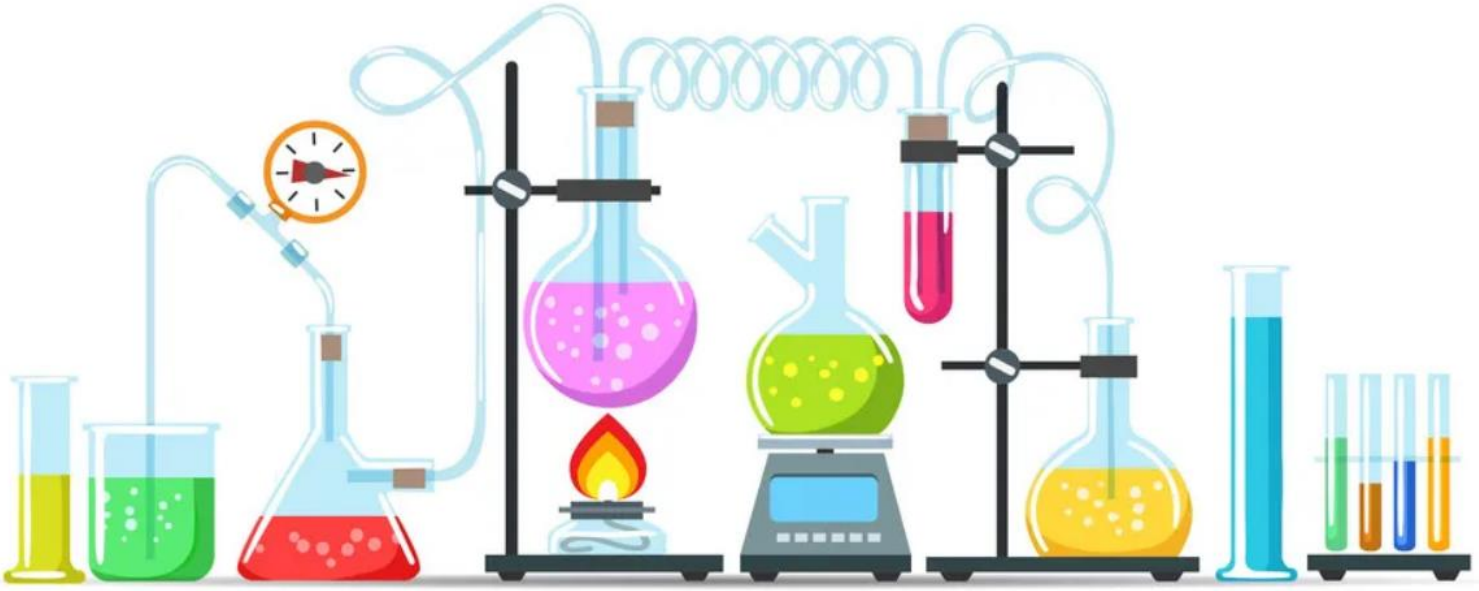
CHEMISTRY

CHAPTER 16: CHEMISTRY IN EVERYDAY LIFE



CHEMISTRY IN EVERYDAY LIFE

Introduction:

In this Unit, we shall learn the application of Chemistry in three important and interesting areas, namely–medicines, food materials and cleansing agents. For cleanliness, we use soaps, detergents, toothpastes, bleaches etc., which all are made up of chemical compounds.

Similarly, Clothes (Cotton, Wool, Silk, Terylene), Food materials (Carbohydrates, Proteins, Oil, Fats), Medicines (Antibiotics, Antimalarials etc.), Explosives, Fuels, Rocket propellants, Building materials etc. are all chemical compounds or derived from them.

Importance of Chemistry in our daily life: Medicines

A drug is a chemical agent, which affects human metabolism and provides cure from ailment.

Or Drugs are chemicals which interact with macromolecular targets and produce a biological response.

Drugs will interact with macromolecules targets (where these targets are chemical compounds like proteins, lipids etc.) in order to maintain balance in the body.

When the biological response is therapeutic and useful, these chemicals are called medicines and are used in diagnosis, prevention and treatment of diseases.

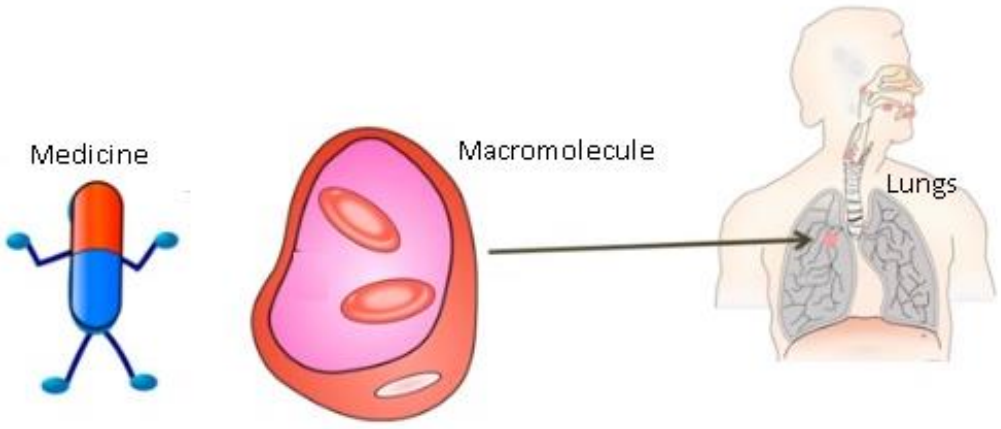
Medicines are sub classification of the drugs. They produce good response and they are useful in order to diagnosis, prevention and treatment of diseases.

If taken in doses higher than those recommended, most of the drugs used as medicines are potential poisons.

Use of chemicals for treatment and cure of disease is called chemotherapy.

The treatment of disease by chemical compound which destroy the microorganisms without attacking the tissue of the human body is known as chemotherapy.

The compounds used are called chemotherapeutic agents.



Drugs and their Classification:

Drugs are chemicals of low molecular masses (~100-500u). They produce biological response by interacting with macromolecular targets. If the biological response is therapeutic and useful, these chemicals are called medicines. They are used in diagnosis, prevention and treatment of diseases.

Classification of Drugs

Drugs can be classified mainly on the basis of following criteria:

(i) On the basis of pharmacological effect

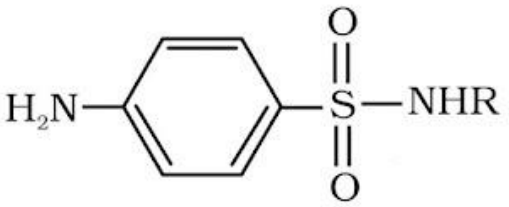
It is useful for doctors because it provides them whole range of drugs available for treatment of particular type of problem. Eg.- Analgesic - Shows pain killing effect. Antiseptic - Kill or arrest the growth of microorganisms.

(ii) On the basis of drug action

It is based on action of drug on a particular biochemical process. Eg.- Histamines causes inflammation in the body and there are various ways in which action of histamines can be blocked. All antihistamines inhibit the action of the histamines.

(iii) On the basis of chemical structure

It is based on chemical structure of the drug. Often drugs with common structural features, have similar pharmacological activity. Sulphonamides have common structural feature as shown above. Eg.



(iv) On the basis of molecular targets

Drug possessing some common structural features, may have same mechanism of action on targets. These target molecules or drug targets are usually biomolecules such as carbohydrates, lipids, proteins and nucleic acids.

Drug-Target Interaction:

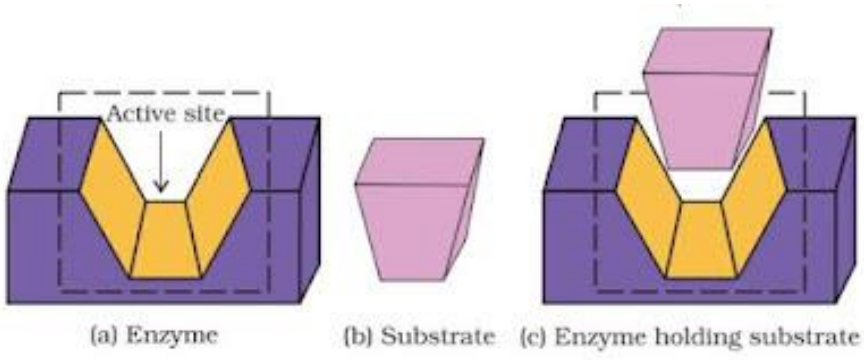
Macromolecules of biological origin perform various functions in the body. **For example**, Proteins which perform the role of biological catalyst in the body are called enzymes, those which are crucial to communication system in the body are called **receptors**. Carrier proteins carry polar molecules across the cell membrane. Nucleic acids have coded genetic information for the cell.

Enzymes as Drug Targets

(i) Catalytic action of enzymes

Enzymes perform two major functions :

a) The first function of enzyme is to hold the substrate for chemical reaction. Enzymes have active sites, which hold the substrate molecule in a suitable position. The substrate can bind through enzyme by interactions such as ionic bonding, hydrogen bonding, van der Waals interaction or dipole-dipole interaction.



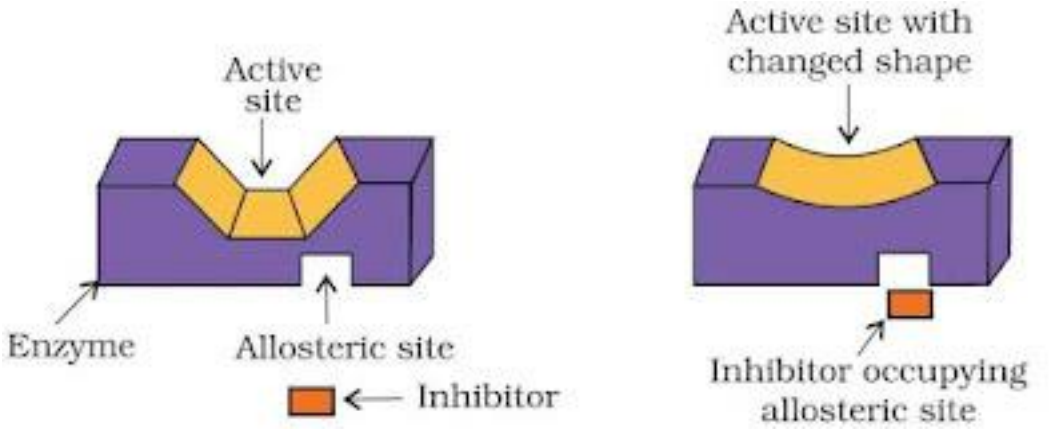
b) The second function of enzyme is to provide functional groups that will attack the substrate and carry out chemical reaction.

(ii) Drug-enzyme interaction

Enzyme inhibitors- Drugs can inhibit the activities of enzymes. They can block the binding site of the enzyme, thus prevent the binding of substrate or they can inhibit the catalytic activity of the enzyme. Drug can inhibit the attachment of substrate on active size of enzymes in following two ways :

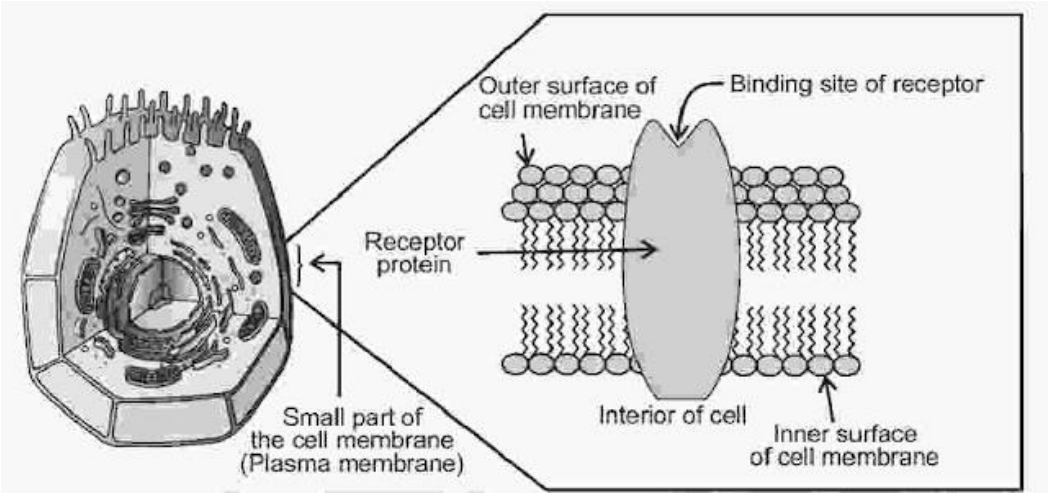
a) **Competitive inhibitors :** These are drugs which compete with natural substrate for their attachment on the active site of enzymes.

b) **Non-competitive inhibitors :** These drugs do not bind to the enzyme's active site, rather bind to a different site of enzyme called Allosteric site and changes the shape of active site in such a way that substrate can't recognise it.



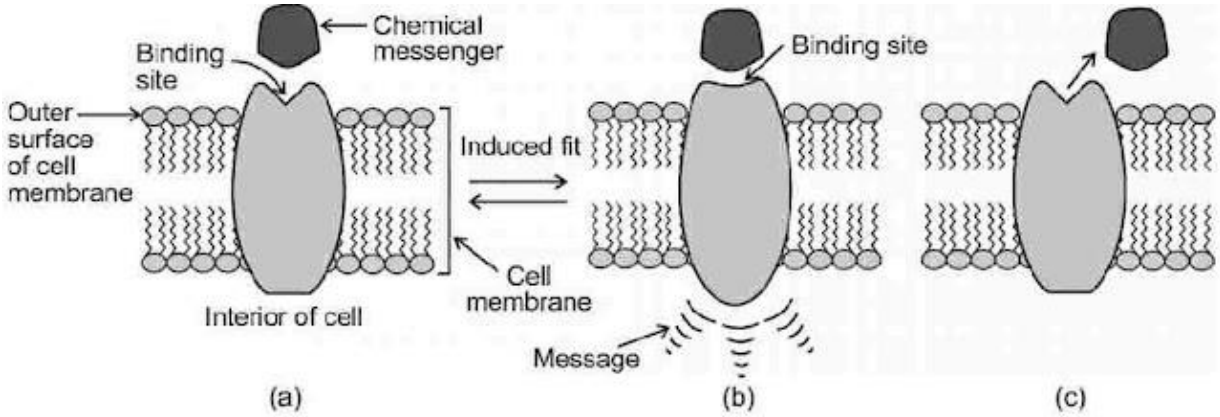
Receptors as Drug Targets

Receptors are proteins that are crucial to body's communication process. Receptor proteins are embedded in cell membranes 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.



Chemical Messengers are the chemicals in the body, through which message between two

neurons or that between neurons to muscles is communicated. They are received at binding sites of receptor proteins. To accommodate a messenger, shape of receptor site changes and brings about the transfer of message into the cell. Thus, chemical messenger give message to the cell without entering the cell.



Drugs that bind to the receptor site and inhibit its natural function are called **antagonists**. These are useful when blocking of message is required. There are other types of drugs that mimic the natural messenger by switching on the receptor, these are called **agonists**. These are useful when there is lack of natural chemical messenger.

Therapeutic Action of Different Classes of Drugs:

Few important classes of drugs are :

1. Antacids

Over production of acid in stomach causes pain and irritation and in severe cases ulcers are developed. Antacids such as sodium hydrogen carbonate or mixture of aluminium and magnesium hydroxide was used. But taking excess hydrogen carbonate makes the stomach alkaline and trigger the production of even more acid. Metal hydroxides are better antacids, as they are insoluble and do not increase the pH above neutrality.

2. Antihistamines

Histamine is a potent vasodilator. It has various functions, like contraction of smooth muscles in the bronchi and gut and relaxing other muscles such as those in walls of fine blood vessels. Histamines are also responsible for nasal congestion associated with common cold and allergic response to pollen. Synthetic drug brompheniramine (Dimetapp) and terfenadine (Seldane) act as antihistamines.

3. Neurologically Active Drugs

(i) Tranquilizers : They affect the message transfer mechanism from nerve to receptor. They are class of chemical compounds used for treatment of stress, mild or even severe mental diseases. They form essential component of sleeping pills. They relieve anxiety,

stress, irritability or excitement by including sense of well being. Examples, Chlordiazepoxide, meprobamate are mild tranquilizers suitable for relieving tension.

(ii) Analgesics : They reduce or abolish pain without causing impairment of consciousness, mental confusion, incoordination or paralysis or some other disturbances of nervous system. They are classified as :

a) Non-narcotic (non-addictive) analgesics : Example- Aspirin, Paracetamol.

b) Narcotic analgesics : Example- Morphine and its homologues like Heroin, Codeine etc.

4. Antimicrobials

They destroy or prevent development or inhibit the pathogenic action of microbes such as bacteria (by antibacterial drug), fungi (by antifungal agents), virus (by antiviral agents) or other parasites (antiparasitic drugs) selectively.

Antibiotics : These are drugs used to cure infections because of low toxicity for humans and animals. Initially, they were classified as chemical substances produced by microorganisms, that inhibit the growth or even destroy other microorganisms.

5. Antiseptic and Disinfectants

They are chemicals which either kill or prevent growth of microorganisms.

Antiseptics

They are applied to living tissues such as wounds, cuts, ulcers and diseased skin surfaces. They are not ingested like antibiotics. Examples are :

i. Furacine, Soframycin.

ii. Dettol, which is a mixture of chloroxylenol and terpineol.

iii. Bithionol, which is added to soaps to impart antiseptic properties.

iv. Iodine, which a powerful antiseptic, is a 2-3% solution in alcohol-water mixture, also known as tincture of iodine.

v. Iodoform, which is also used as antiseptic for wounds.

Disinfectants

They are applied to inanimate objects such as floors, instruments, drainage system etc. Same substance can act as antiseptic as well as disinfectant by varying its concentration. For example, 0.2% solution of phenol is an antiseptic but 1% solution of phenol is disinfectant.

6. Antifertility Drugs

They are used in direction of birth control and in family planning. Birth control pills essentially contains a mixture of synthetic estrogen and progesterone derivatives. Both of these compounds are hormones. Progesterone suppresses ovulation. Synthetic progesterone derivatives are more potent than progesterone. Example, Norethindrone a synthetic

progesterone derivative, has antifertility action.

Chemicals in Food:

Chemicals are added to food for (i) their preservation, (ii) enhancing their appeal, and (iii) adding nutritive value in them. Main categories of food additives are as follows:

- Food colours
- Flavours and sweeteners
- Fat emulsifiers and stabilising agents
- Flour improvers- antistalling agents and bleaches
- Antioxidants Preservatives
- Nutritional supplements like minerals, vitamins and amino acids.

1. Artificial Sweetening Agents

They are as sweet as sugar, but have no or less calories, whereas natural sweeteners e.g., sucrose add to calorie intake. It is used by a diabetic person and those who want to control their intake of calories. Ortho-sulphobenzimide, called saccharin is the first popular artificial sweetening agent, which is about 550 times as sweet as cane sugar. It is excreted from the body in urine unchanged. It is harmless and appears to be entirely inert.

Other examples are :

(i) Aspartame: It is the most successful and widely used sweetener. It is roughly 100 times as sweet as cane sugar. It is methyl ester of dipeptide formed from aspartic acid and phenylalanine. As it is unstable at cooking temperature, its use is limited to cold foods and soft drinks.

(ii) Alitame : It is a high potency sweetener, more stable than aspartame. But control of sweetness of food is difficult while using it.

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

Food Preservatives

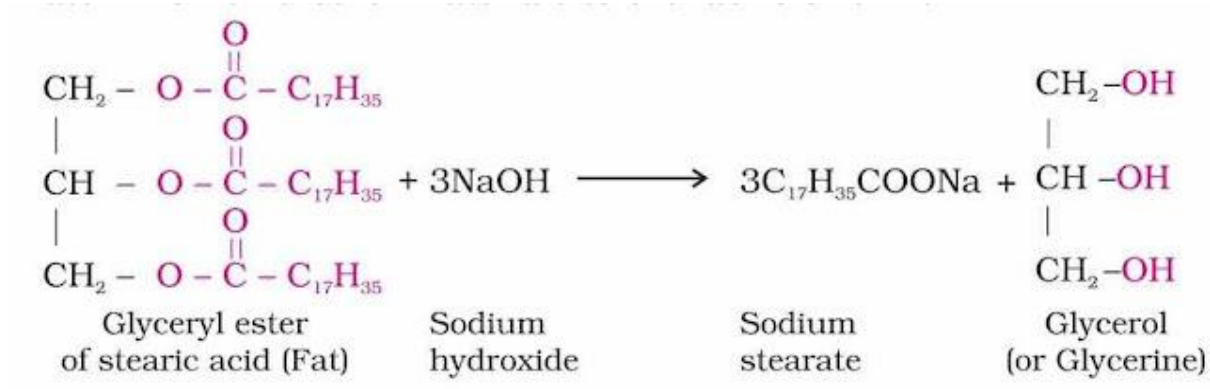
They prevent spoilage of food due to microbial growth. Commonly used preservatives are table salt, sugar, vegetable oils, sodium benzoate (C_6H_5COONa), salts of sorbic acid and propanoic acid. Sodium benzoate is used in limited quantities and is metabolised in the body.

Cleansing Agents

They improve cleansing properties of water and help in removal of fats which bind other

materials to the fabric or skin. They include-

Soaps: Soaps used for cleaning purpose are sodium or potassium salts of long chain fatty acids e.g., stearic, oleic and palmitic acids. Soaps containing sodium salts are formed by heating fat (i.e., glyceryl ester of fatty acid) with aqueous sodium hydroxide solution. This reaction is known as saponification.



In this reaction, esters of fatty acids are hydrolysed and soap obtained remains in colloidal form. It is precipitated from solution by adding sodium chloride. The solution left after removing soap contains glycerol and can be recovered by fractional distillation.

Types of Soaps

(i) Toilet Soaps : They are prepared by using better grades of fats and oils and excess of alkali is removed. Colour and perfumes are added to make these more attractive.

(ii) Transparent Soaps : They are made by dissolving the soap in ethanol and then evaporating the excess solvent.

(iii) Medicated Soaps : Substances of medicinal values are added.

(iv) Shaving Soaps : Contain glycerol to prevent rapid drying. A gum called, rosin is added while making, it forms sodium rosinate which lathers well.

(v) Laundry Soaps : These contains fillers like sodium rosinate, sodium silicate, borax and sodium carbonate.

Why soaps do not work in hard water?

As we know that hard water contains calcium and magnesium ions which forms insoluble salts with soaps, that gets separated as scum in water.

$$2C_{17}H_{35}COONa + CaCl_2 \longrightarrow 2NaCl + (C_{17}H_{35}COO)2Ca$$

In fact, the scum so separated offers hinderance to soap action as the precipitate adheres onto the fabric as gummy mass. Also, the hair washed with hard water looks dull because of this sticky precipitate. Similarly, dyes do not absorb evenly on cloth washed with soap using hard water.

Limitations of Detergents

The problem of using detergents is that if their hydrocarbon chain is highly branched, then bacteria cannot degrade this easily and their slow degradation leads to their accumulation. Effluents containing such detergents reach rivers, ponds etc. and persist in water even after sewage treatment. This cause foaming in rivers, ponds and streams which pollutes the water.

Now a days, the branching of hydrocarbon chain is controlled and kept to the minimum. Unbranched chains can be biodegraded more easily and hence pollution is prevented.

Antimicrobials

Antimicrobials

Diseases 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.

Antibiotics, antiseptics and disinfectants are antimicrobial drugs.

Antibiotics

Antibiotics are used as drugs to treat infections because of their low toxicity for humans and animals.

An antibiotic is a substance produced wholly or partly by chemical synthesis, which in low concentrations inhibits the growth or destroys microorganisms by intervening in their metabolic processes.

In order to find chemicals this will affect the invading bacteria and not the host.

Paul Ehrlich, a German bacteriologist, conceived this idea. He investigated arsenic based structures in order to produce less toxic substances for the treatment of syphilis.

He developed the medicine, arsphenamine, known as salvarsan.

Although salvarsan is toxic to human beings, its effect on the bacteria, spirochete, which causes syphilis, is much greater than on human beings.

He noted that there is similarity in structures of salvarsan and azodyes. The –As = As– linkage present in arsphenamine resembles the –N = N – linkage present in azodyes in the sense that arsenic atom is present in place of nitrogen.

In 1932, he succeeded in preparing the first effective antibacterial agent, prontosil, which resembles in structure to the compound, salvarsan. Soon it was discovered that in the body prontosil is converted to a compound called sulphanilamide, which is the real active compound. Thus the sulpha drugs were discovered.

A large range of sulphonamide analogues was synthesised. One of the most effective is sulphapyridine.

Despite the success of sulphonamides, the real revolution in antibacterial therapy began with the discovery of Alexander Fleming in 1929, of the antibacterial properties of a Penicillium fungus.

Antibiotics have either cidal (killing) effect or a static (inhibitory) effect on microbes.

A few examples of the two types of antibiotics are as follows:

Bactericidal	Bacteriostatic
Penicillin	Erythromycin
Aminoglycosides	Tetracycline
Ofloxacin	Chloramphenicol

Antibiotics which kill or inhibit a wide range of Gram-positive and Gram-negative bacteria are said to be broad spectrum antibiotics.

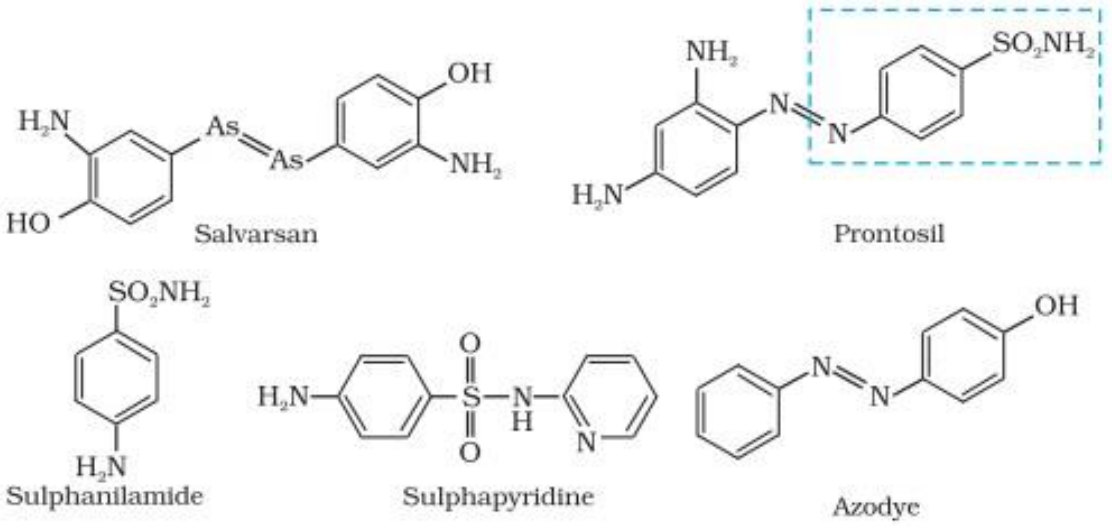
Those are effective mainly against Gram-positive or Gram-negative bacteria are narrow spectrum antibiotics.

If effective against a single organism or disease, they are referred to as limited spectrum antibiotics.

Penicillin G has a narrow spectrum. Ampicillin and Amoxicillin are synthetic modifications of penicillin's. These have broad spectrum.

It is absolutely essential to test the patients for sensitivity (allergy) to penicillin before it is administered.

In India, penicillin is manufactured at the Hindustan Antibiotics in Pimpri and in private sector industry.



The structures of salvarsan, prontosil azodye and sulphapyridine showing structural similarity.

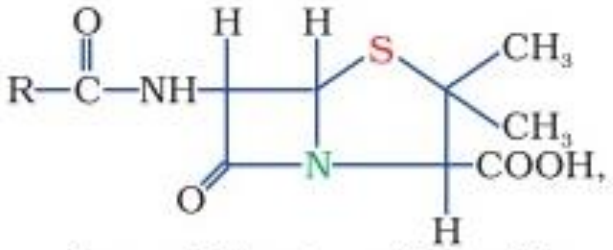
Chloramphenicol

Chloramphenicol, isolated in 1947, is a broad spectrum antibiotic.

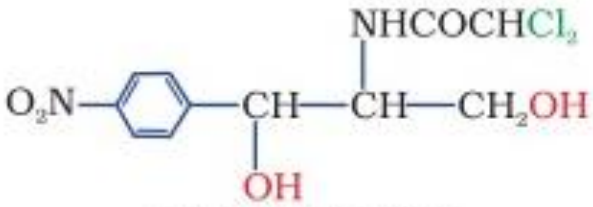
It is rapidly absorbed from the gastrointestinal tract and hence can be given orally in case of typhoid, dysentery, and acute fever, certain form of urinary infections, meningitis and pneumonia.

Vancomycin and ofloxacin are the other important broad spectrum antibiotics.

The antibiotic dysidazirine is supposed to be toxic towards certain strains of cancer cells.



General Sturcture of Pencillin

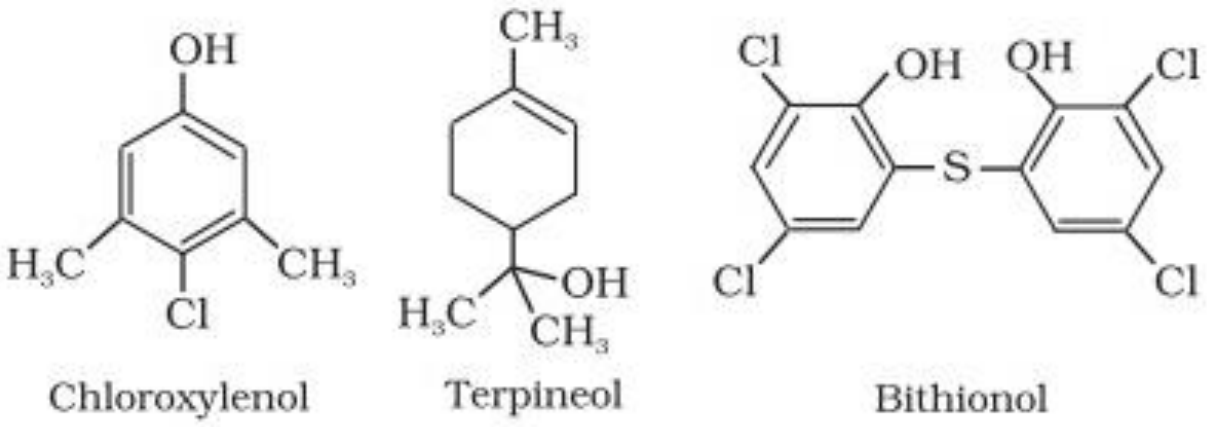


Chloramphenicol

Antiseptics & disinfectants

- Antiseptics are applied to the living tissues such as wounds, cuts, ulcers and diseased skin surfaces.
- Examples are furacine, soframicine, etc. These are not ingested like antibiotics.
- Commonly used antiseptic, Dettol is a mixture of chloroxylenol and terpineol.

- Bithionol (the compound is also called bithionol) is added to soaps to impart antiseptic properties.
- Iodine is a powerful antiseptic. Its 2-3 per cent solution in alcohol water mixture is known as tincture of iodine.
- It is applied on wounds.
- Iodoform (CHI3) is also used as an antiseptic for wounds.
- Boric acid in dilute aqueous solution is weak antiseptic for eyes.



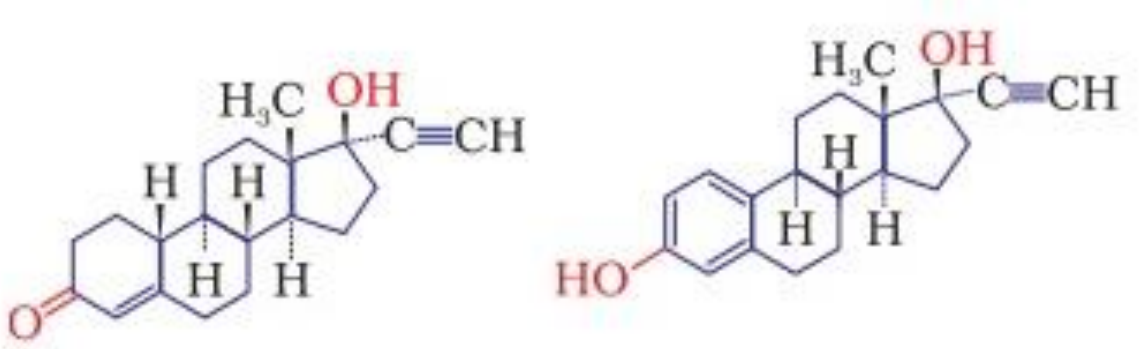
Chloroxylenol Terpineol Bithionol

Disinfectants

- They are applied to inanimate objects such as floors, drainage system, instruments, etc. Same substances can act as an antiseptic as well as disinfectant by varying the concentration.
- For example, 0.2 per cent solution of phenol is an antiseptic while its one percent solution is disinfectant.
- Chlorine in the concentration of 0.2 to 0.4 ppm in aqueous solution and sulphur dioxide in very low concentrations, are disinfectants.

Antifertility Drugs

- These are the chemical substances which are used to control pregnancy.
- They are also called as oral contraceptives.
- Birth control pills essentially contain a mixture of synthetic estrogen and progesterone derivatives. Both of these compounds are hormones.
- It is known that progesterone suppresses ovulation.
- Synthetic progesterone derivatives are more potent than progesterone.
- Norethindrone is an example of synthetic progesterone derivative most widely used as antifertility drug. The estrogen derivative which is used in combination with progesterone derivative is ethynylestradiol (novestrol).



Norethindrone Ethynylestradiol (novestrol)

Class : 12th Chemistry
Chapter-16 : Chemistry In Everyday Life (Part_1)

Chemicals in Food
Purpose:
• For their preservation.
• Enhancing their appeal.
• Adding nutritive value.
(a) Artificial Sweetening Agents: Natural sweeteners (sucrose), artificial sweeteners (Aspartame, Saccharin)
(b) Food Preservatives : Prevent spoilage of food due to microbial growth. (Table salt, sugar

Chemistry In Everyday Life

Cleansing Agents → Detergents →Types
(i) Soap (Saponification)
Glyceryl ester of stearic acid (fat) + Sodium hydroxide → Sodium stearate + Glycerol
(ii) Synthetic Detergents :
• Anionic detergents : Sodium salts of sulphonated long chain alcohols or hydrocarbons. (sodium salts of alkyl benzene sulphonates)
• Cationic detergents : Quaternary ammonium salts of amines with acetates, chlorides or bromides as anions. (Cetyltrimethylammonium bromide)
• Non-ionic Detergents : Non-ionic type.

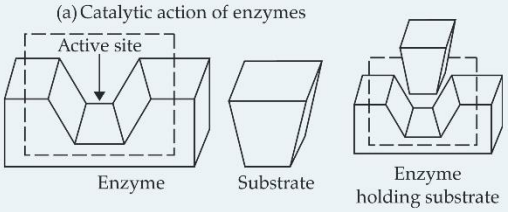
Therapeutic action of Different Classes of Drugs
• Antacids: Substances that neutralize the excess HCl and raise pH in stomach (Ranitidine, Cimetidine)
• Antihistamines : Interfere with natural action of histamine by competing with histamine for binding sites of receptor where histamine exerts its effect.
• **Neurologically Active Drugs**
(a) Tranquilizers: Class of chemical compounds used for the treatment of stress and mild or even severe mental diseases. (Iproniazid, Phenelzine)
(b) Analgesics: Reduce/abolish pain without causing impairment of consciousness, mental confusion, incoordination or paralysis or other disturbances of nervous system. These are classified as
(i) Non-narcotic (non-addictive) : (Aspirin, Paracetamol)
(ii) Narcotic : (Morphine)
• **Antimicrobials**
(a) Antibiotics : Drugs to treat infections because of their low toxicity for humans and animals. (Prontosil)
(b) Antiseptics and Disinfectants : Chemicals which either kill or prevent the growth of microorganisms. Antiseptics are applied to living tissues whereas disinfectants are applied to inanimate objects.
• **Antifertility Drugs:** Birth control pills (Norethindrone, ethynyl estradiol)

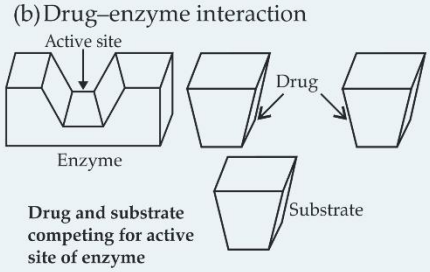
Class : 12th Chemistry
Chapter-16 : Chemistry In Everyday Life (Part_2)

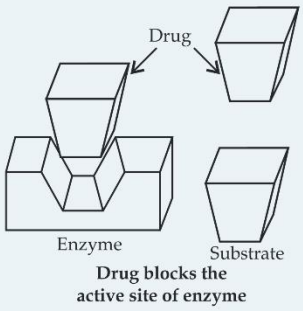
Chemistry In Everyday Life

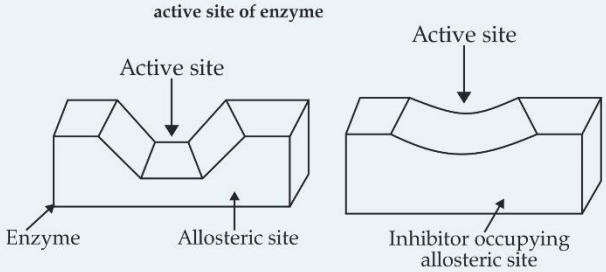
Medicines: Chemical which generate therapeutic and useful biological response

• Drugs are chemicals of low molecular masses. Interact with macromolecular targets to produce a biological response.
• Classification of drugs:
(a) On the basis of pharmalogical effect : Provides range of drugs available for a particular type of problem. (Analgesics, Antiseptics).
(b) On the basis of drugs action : (Antihistamines inhibit action of histamine responsible for causing inflamma- tion in the body.
(c) On the basis of chemical structure : Common structural features. (Sulphonamides)
(d) On the basis of molecular targets : Most useful
• Drugs Ta rget Interaction:
(i) Enzymes as Drug Targets









(ii) Receptors as Drug Targets: Receptors are proteins crucial for body's communication and are embedded in cell membrane.

Important Questions

Multiple Choice questions-

1. Antipyretics are medicinal compounds which

   (a) lower body temperature
   (b) relieve pain
   (c) control malaria
   (d) kill microorganisms.

2. 0.2% solution of phenol is an

   (a) antibiotic
   (b) antiseptic
   (c) disinfectant
   (d) analgesic

3. Which of the following is an analgesic?

   (a) Ranitidine
   (b) Aspirin
   (c) Penicillin
   (c) None of these

4. Aspirin is an

   (a) antipyretic
   (b) antibiotics
   (c) antiseptic
   (d) None of these

5. Acetyl salicylic acid is used as

   (a) an antiseptic
   (b) an antibiotic
   (c) an analgesic
   (d) a pesticide

6. Which is used as a preservative to protect processed food?

   (a) Sodium sulphate
   (b) Saccharin
   (c) Sodium bicarbonate
   (d) Sodium metabisulphite

7. Dettol is used as

   (a) disinfectant
   (b) antiseptic

(c) analgesic
(d) anti-allergic

8. Penicillin is

(a) Hormone
(b) Antibiotic
(c) Antiseptic
(d) Lipid

9. Paracetamol is

(a) antiseptic
(b) analgesic
(c) antiseptic and analgesic
(d) antibiotic

10. Which of the following is used as artificial sweetener?

(a) Saccharin
(b) Aspirin
(c) Omeprazole
(d) Pheniramine

Very Short Questions-

1. Define Drugs.
2. Define chemo therapy.
3. What are the various basis of classification of drugs?
4. Give some examples of drug targets.
5. What are antagonists and agonists?
6. Metal – hydroxides are used an antacids instead of metal hydrogen carbonates. Why?
7. What are antihistamines? Give two examples.
8. Give two examples of barbiturates.
9. What are analgesics?
10. What are tranquilizers?

Short Questions-

1. **How does an antidepressant work? Explain with example.**
2. **Explain the types of analgesics with example.**
3. **What are antibiotics?**

4. **How are antibiotics classified? Explain with example.**
5. **What in the difference between antiseptics & disinfectants?**
6. **How is the problem of non – biodegradable detergents solved?**
7. How are detergents classified?

Long Questions-

1. Explain drug – enzyme interaction.
2. Why do we need to classify drugs in different ways?
3. What is meant by the term 'broad spectrum antibiotics'? Explain.
4. How do antiseptics differ from disinfectants? Give one example of each.
5. Why are cimetidine and ranitidine better antacids than sodium hydrogen carbonate or agnesium or aluminium hydroxide?
6. Explain the following terms with suitable examples
   (i) Cationic detergents
   (ii) Anionic detergents and
   (iii) Non-ionic detergents
7. Why do soaps not work in hard water?
8. Explain the cleansing action of soaps.

Assertion and Reason Questions:

1. In these questions, a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

a) Assertion and reason both are correct statements and reason is correct explanation for assertion.

b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.

c) Assertion is correct statement but reason is wrong statement.

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

Assertion: Enzymes have active sites that hold substrate molecule for a chemical.

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

2. In these questions, a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

a) Assertion and reason both are correct statements and reason is correct explanation for assertion.

b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.

c) Assertion is correct statement but reason is wrong statement.

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

Assertion: Sodium chloride is added to precipitate soap after saponification.

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

MCQ Questions-

1. (a) lower body temperature
2. (b) antiseptic
3. (b) Aspirin
4. (a) antipyretic
5. (c) an analgesic
6. (d) Sodium metabisulphite
7. (b) antiseptic
8. (b) Antibiotic
9. (b) analgesic
10. (a) Saccharin

Very Short Answers-

1. Drugs are chemicals of low molecular masses which interact with macromolecular targets and produce a biological response.

2. The use of chemicals for therapeutic use is called chemotherapy.

3. Drugs are classified on the basis of
(a) Pharmacological effect
(b) Drug action
(c) Chemical structure
(d) Molecular targets

4. Examples of drug targets – Enzymes, Receptors, Lipids, Carbohydrates etc.

5. Drugs that bind to the receptor site & inhibit its natural action are called antagonists whereas the drugs that mimic the natural messenger by switching on the receptor

are agonists.

6. Excessive hydrogen carbonates can make the stomach alkaline and trigger the production of even more acid. Therefore metal hydroxides are better antacids as they are insoluble & do not increase pH above neutrality.
7. Antihistamines prevent the interaction of histamine with the receptors present in the stomach wall e.g. Rantidine, Soldane etc.
8. Examples of barbiturates:Veronal, amytal, Nebutal, Liminal & Seconal.
9. Analgesics reduce or cure pain without causing impairment of consciousness, mental confusion, incoordiantion or paralysis or some other problem of nervous system.
10. Tranquilizers are neurologically active drugs which are used for the treatment of stress and mild or even severe mental diseases.

Short Answers-

1. Antidepressants are used in case of a person suffering from depression e.g. noradrenalin is a neurotransmitter that plays a role in mood change. If the level of noradrenaline is low, the person suffers from depression. An antidepressants inhibits the enzyme which catalyses the degradation of noradrenalin. If the enzyme is inhibits, the neurotransmitter is slowly metabolized & can activate the receptor for longer time & counteracts the effect of depression.
2. Analgesics are classified an
   (i) Non narcotic analgesics – These drugs are effective in relieve skeletal pain & are non – addictive. They may have many other effects like reducing fever and preventing platelet coagulation. e.g. Aspirin & Paracetamol.
   (ii) Narcotic analgesics – These are habit forming or addictive drugs e.g. morphine & its homologues. They, when administered in medicinal doses relieve pain & produce sleep but in poisonous doses, they can produce coma, convulsions & even death.
3. Antibiotics are the drugs used to treat infections because of their low toxicity for humans & animals. They are the substances produced wholly or partly by chemical synthesis, which in low concentration inhibit the growth or destroys the microorganisms by intervening in their metabolic processes.
4. Antibiotics are classified on the basis of –
   (1) Their cidal (killing) or. Static (inhibitory) effect. They can be Bactericidal (inhibits the actinty) e.g. penicillin in bactericidal white Tetracycline is bactereostatic.
   (2) Their spectrum of action i.e. the range of bacteria or other microorganisms that are affected by them. Antibiotics which are effective against a wide range of Gram – positive are broad spectrum antibiotics, those effective mainly against Gram – positive or gram negative bacteria are narrow spectrum antibiotics wherever those effective against only a single bacteria are limited spectrum antibiotics. e.g. Penicillin G is

narrow spectrum while Arnpicillin in broad spectrum antibiotic.

5. Antiseptics are those antimicrobials which are applied to the living tissues such an wounds cuts, ulcers and diseased skin surfaces e.g. sofracmicine etc. these are not ingested like antibiotics. Disinfectants are applied to inanimate objects such as floors, drainage system instruments etc. e.g. phenol.
6. The detergents having highly branched hydrocarbon part is non – biodegradable & causes water pollution. This problem can be overcome if the branching of hydrocarbon chain is controlled & kept to minimum – unbranched detergents are biodegradable and cause less pollution.
7. Synthetic detergents are classified as:

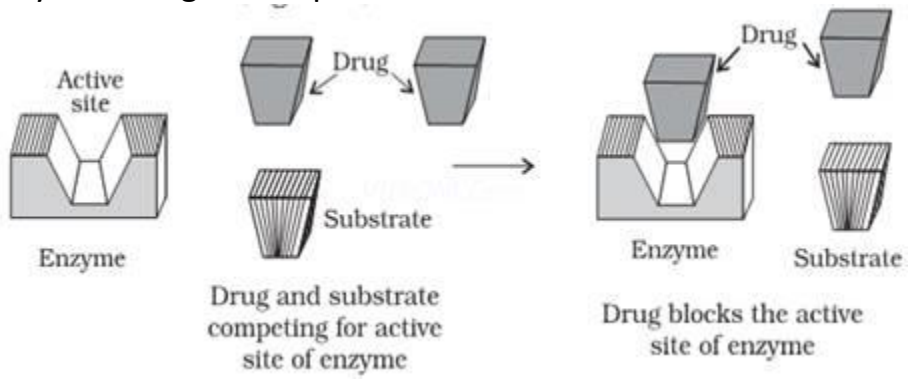
   (a) Anionic detergents – these are sodium salts of sulphonated long chain alcohols or hydrocarbon. Here the anionic part of the molecule is involved in the cleansing action. e.g. sodium laurylsulphate.

   (b) Cationic detergents – these are quaternary ammonium salts of amines with acetates, chlorides or bromides anions. e.g. cetyletrimethyl – ammonium bromide.

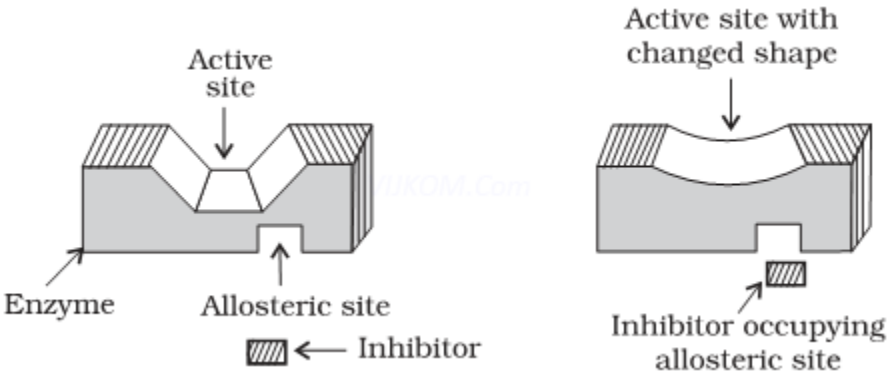
   (c) Non-ionic detergents: these detergents do not contain any ion in their constitution. e.g. $CH_3(CH_2)_{16}COO(CH_2CH_2O)_nCH_3CH_3OH$

Long Answers-

1. <u>Drug – Enzyme interaction</u> – Drugs can block the binding site of the enzyme and prevent the binding of substrate or can inhibit the catalytic activity of enzyme acting as enzyme inhibitors. Drugs inhibit the attachment of substrate on active site of enzyme in two different ways –
   (i) They compete with the natural substrate for their attachment on the active site of enzyme acting as competitive inhibitors.



   (ii) Some drugs bind to a different site, called allosteric site so as to change the shape of active site in such a way that substrate cannot recognise it.



If the bond formed between an enzyme & an inhibitor is a strong covalent bond, the enzyme is blocked permanently & is degraded by the body.

2. The classification of drugs and the reasons for classification are as follows:

(i) On the basis of pharmacological effect:

This classification provides doctors the whole range of drugs available for the treatment of a particular type of problem. Hence, such a classification is very useful to doctors.

(ii) On the basis of drug action:

This classification is based on the action of a drug on a particular biochemical process. Thus, this classification is important.

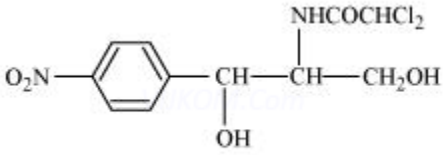
(iii) On the basis of chemical structure:

This classification provides the range of drugs sharing common structural features and often having similar pharmacological activity.

(**iv) On the basis of molecular targets:**

This classification provides medicinal chemists the drugs having the same mechanism of action on targets. Hence, it is the most useful to medicinal chemists.

3. Antibiotics that are effective against a wide range of gram-positive and gram-negative bacteria are known as broad spectrum antibiotics. Chloramphenicol is a broad spectrum antibiotic.



Chloramphenicol

It can be used for the treatment of typhoid, dysentery, acute fever, pneumonia, meningitis, and certain forms of urinary infections. Two other broad spectrum antibiotics are vancomycin and ofloxacin. Ampicillin and amoxicillin -synthetically modified from penicillin – are also broad spectrum antibiotics.

4. Antisepticsand disinfectants are effective against micro-organisms. However, antiseptics are applied to the living tissues such as wounds, cuts, ulcers, and diseased

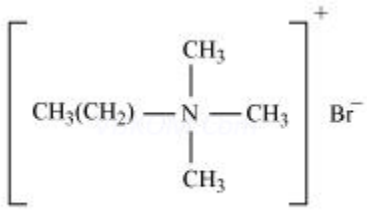
skin surfaces, while disinfectants are applied to inanimate objects such as floors, drainage system, instruments, etc. Disinfectants are harmful to the living tissues.

Iodine is an example of a strong antiseptic. Tincture of iodine (2 – 3 percent of solution of iodine in alcohol – water mixture) is applied to wounds. 1 percent solution of phenol is used as a disinfectant.

5. Antacids such as sodium hydrogen carbonate, magnesium hydroxide, and aluminium hydroxide work by neutralising the excess hydrochloric acid present in the stomach. However, the root cause for the release of excess acid remains untreated. Cimetidine and rantidine are better antacids as they control the root cause of acidity. These drugs prevent the interaction of histamine with the receptors present in the stomach walls. Consequently, there is a decrease in the amount of acid released by the stomach. This is why cimetidine and rantidine are better antacids than sodium hydrogen carbonate, magnesium hydroxide, and aluminium hydroxide.

6. (i) Cationic detergent

Cationic detergents are quaternary ammonium salts of acetates, chlorides, or bromides. These are called cationic detergents because the cationic part of these detergents contains a long hydrocarbon chain and a positive charge on the N atom. For example: cetyltrimethylammonium bromide



Cetyltrimethylammonium bromide

(ii) Anionic detergents

Anionic detergents are of two types:

1.Sodium alkyl sulphates: These detergents are sodium salts of long chain alcohols. They are prepared by first treating these alcohols with concentrated sulphuric acid and then with sodium hydroxide. Examples of these detergents include sodium lauryl sulphate ($C_{11}H_{23}CH_2OSO_3$-Na+) and sodium stearyl sulphate ($C_{17}H_{35}CH_2OSO_3$-Na+).

2.Sodium alkylbenzenesulphonates: These detergents are sodium salts of long chain alkylbenzenesulphonic acids. They are prepared by Friedel-Crafts alkylation of benzene with long chain alkyl halides or alkenes. The obtained product is first treated with concentrated sulphuric acid and then with sodium hydroxide. Sodium 4-(1-dodecy) benzenesulphonate (SDS) is an example of anionic detergents.

(iii)Non-ionic detergents

Molecules of these detergents do not contain any ions. These detergents are esters of alcohols having high molecular mass. They are obtained by reacting polyethylene

glycol and stearic acid.

$$CH_3(CH_2)_{16}COOH + HO(CH_2CH_2O)_nCH_2CH_2OH \xrightarrow{-H_2O} CH_3(CH_2)_{16}COO(CH_2CH_2O)_nCH_2CH_2OH$$

Stearic acid — polyethyleneglycol

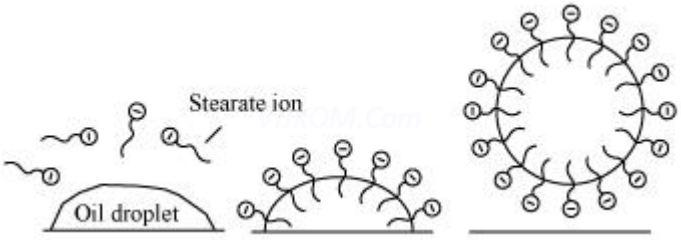
7. Soaps are sodium or potassium salts of long-chain fatty acids. Hard water contains calcium and magnesium ions. When soaps are dissolved in hard water, these ions displace sodium or potassium from their salts and form insoluble calcium or magnesium salts of fatty acids. These insoluble salts separate as scum.

$$2C_{17}H_{35}COONa + CaCl_2 \longrightarrow 2NaCl + (C_{17}H_{35}COO)_2Ca$$

Soap — Isoluble calcium stearate (soap)

This is the reason why soaps do not work in hard water.

8. Soap molecules form micelles around an oil droplet (dirt) in such a way that the hydrophobic parts of the stearate ions attach themselves to the oil droplet and the hydrophilic parts project outside the oil droplet. Due to the polar nature of the hydrophilic parts, the stearate ions (along with the dirt) are pulled into water, thereby removing the dirt from the cloth.



Assertion and Reason Answers:

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

Explanation:

Drugs compete with natural substrate by attaching by weak bonds such as ionic bonding. H-bonding, van der Waals interaction, etc., to the active site of the enzyme.

2. (a) Assertion and reason both are correct statements and reason is correct explanation for assertion.

Explanation:

Hydrolysis of esters of long chain fatty acids by alkali gives soap a colloid. The process is called saponification.

Sodium chloride is added to precipitate soap which is in colloidal form.