***(d)*** Sucrose and glucose are natural sweetening agent while aspartame and sucralose are artificial sweetening agent.

Aspartame is roughly 100 times as sweet as cane sugar. It is methyl ester of dipeptide formed from aspartic acid and phenylalanine. Use of aspartame is limited to cold foods and soft drinks because it is unstable at cooking temperature.

Sucralose is trichloro derivative of sucrose. Its appearance and taste are like sugar. It is stable at cooking temperature. It does not provide calories.

Q. 18 Which of the following will not enhance nutritional value of food?

(a) Minerals (b) Artificial sweeteners

(c) Vitamins (d) Amino acids

Ans.***(b)*** Vitamins and minerals are essential nutrients because they perform hundred of roles in the body. They help shore up bones, heal wounds, and bolster immune system. They also convert food into energy, and repair cellular damage.

Artificial sweeteners are non-caloric substitutes for sugar. They are often intensly more sweet than sugar but do not enhance nutritional value of food.

Amino acids are the monomers of proteins. Proteins require for the growth and maintenance of the body. Therefore, amino acids will also enhance the nutritional value of food.

Multiple Choice Questions (More Than One Options)

Q. 19 Which of the following statements are incorrect about receptor proteins?

(a) Majority of receptor proteins are embedded in the cell membranes
(b) The active site of receptor proteins opens on the inside region of the cell
(c) Chemical messengers are received at the binding sites of receptor proteins
(d) Shape of receptor doesn't change during attachment of messenger

Ans. ***(b, d)***

Receptors are proteins that are crucial to body's communication process. Majority of these are embedded in cell membranes. They are embedded in the cell membrane in such a way that their small part possessing active site projects out of the surface of the membrane and opens on the outside region of the cell membrane.

In the body, message between two neurons and that between neuron to muscles is communicated through certain chemicals. These chemicals, known as chemical messengers are received at the binding site of receptors proteins.

To accommodate a messenger, shape of the receptor site changes. This brings about the transfer of message into the cell. Thus, chemical messenger gives message to the cell without entering the cell.

Q. 20 Which of the following are not used as food preservatives?

(a) Table salt
(b) Sodium hydrogencarbonate
(c) Cane sugar
(d) Benzoic acid

Ans. ***(b, c)***

Food preservatives prevent spoilage of food due to microbial growth. The most commonly used preservatives include table salt, sugar, vegetable oils and sodium benzoate. Sodium hydrogen carbonate and cane sugar are not used as food preservatives.

Q. 21 Compounds with antiseptic properties are .....

(a) $CHCl_3$
(b) CHI_3
(c) boric acid
(d) 0.3 ppm aqueous solution of Cl_2

Ans. ***(b, c)***

Antiseptics are the chemical substances which either kill or prevent the growth of microorganisms.

(a) $CHCl_3$ (chloroform) was used as an anaesthesia in surgery but now it is used in the production of the freon refrigerant R-22.
(b) Iodoform (CHI_3) produces iodine on coming in contact with skin, so it is used as an antiseptic for wounds.
(c) Boric acid (H_3BO_3) in dilute aqueous solution is a weak antiseptic for eyes. Thus, chemical messenger gives messagle to the all without entering the cell.
(d) Chlorine in the concentration of 0.2 to 0.4 ppm in aqueous solution and sulphur dioxide in very low concentrations, are disinfectants.

Q. 22 Which of the following statements are correct about barbiturates?

(a) Hypnotics or sleep producing agents
(b) These are tranquilizers
(c) Non-narcotic analgesics
(d) Pain reducing without disturbing the nervous system

Ans. ***(a, b)***

Barbituric acid and its derivatives such as veronal, luminal, seconal, amytal and nembutal constitute an important class of tranquilizers called barbiturates. They are used as hypnotics *i.e.,* sleep producing agents.

Q. 23 Which of the following are sulpha drugs?

(a) Sulphapyridine (b) Prontosil

(c) Salvarsan (d) Nardil

Ans. ***(a, b)***

Sulpha drugs kills bacteria and fungi by interfering with their metabolism.

(a) Sulphapyridine is a sulphonamide antibacterial drug. It is no longer prescribed for the treatment of infections in humans. It is a good antibacterial drug, but its water solubility is very pH dependent. Thus, there is a risk of crystallisation within the bladder or urethra, which could lead to pain or blockage.

(b) Prontosil is also called sulphamidochrysoidine. It is used in the treatment of general bacterial infection in humans.

(c) Salvarsan is arsenic based antibacterial drug. It is used in the treatment of syphilis.

(d) Nardil is an antidepressant drug.

Q. 24 Which of the following are antidepressants?

(a) Iproniazid (b) Phenelzine

(c) Equanil (d) Salvarsan

Ans. ***(a, b, c)***

Antidepressants are the substances which correct chemical imbalances of neurotransmitters in the brain and probably cause changes in mood and behaviour.

Iproniazid is a hydrazine drug used as an antidepressant. Phenelzine is also known as Nardil. It is used in the treatment of major depressive disorder.Equanil is used in controlling depression and hypertension.

Salvarsan is an antibacterial drug. It is used in the treatment of Syphilis.

Q. 25 Which of the following statements are incorrect about penicillin?

(a) An antibacterial fungus

(b) Ampicillin is its synthetic modification

(c) It has bacteriostatic effect

(d) It is a broad spectrum antibiotic

Ans. ***(c, d)***

Penicillin is a group of antibiotics derived from *Penicillium* fungi. Ampicillin and Amoxycillin are synthetic modifications of penicillin. Pencillin destroys bacteria by destroying the cell wall of the microorganism or kill the bacteria so, it has bacteriocidal effect.

Penicillin as a class of antibiotics are generally narrow spectrum but when used in the combination with other antibiotics, it can make up a part of broad spectrum antibiotics.

Q. 26 Which of the following compounds are administered as antacids?

(a) Sodium carbonate (b) Sodium hydrogencarbonate

(c) Aluminium carbonate (d) Magnesium hydroxide

Ans. ***(b, d)***

Antacid is a substance which neutralizes excess of acid in stomach.

The chemical formula of sodium hydrogen carbonate is $NaHCO_3$. It is often used as an antacid because it neutralises excess of HCl secreted from the walls of stomach

$$NaHCO_3(s) + HCl(aq) \rightarrow NaCl(aq) + H_2O(l) + CO_2$$

However, excessive hydrogen carbonate can make the stomach alkaline and trigger the production of even more acid.

Milk of magnesia, which is an aqueous solution of magnesium hydroxide is also used as an antacid.

Q. 27 Amongst the following antihistamines, which are antacids?

(a) Ranitidine
(b) Brompheniramine
(c) Terfenadine
(d) Cimetidine

Thinking Process

This question is based on the inter-relation between the antihistamines and antacids. Antihistaminies drugs are used in the treatment of hyperacidity came through the discovery accordig to which a chemical, histamine, stimulates the secreation of pepsin and hydrochloric acid in the stomach.

Ans. ***(a, d)***

Histamine is a substance that stimulates the secretion of pepsin and hydrochloric acid. There are some antacids like cimetidine were designed to prevent the interaction of histamine with the receptors present in the stomach wall. As a result less HCl is released and the cause of hyperacidity is controlled/cured.

Ranitidine is also fall in the category of antihistamine. It is used to cure hyperacidity.

Brompheniramine is an antihistamine. It is used to treat runny nose, sneezing, itching and watery eyes caused by allergy.

Terfenadine, an antihistamine, was used for allergy.

Q. 28 Veronal and luminal are derivatives of barbituric acid which are .....

(a) tranquilizers
(b) non-narcotic analgesic
(c) anti-allergic drugs
(d) neurologically active drugs

Ans. ***(a, d)***

Derivatives of barbituric acid *viz.,* veronal and luminal are called barbiturates. These barbiturates constitute an important class of tranquilizers.

Tranquilizers are a class of chemical compounds used for the treatment of stress and mild or severe mental diseases. Tranquilizers are neurologically active drugs. These drugs affect the message transfer mechanism from nerve to receptor.

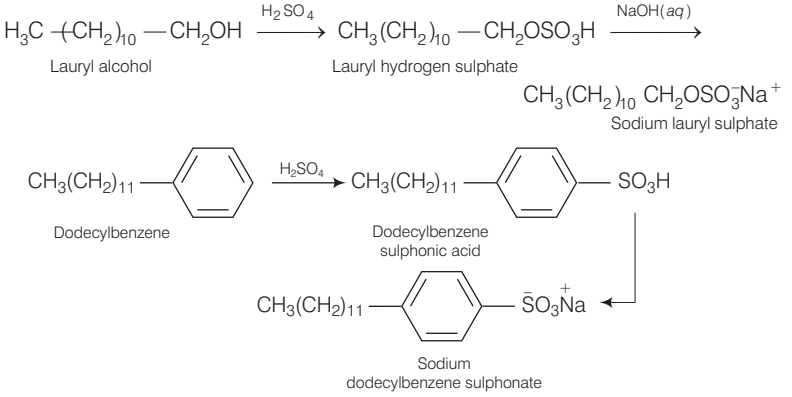
Q. 29 Which of the following are anionic detergents?

(a) Sodium salts of sulphonated long chain alcohol
(b) Ester of stearic acid and polyethylene glycol
(c) Quarternary ammonium salt of amine with acetate ion
(d) Sodium salts of sulphonated long chain hydrocarbons

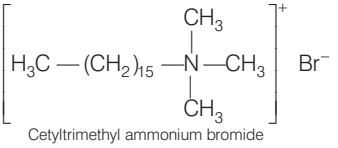
Ans. ***(a, d)***

Detergents are cleansing agents which have all the properties of soap, but which actually do not contain any soap. They are of three types which given below

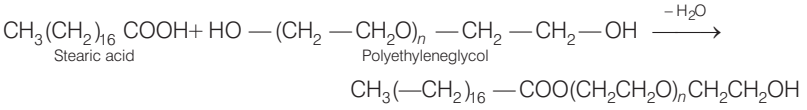
1. **Anionic detergents** These are sodium salts of sulphonated long chain alcohols or hydrocarbons.



2. **Cationic detergents** These are quarternary ammonium salts of amines with acetates chlorides or bromides as anions *e.g.,*



3. **Non-ionic detergents** It is formed by the reaction of stearic acid with polyethylene glycol.



Q. 30 Which of the following statements are correct?

(a) Cationic detergents have germicidal properties

(b) Bacteria can degrade the detergents containing highly branched chains

(c) Some synthetic detergents can give foam even in ice cold water

(d) Synthetic detergents are not soaps

Ans. ***(a, c, d)***

(a) Cationic detergents are quarternary ammonium salts of amines with acetates, chlorides or bromides as anions. These detergents have germicidal properties. Hence, option (a) is correct.

(b) Bacteria can not degrade the detergents containing highly branched chains, therefore, in most of the detergents used these days, the branching is kept to a minimum so that the detergents become easily biodegradable. Hence , option (b) is incorrect.

(c) Some synthetic detergents can give foam even in ice cold water. Hence, option (c) is correct.

(d) Synthetic detergents are cleansing agents which have all the properties of soaps, but which actually do not contain any soap. Hence, option (d) is correct.

Short Answer Type Questions

Q. 31 What is the average molecular mass of drugs?

Ans. Drugs are the chemicals of low molecular masses *i.e.,* (~100 – 500 u). They interact with macromolecular targets and produce a biological response. When the biological response is therapeutic and useful, these chemicals are called medicines.

Q. 32 Write the uses of medicines.

Ans. Chemical substances which are used in diagnosis, prevention and treatment of diseases which are called medicines.

Medicines are used in diagnosis, prevention and treatment of diseases.

Note *If drugs taken in doses higher than those recommended, most of the drugs used as medicines are potential poisons. Use of chemicals for therapeutic effect is called chemotherapy.*

Q. 33 What are antiseptics?

Ans. Antiseptics are the antimicrobes. Antiseptics are the chemical which either kill or prevent the growth of microorganism and are safe to be applied to the living tissues *e.g.,* soframicine. They can not be taken orally like antibiotics.

Q. 34 Which type of drugs come under antimicrobial drugs?

Ans. Disease in human beings and animals may be caused by a variety of microorganisms such as bacteria, virus, fungi and other pathogens.

An antimicrobial tends to destroy/prevent development or inhibit the pathogenic action of microbes such as bacteria (antibacterial drugs), fungi (antifungal agents), virus (antiviral agents), or other parasites (antiparasitic drugs) selectively. Antiseptic, disinfectants, antibiotics and sulpha drugs are antimicrobial drugs.

Q. 35 Where are receptors located?

Ans. Receptors are proteins that are crucial to body's communication process. Receptors are embedded on the outer surface of the cell membrane in such a way that their small part possessing active site projects out of the surface of the membrane and opens on the outside region of the cell membrane.

Q. 36 What is the harmful effect of hyperacidity?

Ans. Hyperacidity produces sudden stomach pain. It may lead to vomiting, loss of appetite, flatulence and heart burn. It is also responsible for chronic indigestion and in severe cases cause gastric ulcers.

Q. 37 Which site of an enzyme is called allosteric site?

Ans. Sites different from active site of enzyme where a molecule can bind and change the shape of the active site is called allosteric site.

*(Also, refer to Q.*16)

Q. 38 What type of forces are involved in binding of substrate to the active site of enzyme?

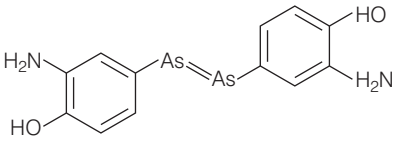
Ans. During the catalytic action of an enzyme, enzyme hold the substrate for a chemical reaction. Active sites of enzymes holds the substrate molecule in a suitable position, so that it can be attacked by the reagent effectively.

Substrate bind to the active site of the enzyme through a variety of interactions. These forces are van der Waals' interactions, ionic bonding, hydrogen bonding or dipole-dipole interaction.

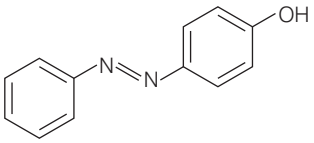
Q. 39 What is the commonality between the antibiotic arsphenamine and azodye?

Ans. Arsphenamine is also known as salvarsan. It is a synthetic organic arsenic compound that was previously used for treating syphilis. Arsphenamine possess — As ═ As — linkage.

Azo dyes are used to promote epithelial growth in the treatment of ulcers, burns, and other wounds. Many azodyes have anticoagulation action. Azo dyes possess — N ═ N — linkage like arsphenamine which possess — As ═ As — linkage.



Salvarsan



Azodye

Q. 40 Which class of drugs is used in sleeping pills?

Ans. Tranquilizers are essential components of sleeping pills. It is the class of chemical compounds used for the treatment of stress and mild or even severe mental diseases. These relieve anxiety stress, irritability or excitement by inducing a sense of well beings.

Q. 41 Aspirin is pain relieving antipyretic drug but can be used to prevent heart attack. Explain.

Ans. Aspirin is 2- acetoxybenzoic acid. It is very effective in reducing or abolishing pain without causing impairment of consciousness, mental confusion, incordination or paralysis or some other disturbance or disorder of the nervous system. It reduces fever (antipyretics) and prevents platelet coagulation.

Due to, it has anti blood clotting action and, therefore, it is widely used to prevent heart attack.

Q. 42 Both antacids and antiallergic drugs are antihistamines but they cannot replace each other. Explain why?

Ans. Histamine is a chemical substance that stimulates the secretion of pepsin and hydrochloric acid in stomach. Antacids are designed to prevent the interaction of histamine with the receptors present in the stomach wall. As a result, less HCl is released in stomach.

Histamine contracts the smooth muscles in the bronchi and gut and relaxes other muscles in walls of fine blood vessels. As a result, histamine causes allergy. Antihistamines interfere with the natural action of histamine by competing with histamine for binding sites of receptor where histamine exerts its effect.

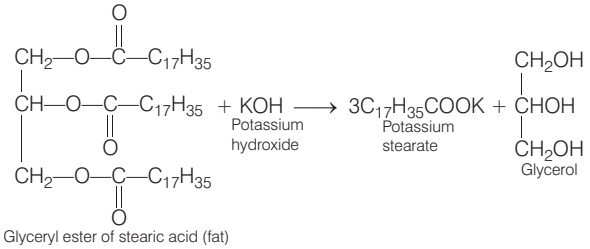
Since, antiallergic and antacids drugs work on different receptors, therefore, antihistamines remove allergy while antacids remove acidity.

Q. 43 What is a soft soap?

Ans. Chemical substances which concentrates at the surface of the solution or interfaces, from surface films, reduces surface tension of the solution and help in removing dirt and dust by emulsifying grease are called surfactants *i.e.,* soap and detergents.

Soaps are sodium or potassium salts of long chain fatty acids such as palmitic acid ($C_{15}H_{31}COOH$), stearic acid ($C_{17}H_3COOH$) and linolic acid ($C_{17}H_{31}COOH$)

Potassium salts of fatty acids such as palmitic acid, stearic acid and oleic acid are called soft soap.

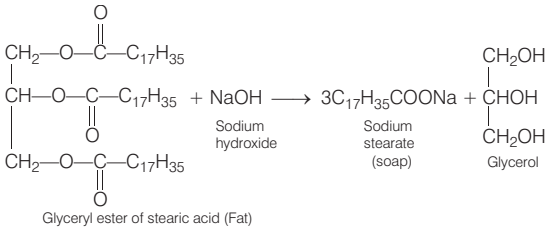


Glyceryl ester of stearic acid (fat)

Generally, potassium soap are soft to the skin so, they are named as soft soap.

Q. 44 If soap has high alkali content it irritates skin. How can the amount of excess alkali be determined? What can be the source of excess alkali?

Ans. A solution of soap is titrated with standard hydrochloric acid. It is an acid-base titration. In this titration, phenolphthalein is used as an indicator. During the preparation of soap, fat (*i.e.,* glyceryl ester of fatty acid) is heated with aqueous sodium hydroxide



Glyceryl ester of stearic acid (Fat)

Thus, the source of this excess alkali (which irritates skin) is the alkali left unused when the soap is prepared by hydrolysis of fat.

Q. 45 Explain why some times foaming is seen in river water near the place where sewage water is poured after treatment?

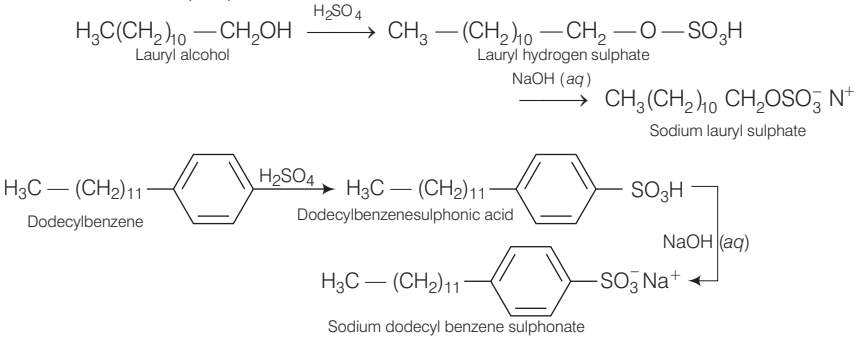
Ans. Detergents have long hydrocarbon chains. If their hydrocarbon chain is highly branched, then bacteria cannot degrade this easily. Such detergents are non-biodegradable. Slow degradation of detergents leads to their accumulation.

These non-biodegradable detergents persist in water even after sewage treatment and cause foaming in rivers, ponds and their water get polluted. In order to overcome this issue branching of the hydrocarbon chain is controlled and kept to minimum.

Q. 46 Which category of the synthetic detergents is used in toothpaste?

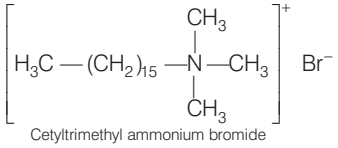
Ans. Anionic detergents such as sodium lauryl sulphate, sodium dodecylbenzenesulphonate etc are used in toothpaste. They are responsible to clean the teeth and to provide a foam that helps to carry away the debris.

Further, sodium lauryl sulphates have significant antibacterial properties, and can penetrate as well as dissolve the plaque.



Q. 47 Hair shampoos belong to which class of synthetic detergent?

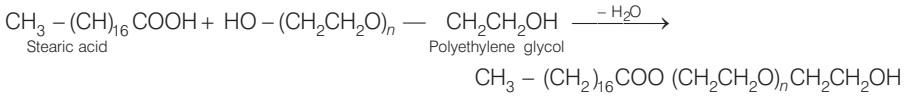
Ans. Hair shampoos are made up of cationic detergents. These are quarternary ammonium salts of amines with acetates, chlorides or bromides as anions, *e.g.,* cetyltrimethyl ammonium bromide.



Cetyltrimethyl ammonium bromide

Q. 48 Dishwashing soaps are synthetic detergents. What is their chemical nature?

Ans. Dishwashing soaps are non-ionic detergents. It can be prepared by the reaction of stearic acid with polyethylene glycol.

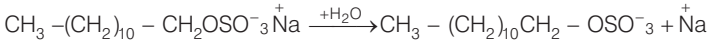


Since, non-ionic detergents do not contain any ion in their constitution, it is neutral in nature.

Q. 49 Draw the diagram showing micelle formation by the following detergent. $CH_3(CH_2)_{10}CH_2OSO_3^-Na^+$

Ans. Sodium lauryl sulphate, $CH_3(CH_2)_{10}CH_2OSO_3^-Na^+$ is an example of anionic detergent.

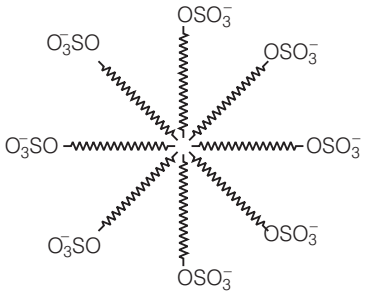
When added to water, it dissociates as follows



These anions are present on the surface with their $-OSO_3^-$ groups in water and hydrocarbon part staying away from it and remain at the surface.

At higher concentration, these anions are pulled into the bulk of the solution and form an aggregate of spherical shape with their hydrocarbon part pointing towards the centre and OSO_3^- part outwards on the surface of the sphere.

An aggregate thus formed is known as micelle.

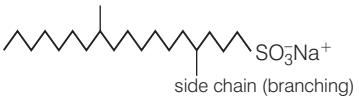


Micelle

Q. 50 How does the branching of hydrocarbon chain of synthetic detergents affect their biodegradability?

Ans. Detergents having highly branched hydrocarbon chains cause pollution in rivers. The reason being that side chains stop bacteria from attacking and breaking the chains.

Thus, lesser the branching more is the biodegradability *i.e.,* detergents with long straight hydrocarbon chains are more easily degraded than those having branched hydrorcarbon chains.



side chain (branching)

Since, unbranched (*i.e.,* straight) chains are more prone to attack by bacteria, therefore, in most of the detergents used these days, the branching is kept to be minimum, so that the detergents become easily biodegradable.

Q. 51 Why is it safer to use soap from the environmental point of view?

Ans. Soaps are biodegradable while detergents containing branched hydrocarbon chains are quite stable, *i.e.,* they are not degraded by the action of microorganism and therefore it cause water pollution in rivers and other water ways.

Q. 52 What are analgesics?

Ans. Analgesics reduce or abolish pain without causing impairment of consciousness, mental confusion, incoordination or paralysis or some other disturbances of nervous system.

These are classified in two groups

(i) **Non-narcotic analgesics** These are non-addictive analgesics *e.g.,* aspirin.

(ii) **Narcotic analgesics** Morphine is an example of narcotic analgesics.

Q. 53 What is the scientefic explanation for the feeling of depression ?

Ans. Noradrenaline is a neuro-transmitter which plays an crucial role in mood changes. If any person has low level of noradrenaline, then the message transfer process becomes slow and the person feeling of depression.

Q. 54 What is the basic difference between antiseptics and disinfectants ?

Ans. Antiseptics and disinfectants both are antimicrobials. Antiseptics prevent or destroy development or inhibit the pathogenic action of microbes. They are safe to be applied on living tissues.

On the other hand, disinfectants also kill microorganisms but are not safe to be applied on living tissues. They are generally applied on non-living objects such as drains, toilets, floors and living rooms infected with bacteria and disease carrying germs.

Q. 55 Between sodiumhydrogencarbonate and magnesium hydroxide which is a better antacid and why ?

Ans. Magnesium hydroxide [$Mg(OH)_2$] is a better antacid because being insoluble it does not allow the pH to increase above neutrality. On the other hand, sodium hydrogen carbonate being soluble and its excess amount can make the stomach alkaline and trigger the production of even more acid.

Q. 56 Which analgesics are called opiates ?

Ans. Analgesics reduce or abolish pain without causing impairment of consciousness, mental confusion, incoordination or paralysis or some other disturbances of nervous system. *These are classifieds in two categories*

(i) **Non-narcotic** (non-addicitive) **analgesics** - Aspirin and paracetamol belong to the class of non-narcotic analgesics.

(ii) **Narcotic analgesics**–Morphine and many of its homologues, when administered in medicinal doses, relieve pain and produce sleep. In poisonous doses, these produce stupor, coma, convulsions and ultimately death. Morphine narcotics are sometimes referred to as opiates, since they are obtained from the opium poppy.

Q. 57 What is the medicinal use of narcotic drugs ?

Ans. Narcotic analgesics (morphine and many of its homologous) when administered in medicinal doses, relieve pain and produce sleep. Since, these drugs relieve pain and produce sleep, therefore are chiefly used for the relief of postoperative pain, cardian pain and pains of terminal cancer, and in child birth.

Q. 58 What are antagonistic drugs ?

Ans. Drugs that bind to the receptor site and inhibit its natural function are called antagonist, drugs *e.g.,* cimetidine is an antagonist drug because it binds to the receptor site in stomach otherwise histamine will bind to the receptor site and induce the secretion of HCl in stomach.

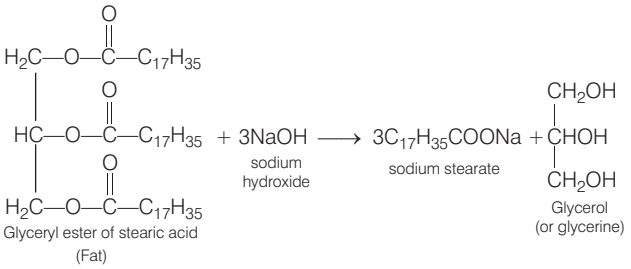
Thus, this antacid blocks the receptor site and hence, the secretion of HCl is reduced thereby reducing/removing hyperacidity.

Q. 59 What is the mode of action of antimicrobial drugs?

Ans. An antimicrobes tend to destroy/prevent development or inhibit the pathogenic action of microbes such as bacteria, fungi, virus or other parasites selectively. Thus, antimicrobial are drugs which cure diseases caused by microorganisms.

Q. 60 What is the side product of soap industry ? Give reactions showing soap formation.

Ans. Soaps are sodium or potassium salts of long chain fatty acids such as stearic acid, oleic acid and palmitic acid. Soaps containing sodium salts are formed by heating fat (*i.e.,* glyceryl ester of fatty acid) with aqueous sodium hydroxide Ans.



This reaction is known as saponification. In this reaction, esters of fatty acids are hydrolysed and the soap obtained remains in colloidal form. It is precipitated from the solution by adding NaCl. The solution left after removing the soap contains glycerol as side product.

Q. 61 What is the difference between bathing soap and washing soaps?

Ans. Bathing soaps are potassium salts of long chain fatty acids. They are usually soft and are also free from unused alkali. On the other hand, washing soaps are sodium salts of long chain fatty acids.They are usually hard and also contain some residual alkali.

Q. 62 How are transparent soaps manufactured?

Ans. Soap that float in water are made by beating tiny air bubbles before their hardening. Transparent soaps are made by dissolving the soap in ethanol and then evaporating the excess solvent.

Q.63 What is the advantage of using antihistamines over antacids in the treatment of acidity?

Ans. Usual antacid like sodium hydrogen carbonate control only the symptom and not the cause. They neutralize the excess of acid produce in the stomach. but do not control the cause of production of excess of HCl in stomach.

Histamine, a chemical, is responsible for the secretion of pepsin and HCl in the stomach. Antihistamine are the drugs which supress the action of histamine, which in turn supress the secretion of pepsin and HCl in the stomach. Antihistamine prevent the binding of histamine with the receptors present in the stomach wall.

As a result, less HCl is produced and hyperacidity is cured. Thus, a better treatment for curing acidity is to use antihistamines over antacids.

Q.64 What are the functions performed by histamine in the body?

Ans. Histamine is a potent vasodilator. It performs various functions in the body

(i) It contracts muscles in gut and bronchi.

(ii) It relaxes some other muscles, *e.g.,* in the walls of blood vessels.

(iii) It is responsible for congestion in the nose associated with common cold and allergies.

(iv) It stimulates the release of pepsin and HCl in stomach.

Q. 65 With the help of an example explain how do tranquilizers control the feeling of depression?

Ans. Noradrenaline is a neurotransmitter which plays a crucial role in mood changes. If somehow any person has low level of noradrenaline in the body, then the signal sending activity becomes slow and the person suffers from depression.

For removing depression and to boost the mood, tranquilizers are used. These drugs inhibit the engyme which catalyse the degradation of noradrenaline.

From this result, neurotransmitter noradrenaline is slowly metabolised and can thus activate the receptor for longer periods.

Q. 66 Why are certain drugs called enzyme inhibitors?

Ans. Some drugs can block the binding site of the enzyme and prevent the binding of the substrate, or can inhibit the catalytic activity of the enzyme. Such drugs are called enzyme inhibitors.

(*Also, refer to Q.* 16.)

Q. 67 What are fillers and what role these fillers play in soap?

Ans. Substances which are added to soaps to change their properties in order to make them more useful for a particular application, are called fillers. *Some important examples are given below*

(i) Sodium rosinate, sodium silicate, borax and sodium carbonate are added to laundary soaps to increase their lather forming ability.

(ii) Glycerol is added to shaving soaps to prevent them from rapid drying.

(iii) In medicated soaps, substances of medicinal values are added.

Q. 68 Sugar is the main source of energy as it produces energy on metabolic decomposition. But these days low calorie drinks are more popular, why?

Ans. Natural sweetners *e.g.,* sucrose add to calorie intake. Due to occurrence of more cases of diabetes and obesity among young and old people, these days people usually take low calorie drinks. *These are artificial sweetening agents as given below*

Saccharin It is 550 times as sweet as cane sugar. It is excreted from the body through urine.

Aspartame It is 100 times as sweet as cane sugar. Its use is limited to cold foods and soft drinks because it is unstable at cooking temperature.

Alitame It is more stable than aspartame but the control of sweetners of food is difficult while using it.

Sucralose It is stable at cooking temperature. It does not provide calories.

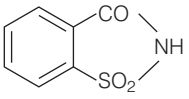
These artificial sweetening agents do not metabolize and hence do not produce any energy.

Q. 69 Pickles have a long shelf life and do not get spoiled for months, why?

Ans. Plenty of salt and cover of oil act as preservatives. These food preservatiues prevent spoilage of food due to microbial growth. Salt and oil do not allow moisture and air to enter the material and hence bacteria cannot thrive on them. Therefore, pickles do not get spoiled for months together.

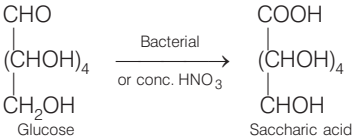
Q. 70 What is the difference between saccharin and saccharic acid?

Ans. Saccharin is an artificial sweetening agent. It is about 550 times as sweet as cane sugar. It is excreted from the body in urine unchanged. It appears to be entirely inert and harmless when taken. Its use is of great value to diabetic people who need to control intake of calories.



Saccharin

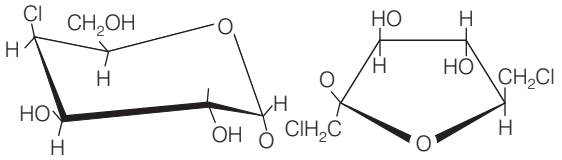
On the other hand, saccharic acid, is a dibasic acid obtained by the bacterial oxidation of glucose in the mouth or by conc. HNO_3 in the laboratory.



Glucose Saccharic acid

Q. 71 Name an artificial sweetener which is derivative of sucrose.

Ans. **Sucralose** is trichloro derivative of the sucrose. Its appearance and taste are like sugar. It is stable at cooking temperature. Sucralose contributes zero calories to the diet, compared with sucrose, which contributes 16 calories per teaspoon. Structure of sucralose is

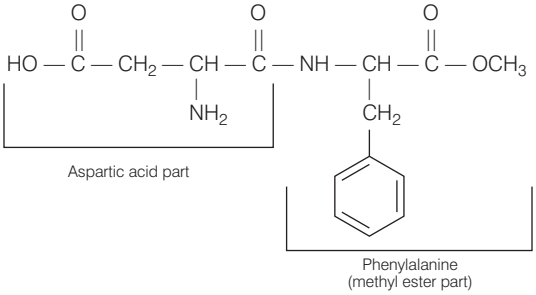


Sucralose

Q. 72 Name two α-amino acids which form a dipeptide which is 100 times more sweet than cane sugar ?

Ans. Aspartame is the most successful and widely used artificial sweetener. It is methyl ester of dipeptide formed from aspartic acid and phenylalanine. Its use is limited to cold foods and soft drinks because it is unstable at cooking temperature.

Structure of aspartame is



Aspartic acid part

Phenylalanine
(methyl ester part)

Q. 73 Aspartame is unstable at cooking temperature, where would you suggest aspartame to be used for sweetening?

Ans. Aspartame is used in cold foods and soft drinks. It is an artifical sweetening agent.
(*Also, refer to Q*. 72)

Q.74 Sodium salts of some acids are very useful as food preservatives. Suggest a few such acids.

Ans. A preservative is naturally occuring or synthetically produced substance that is added to foods to prevent decomposition by microbial growth or by undesirable chemical changes. Sodium salts of same acids are very useful as food preservatives. *Some examples of such acids are as follows*

(i) Benzoic acid in the form of its sodium salt, constitutes one of the most common food preservative. Sodium benzoate is a common preservative in acid or acidified foods such as fruit, juices, pickles etc. Yeasts are inhibited by benzoate to a greater extent than are moulds and bacteria.

(ii) Sorbic acid and its salts (sodium, potassium and calcium) also have preservative activities but the applications of sodium sorbate $C_6H_7NaO_2$ are limited compared to that for potassium salt.

(iii) Sodium erythorbate $C_6H_7NaO_6$ is a food additive used predominate in meats, poultry and soft drinks.

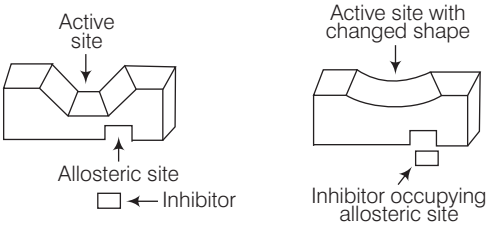
(iv) Sodium propanoate $Na(C_2H_5COO)$ is used in bakery products as mold inhibitor.

Q. 75 Explain the role of allosteric site in enzyme inhibition?

Ans. Some drugs do not bind to the active site of enzymes to inhibit their activities. These bind to a different site of enzyme. This binding of inhibitor (drug) changes the shape of the active site in such a way that substrate cannot recognise it.

The site different from active site of an enzyme where a drug molecule can bind is called the allosteric site.

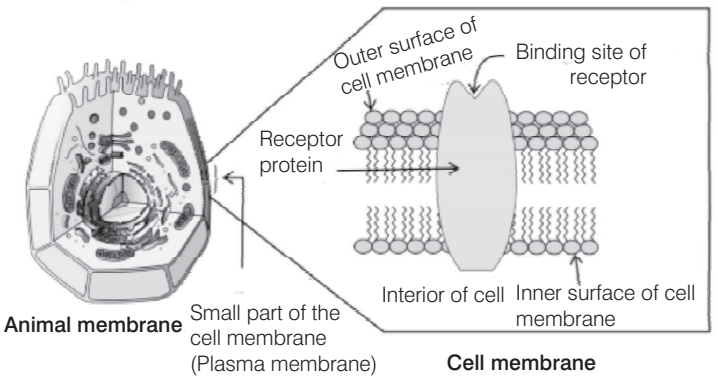
Non-competitive inhibitor changes the active site of enzyme after binding at allosteric site.



Non-competitive inhibitor changes the active site of enzyme after binding at allosteric site

Q. 76 How are receptor proteins located in the cell membrane?

Ans. Receptor proteins are embedded in the cell membrane in such a way that their small part possessing active site projects out of the surface of the it membrane and opens on the outside region of the cell membrane.



Receptor protein embedded in the cell membrane, the active site of the receptor opens on the outside region of the cell

Q.77 What happens when the bond formed between an enzyme and an inhibitor is a strong covalent bond?

Ans. Generally, a weak bond such as H-bonding, van der Waals' interactions, etc., is formed between the enzyme and inhibitor. If a strong covalent bond is formed between the enzyme and the inhibitor which cannot be broken easily, then the enzyme is blocked permanently. The body then degrades the enzyme-inhibitor complex and synthesises the new enzyme.

Matching The Columns

Q. 78 Match the medicines given in Column I with their uses given in Column II.

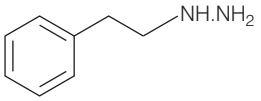
Column I		Column II	
A.	Ranitidine	1.	Tranquilizer
B.	Furacine	2.	Antibiotic
C.	Phenelzine	3.	Antihistamine
D.	Chloramphenicol	4.	Antiseptic
		5.	Antifertility drug

Ans. **A.** → (3) **B.** → (4) **C.** → (1) **D.** → (2)

A. **Ranitidine** It prevents the interaction of histamine with the receptors present in the stomach wall. Thus, it controls the secretion of HCl and pepsin in stomach.

B. **Furacine** Furacine is an antiseptic. It can be applied to the living tissues to kill or to prevent the growth of microorganisms.

C. **Phenelzine** It is also known as Nardil. Its structure is



It is used to treat depression.

D. **Chloramphenicol** It is a broad spectrum antibiotic. It can be given orally in case of typhoid, acute fever, dysentary, certain urinary infections, meningitis and pneumonia.

Q. 79 Match the soaps given in Column I with items given in column II.

Column I		Column II	
A.	Soap chips	1.	dried miniature soap bubbles
B.	Soap granules	2.	small broken pieces of soap formed from melted soaps
C.	Soap powder	3.	soap powder + abrasives + builders (Na_2CO_3 ,Na_3PO_4)
D.	Scouring soap	4.	soap powder + builders like Na_2CO_3 and Na_3PO_4

Ans. **A.** → (2) **B.** → (1) **C.** → (4) **D.** → (3)

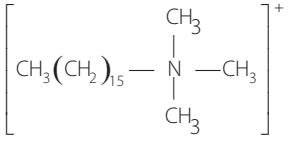
A. Soap chips are made by running a thin sheet of melted soap into a cool cylinder and scraping off the soaps in small broken pieces.

B. Soap granules are dried miniature soap bubbles.

C. Soap powders contain soap powder and builders like sodium carbonate and trisodium phosphate. Builders make the soap act more rapidly.

D. Scouring soaps contain soap powder, a scouring agent (abrasive) such as powdered pumice or finely divided sand and builders.

Q. 80 Match structures given in Column I with the type of detergents given in Column II.

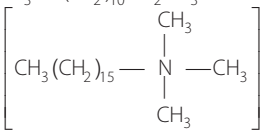
Column I		Column II	
A.	$CH_3(CH_2)_{16}COO(CH_2CH_2O)_n, CH_2CH_2OH$	1.	Cationic detergent
B.	$C_{17}H_{35}COO^-Na^+$	2.	Anionic detergent
C.	$CH_3—(CH_2)_{10}CH_2SO_3^-Na^+$	3.	Nonionic detergent
D.		4.	Soap

Ans. **A.** → (3) **B.** → (4) **C.** → (2) **D.** → (1)

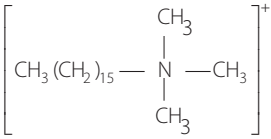
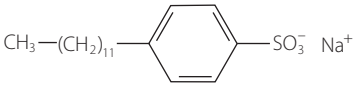
Non-ionic detergent – $CH_3(CH_2)_{16}COO(CH_2CH_2O)_n, CH_2CH_2OH$

Soap – $C_{17}H_{35}COO^-Na^+$

Anionic detergent – $CH_3—(CH_2)_{10}CH_2SO_3^-Na^+$

Cationic detergent – 

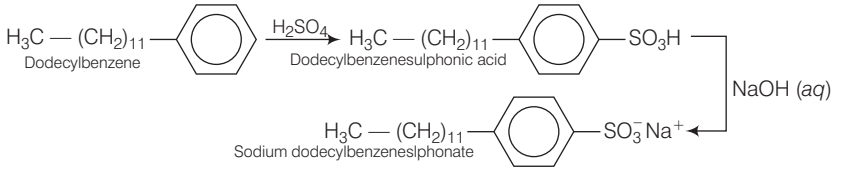
Q. 81 Match the detergents given in Column I with their uses in Column II.

Column I		Column II	
A.		1.	Dishwashing powder
B.		2.	Laundry soap
C.	$C_{17}H_{35}CO\overset{-}{O}\overset{+}{N}a + Na_2CO_3$ + Rosin	3.	Hair conditioners
D.	$CH_3(CH_2)_{16}COO(CH_2CH_2O)_n CH_2 CH_2 OH]$	4.	Toothpaste

Ans. **A.** → (3) **B.** → (4) **C.** → (2) **D.** → (1)

A. Hair shampoos /conditioners are made up of cationic detergents. These are quarternary ammonium salts of amines with chlorides, bromides or acetates, *e.g.,* cetyltrimethyl ammonium bromide.

B. Anionic detergents are used in toothpaste *e.g.,* sodium dodecyl benzene sulphonate. It can be prepared as follows



C. Laundary soaps contain fillers like soidum rosinate. Sodium silicate, borax and sodium carbonate. Sodium rosinate makes the soap to lather well.

D. Dishwashing powder are non–ionic detergents

$$\underset{\text{Stearic acid}}{CH_3—(CH_2)_{16}—COOH} + HO—\underset{\text{Polyethylene glycol}}{(CH_2CH_2O)_n—CH_2—CH_2OH} \xrightarrow{-H_2O}$$

$$H_3C—(CH_2)_{16}\ COO\ (CH_2\ CH_2O)_nCH_2CH_2OH$$

Q. 82 Match the class of compounds given in Column I with their functions given in Column II.

Column I		Column II	
A.	Antagonists	1.	Communicate message between two neurons and that between neurons to muscles.
B.	Agonists	2.	Bind to the receptor site and inhibit its natural function.
C.	Chemical messenger	3.	Crucial to body's communication process.
D.	Inhibitors	4.	Mimic the natural messenger.
E.	Receptors	5.	Inhibit activities of enzymes.

Ans. **A.** → (2) **B.** → (4) **C.** → (1) **D.** → (5) **E.** → (3)

A. **Antagonist** drugs are used when blocking of message is required. *e.g.,* dopamine antagonist is a drug which blocks the dopamine receptors by receptor antagonism.

B. **Agonist** drugs are useful when there is lack of chemical messenger. *e.g.,* heroin.

C. These **chemical messengers** are received at the binding sites of receptor. These communicate message between two neurons and that between neurons to muscles.

D. **Inhibitors** block the binding site of the enzyme and prevent the binding of the substrate, or inhibit the catalytic activity of the enzyme.

E. **Receptors** are proteins that are crucial to body's communication. They are embedded in the cell membrane in such a way that their small part possessing active site projects out of the surface of the membrane and opens on the outside region of the cell membrane.

Q. 83 Match the classes of drugs given in Column I with their action given in Column II.

Column I		Column II	
A.	Analgesics	1.	Inhibit the growth of microorganisms can be given orally
B.	Antiseptics	2.	Treatment of stress
C.	Antihistamines	3.	Applied to inanimate objects
D.	Antacids	4.	Prevents the interaction of histamine with its receptor
E.	Tranquilizers	5.	Pain killing effect
F.	Antibiotics	6.	Applied to diseased skin surfaces
G.	Disinfectants	7.	Treatment of acidity

Ans. **A.** → (5) **B.** → (6) **C.** → (4) **D.** → (7) **E.** → (2) **F.** → (1) **G.** → (3)

A. **Analgesics** reduce or abolish pain without causing impairment of consciousness, mental confusion, in coordination or paralysis or some other disturbances of nervous system, *e.g.,* aspirin.

B. **Antiseptics** are the chemicals which either kill or prevent the growth of mircoorganisms. They are applied to living tissues such as wounds, cuts etc., *e.g.,* tincture of iodine.

C. **Antihistamines** are anti-allergic drugs. These drugs interfere with the natural action of histamine by competing with histamine for binding sites of receptor where histamine exerts its effect. *e.g.,* seldane.

D. **Antacids** are used to neutralise excess of acid released in stomach *e.g.,* mixture of $Mg(OH)_2$ and $Al(OH)_3$.

E. **Tranquilizers** are used for the treatment of stress, and mild or even severe mental diseases *e.g.,* equanil.

F **Antibiotics** are antimicrobial drugs. Antibiotics are used as drugs to treat infections because of their low toxicity for humans and animals *e.g.,* chloramphenicol.

G. **Disinfectants** are the chemicals which either kill or prevent the growth of microorganisms but they can be applied on non-living objects *e.g.,* 1 per cent solution of phenol.

Assertion and Reason

In the following questions a statement of assertion (A) followed by a statement of reason (R) is given. Choose the correct answer out of the following choices.

(a) Assertion and reason both are correct statements but reason does not explain assertion.

(b) Assertion and reason both are correct and reason explains the assertion.

(c) Both assertion and reason are wrong statements.

(d) Assertion is correct statement reason is wrong statement.

(e) Assertion is wrong statement reason is correct statement.

Q. 84 **Assertion** (A) Penicillin (G) is an antihistamine.
Reason (R) Penicillin (G) is effective against gram positive as well as gram negative bacteria.

Ans. ***(c)*** Both assertion and reason are wrong statements. **Correct assertion** Penicillin (G) is an antibiotic.
Correct reason Penicillin is effective against some gram positive bacteria.

Q. 85 **Assertion** (A) Sulpha drug contain sulphonamide group.
Reason (R) Salvarsan is a sulpha drug.

Ans. ***(d)*** Asssertion is correct statement reason is wrong statement. **Correct reason** Salvarsan is a antibacterial but does not contain sulphonamide group.

Q. 86 **Assertion** (A) Receptors are crucial to body's communication process.
Reason (R) Receptors are proteins.

Ans. ***(a)*** Assertion and reason both are correct statements but reason does not explain assertion. **Correct Explanation** Neurotransmitters are small molecules which bind to the receptor for a very short time to transfer message to it and depart quickly unchanged after transferring the message. The receptor then forwards the message inside the cell.

Q. 87 **Assertion** (A) Enzymes have active sites that hold substrate molecule for a chemical reaction.

Reason (R) Drugs compete with natural substrate by attaching covalently to the active site of enzyme.

Ans. *(d)* Assertion is correct statement reason is wrong statement **Correct reason** Drug compete with natural substrate by attaching by weak bonds such as hydrogen bond, van der Waals', interaction and ionic bonding etc., to the active site of the enzyme.

Q. 88 **Assertion** (A) Chemical messengers are chemicals that enable communication of message between two neurons or between neurons and muscles.

Reason (R) Chemicals enter the cell through receptor.

Ans. *(d)* Assertion is correct statement reason is wrong statement. **Correct reason** Chemicals bind to the receptor sites present on the surface of the membrane or the cell. They give message to the cell without entering the cell.

Q. 89 **Assertion** (A) Transparent soaps are made by dissolving soaps in ethanol.

Reason (R) Ethanol makes things invisible.

Ans. *(d)* Assertion is correct statement reason is wrong statement. **Correct reason** Ethanol removes air and moisture which scatter light.

Q. 90 **Assertion** (A) Sodium chloride is added to precipitate soap after saponification.

Reason (R) Hydrolysis of esters of long chain fatty acids by alkali produces soap in colloidal form.

Ans. *(b)* Assertion and reason both are correct and reason explains the assertion. Sodium chloride is added to precipitate soap after saponification because hydrolysis of esters of long chain fatty acids by alkali produces soap in colloidal form.

Q. 91 **Assertion** (A) Competitive inhibitors compete with natural substrate for their attachment on the active sites of enzymes.

Reason (R) In competitive inhibition, inhibitor binds to the allosteric site of the enzyme.

Ans. *(d)* Assertion is correct statement reason is wrong statement. **Correct reason** In competitive inhibition, inhibitor binds to the active site of the enzyme.

Q. 92 **Assertion** (A) Non-competitive inhibitor inhibits the catalytic activity of enzyme by binding with its active site.

Reason (R) Non-competitive inhibitor changes the shape of the active site in such a way that substrate can't recognise it.

Ans. *(e)* Assertion is wrong statement reason is correct statement. **Correct** assertion Non-competitive inhibitor inhibits the catalytic activity by binding the enzyme at allosteric site.

Q. 93 **Assertion** (A) Chemical messenger gives message to the cell without entering the cell.
Reason (R) Chemical messenger is received at the binding site of receptor proteins.

Ans. *(b)* Assertion and reason both are correct and reason explains the assertion. Chemical messenger gives message to the cell without entering the cell because it is received at the binding site of receptor proteins.

Q. 94 **Assertion** (A) Receptor proteins show selectivity for one chemical messenger over the other.
Reason (R) Chemical messenger binds to the receptor site and inhibits its natural function.

Ans. *(d)* Assertion is correct statement reason is wrong statement. **Correct reason** Chemical messenger binds the receptor site and gives the message to the cell without entering the cell.

Q. 95 **Assertion** (A) All chemicals added to food items are called food preservatives.
Reason (R) All these chemicals increase the nutritive value of the food.

Ans. *(c)* Both assertion and reason are wrong statements. **Correct assertion** Chemicals which are used to protect food against bacteria, yeasts and moulds are called food preservatives.
Correct reason Preservatives do not increase the nutritive values of food.

Q. 96 **Assertion** (A) Preservative are added to food items.
Reason (R) Preservatives inhibit the growth of mircroorganisms.

Ans. *(b)* Assertion and reason both are correct and reason explains the assertion.
Preservatives are added to food items because it inhibit the growth of microorganisms.

Q. 97 **Assertion** (A) Artificial sweeteners are added to the food to control the intake of calories.
Reason (R) Most of the artificial sweeteners are inert and do not metabolise in the body.

Ans. *(b)* Assertion and reason both are correct and reason explains the assertion. Aritificial sweeteners are added to the food to control the intake of calories because most of the artificial sweeteners are inert and do not metabolise in the body.

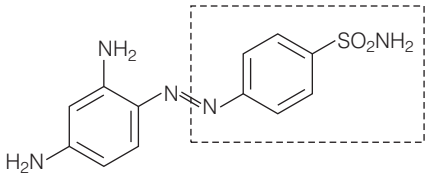
Long Answer Type Questions

Q. 98 In what respect do prontosil and salvarsan resemble. Is there any resemblance between azo dye and prontosil? Explain.

Ans. Prontosil, also called sulfamido chrysoidine, trade name of the first synthetic drug used in the treatment of general bacterial infections in humans.

Prontosil resulted from research, directed by German chemist and pathologist Gerhard Domagk, on the antibacterial action of azo dyes. A red azo dye of low toxicity, prontosil was shown by Domagk to prevent mortality in mice infected with Streptococcus bacteria.

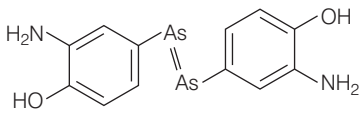
The dye was also effective in controlling staphylococcus infections in rabbits. Within a relatively short period, it was demonstrated that prontosil was effective not only in combating experimental infections in animals but also against Streptococcal disease in humans, including meningitis and puerperal sepsis. Structural formula of prontosil is



Prontosil

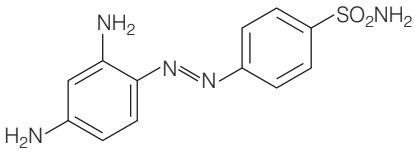
From the structure of prontosil, it is very clear that it has — N = N — linkage. It was discovered that the part of the structure of prontosil molecule shown in box, *i.e.*, p-aminobenzenesulphonamide has antibacterial activity.

Salvarsan is also known as arsphenamine. It was introduced at the begining of 1910s as the first effective treatment for syphilis. It is an organoarsenic molecule and has –As = As– double bond.



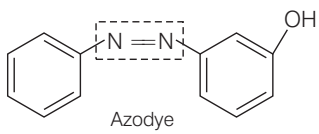
Salvarsan

Salvarsan and prontosil show similarity in their structure. Both of these drugs are antimicrobials. Salvarsan contains — As = As — linkage whereas prontosil has —N = N— linkage.



Prontosil

Prontosil (a red azo dye) and azo dye both have — N = N — linkage.



Azodye

Q. 99 How do enzymes catalyse a chemical reaction in the living system? Explain drug target interaction taking the example of enzyme as target.

Ans. *In the catalytic activity, enzymes perform the following two major functions*

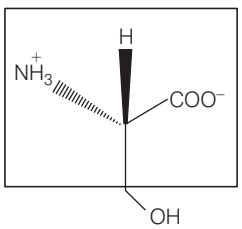
(i) The first function of an enzyme is to hold the substrate molecule for a chemical reaction. the active sites of the enzymes hold the substrate molecule in a suitable position, so that it can be attacked by the reagent effectively.

The substrate molecules bind to the amino acid residues of the protein present the active site of the enzyme through a variety of interactions such as hydrogen bonding, dipole-dipole interactions, van der Waals' interactions and ionic bonding.

These binding forces should be strong enough to hold the substrate long enough so that the enzyme can catalyse the reaction, but weak enough to allow the products to depart after their formation.

(ii) The second function of the enzyme is to provide functional groups which will attack the substrate to carry out the chemical reaction. This function is carried out by some other amino acid residues of protein present on the active site of the enzyme.

These provide free amino groups to attack the substrate and bring about the chemical reaction. If the amino acid serine is present nearby the substrate held on the active site, then its – OH group is free to act as a nucleophile in the enzyme catalysed reaction.



L-serine

The part of the amino acid which lies outside the box act as a nucleophile in enzyme catalysed reactions, but the part of the amino acid which is enclosed in the box is involved in the formation of peptide bond in protein molecule.

Q. 100 Sythetic detergents have advantage over usual soaps as far as cleansing power is concerned. But use of synthetic detergents over a long time creates environmental pollution. How can the pollution caused by synthetic detergents be minimised? Classify the detergents according to their chemical nature.

Ans. Synthetic detergents are cleansing agents which have all the properties of soaps, but which actually do not contain any soap. These can be used in soft as well as in hard water.

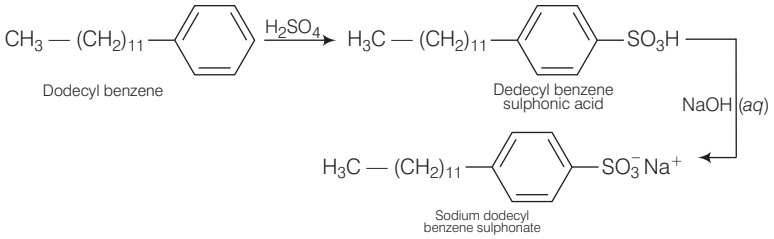
They are mainly classified into three categories

(1) **Anionic Detergents**

Anionic detergents are sodium salts of sulphonated long chain alcohols or hydrocarbons. Alkyl hydrogen sulphates formed by treating long chain alcohols with conc. H_2SO_4 are neutralised with alkali to form anionic detergents. Similarly alkyl benzene sulphonates are obtained by neutralising alkyl benzene sulphonic acids with alkali.

$$\underset{\text{Lauryl alcohol}}{CH_3(CH_2)_{10}\,CH_2OH} \xrightarrow{H_2SO_4} \underset{\text{Laurylhydrogen sulphate}}{CH_3\,(CH_2)_{10}\,CH_2O\,SO_3H} \xrightarrow{NaOH\ (aq)}$$

$$\underset{\substack{\text{Sodium Lauryl sulphate}\\ \text{(Anionic detergent)}}}{CH_3(CH_2)_{10}CH_2O\bar{S}O_3\,Na^+}$$



Dodecyl benzene

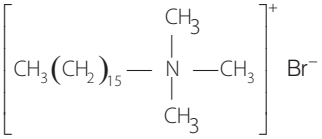
Dedecyl benzene sulphonic acid

Sodium dodecyl benzene sulphonate

In these detergents, the anionic part of the molecule is involved in the cleansing action. They are mostly used for house hold work. They are also used in toothpaste.

(2) **Cationic Detergents**

They are quarternary ammonium salts of amines with acetates, chlorides or bromides as anions. Cationic part possess a long hydrocarbon chain and a positive charge on nitrogen atom. Cetyltrimethylammonium bromide is a popular cationic detergent and is used in hair conditioners.



Cationic detergents have germicidal properties and are expensive, therefore, these are of limited use.

(3) **Non-ionic Detergents**

Non-ionic detergents do not contain any ion in their constitution. One such detergent is formed when stearic acid reacts with polyethylene glycol.

$$\underset{\text{Stearic acid}}{H_3C\text{–}(CH_2)_{16}COOH} + \underset{\text{Polyethyleneglycol}}{HO(CH_2CH_2O)_nCH_2CH_2OH} \xrightarrow{-H_2O}$$

$$\underset{\text{Polyethyleneglycol stearate}}{CH_3(CH_2)_{16}COO(CH_2CH_2O)_nCH_2CH_2OH}$$

Liquid dishwashing detergents are non-ionic type

Advantages of Synthetic Detergents over Soaps

(i) Synthetic detergents can be used in hard water without any wastage while some of the soaps gets wasted.

(ii) Synthetic detergents can be used in acidic medium while soaps get precipitated.

(iii) Synthetic detergents are more soluble in water and hence produce lather more easily than soaps. Some synthetic detergents produce lather even in ice cold water.

(iv) Synthetic detergents decrease the surface tension of water to greater extent and hence have a stronger cleansing action than soap.

Synthetic detergents have advantages over usual soaps but use of synthetic detergents over a long time creates environmental pollution because some detergents have highly branched hydrocarbon chains.

These branches or side chains stop bacteria from attacking and breaking the chains. This result in slow degradation of detergent molecule leading to their accumulation. Effluents containing these detergents reach the rivers, ponds etc. These persist in water even after sewage treatment and thus water gets polluted.

Since, unbranched (*i.e.,* straight) chains are more prone to attack by bacteria, therefore, in most of the detergents used these days, the branching is kept to a minimum, so that the detergents become easily biodegradable and hence pollution is prevented.

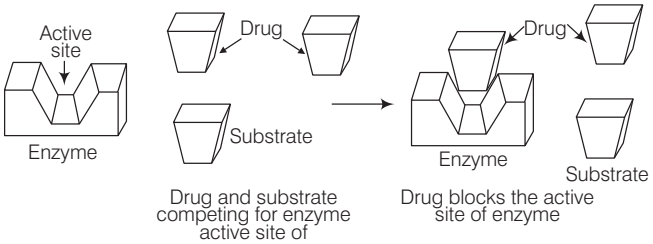
Q. 101 What are enzyme inhibitors ? Classify them on the basis of their mode of attachments on the active site of enzymes. With the help of diagrams explain how do inhibitors inhibit the enzymatic activity.

Ans. Enzymes are responsible to hold the substrate molecule for a chemical reaction and they provide functional groups which will attack the substrate to carry out the chemical reaction. Drugs which inhibit any of the two activities of enzymes are called enzyme inhibitors.

Enzyme inhibitors can block the binding site thereby preventing the binding of the substrate to the active site and hence inhibiting the catalytic activity of the enzyme.

Drugs inhibit the attachment of natural substrate on the active site of enzymes in two different ways as explained below

(i) Drugs which compete with natural substrate for their attachment on the active sites of enzymes are called competitive inhibitors.



(ii) Some drugs, however, do not bind to the active site but bind to a different site of the enzyme which is called allosteric site. This binding of the drug at allosteric site changes the shape of the active site of the enzyme in such a way that the natural substrate cannot recognise it. Such enzymes are called non-competitive inhibitors.