CHEMISTRY IN EVERYDAY LIFE

Drugs and their Classification : Drugs are chemicals of low molecular masses (~ 100 – 500 u). These interact with marcromolecular targets and produce a biological response. When the biological response is therapeutic and useful, these chemicals are called **medicines** and are used in diagnosis, prevention and treatment of diseases. Use of chemicals for therapeutic effect is called **chemotherapy.**

Classification of Drugs

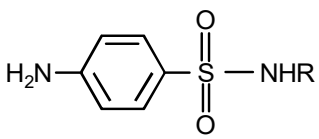
(a) On the basis of pharmacological effect – It is useful for doctors because it provides them whole range drugs available for the treatment of a particular type of problem. For example, anagesics have pain killing effect, antiseptics kill or arrest the growth of microorganisms.

(b) On the basis of drug action

It is based on the action of a drug on a particular biochemical process. For example, all antihistamines inhibit the action of the compound histamine which causes inflammation in the body. There are various ways in which action of histamines can be blocked.

(c) On the basis of chemical structure

Drugs classified in this way share common structural features and often have similar pharmacological activity. For example, sulphonamides have common structural feature, given below



Structural features of sulphonamides

(d) On the basis of molecular targets

Drugs usually interact with biomolecules such as carbohydrates, lipids, proteins and nuclic acids. These are called target molecule or drug targets. Drugs possessing some common structural features may have the same mechanism of action of tragets. It is the most useful classification for medicinal chemists.

Drug–Target Interaction

Proteins which perform the role of biological catalysts in the body are called **enzymes.** Those, protein which are crucial to communication system in the body are called **receptors.** Carrier proteins carry polar molecules across the cell memberane. Nucleic acids have coded genetic information for the cell. Lipids and carbohydrates are structural parts of the cell membrane.

Enzymes as Drug Targets

(a) Catalytic action of enzymes

In their catalytic activity, enzymes perform two major functions.

(i) The first function of an enzyme is to hold the substrate for a chemical reaction. Active sites of enzymes hold the substrate molecule in a suitable position so that it can be attacked by the reagent effectively. Substrates bind to the active site of the enzyme through a variety of interactions such as ionic bonding, hydrogen bonding, van der Waals interaction or dipole dipole interaction.

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

(b) Drug-enzyme interaction

Drugs inhibit any of the above mentioned activities of enzymes. These can block the binding site of the enzyme and prevent 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 anzymes in two different ways:

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

(ii) Some drugs do not bind to the enzyme's active site. These bind to a different site of enzyme which is called **allosteric site.** This binding of inhibitor at allosteric site changes the shape of the active site in such a way that substrate cannot recognise it. If the bond formed between an enzyme and an inhibitor is a strong covalent bond and cannot be broken easily, then the enzyme is blocked permanently. The body then degrades the enzyme-inhibitor complex and synthesises the new enzyme.

Receptors as Drug Targets

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

There are a large number of different receptors in the body that interact with different chemical messengers. These receptors show selectivity for one chemical messenger over the other because their binding sites have different shape, structure and amino acid composition.

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.

Antacids

Substance which neutralises the excess acid and raise the pH to an appropriate level in stomach are called Antacids.Eg. Baking soda, Mixture of Al and Mg hydroxide, Metal hydroxide better because being insoluble they do not increase pH above neutrality.

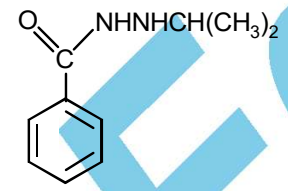
Antihistamines

Histamine, stimulates the secretion of pepsin and HCl in stomach drugs like cimetidine (Tegamet), and ranitidine(Zantac),are used. Histamine is a potent vasodilator. It has various functions. It contracts the smooth muscles in the bronchi and gut and relaxes other muscles, such as those in the walls of fine blood vessels. Histamine is also responsible for the nasal congestion associated with common cold and allergic response to pollen.

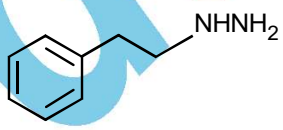
Synthetic drugs, **brompheniramine (Dimetapp) and terfenadine (Seldane),** act. as antihistamine. The drugs interfere with natural action of histamine by competing with histamine for binding sites of receptor where histamine exerts its effect are called antihistamine or antiallergic drugs. "Why do above mentioned antihistamines not affect the secretion of acid in stomach?" The reason is that antiallergic and antacid drugs work on different receptors.

(a) Tranquilizers

Traquilizers and **analgesics** are neurologically active drugs. Tranquilizers are a class of chemical compounds used for the treatment of stress, and mental diseases. These relieve anxiety, stress, irritability or excitement by inducing a sense of well-being. They form an essential component of sleeping pills. There are various types of tranquilizers. They function by different mechanisms. For example noradrenaline is one of the neurotransmitters that plays a role in mood changes. If the level of noradrenaline is low for some reason, then the signal-sending activity becomes low, and the person sufferes from depression. In such situations, **antidepressant drugs** like **Iproniazid and phenelzine** are required. These drugs inhibit the enzymes which catalyse the degradation of noradrenaline. If the enzyme is inhibited, this important neurotransmitter is slowly metabolised and can activate its receptor for longer periods of time, thus counteracting the effect of depression.



Iproniazid



Phenelzine (Nardil)

Some tranquilizers namely, chloridiazepoxide and meprobamate, are relatively mild tranquilizers suitable for relieving tension. Equanil is used in controlling depression and hypertension.

Derivaties of barbituric acid viz. veronal, amytal, nembutal, luminal and seconal constitute an important class of tranquilizers. These derivatives are called **barbiturates.** Barbiturates are hypnotic, i.e., sleep producing agents.

(b) Analgesics

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 as follows:

(i) Non-narcotic (non-addictive) analgesics: eg. **Aspirin and paracetamol**.

Aspirin is the most familiar example. Aspirin inhibits the synthesis of chemicals known as prostaglandins which stimulate inflammation in the tissue and cause pain. These drugs are effective in relieving skeletal pain such as that due to arthritis. These drugs have many other effects such as reducing fever **(antipyretic)** and preventing platelet coagulation. Because of its anti blood clotting action. aspirin, finds use in prevention of heart attacks.

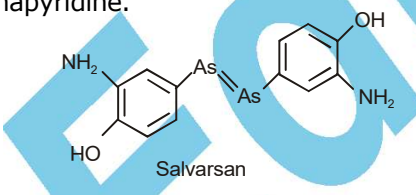
(ii) Narcotic analgesics: Morphine and many of its homologues, when administered in medicinal doses, relieve pain and produce sleep. In poisonous doses, these produce stupor, coma, convulsions and ultimately death. Morphine narcotics are sometime referred to as opiates, since they are obtained from the opium poppy. These analgesics are chiefly used for the relief of postoperative pain, cardiac pain and in child birth.

Antimicrobials

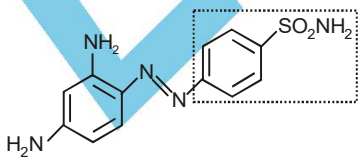
An antimicrontimicrobial tends to destroy/prevent development or inhibit the pathogenic action of microbes such as bacteria (antibacterial drugs), fungi (antifungal agents). virus (antiviral agents), or other parasites (antiparasitic drugs) selectively. Antibiotics, antiseptics and disinfectants are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

(a) Antibiotics

Antibiotics are used as drugs to treat infections because of their low toxicity for humans and animals. Initially antibiotics were classified as chemical substances produced by microorganisms (Bacteria, fungi and molds) that inhibit the growth or even destroy microorganisms. An antibiotic now refers to 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. **Paul Ehrlich** developed **arsphenamine (salvarsan)** medicine for treatment of syphilis caused by **spirochete bacteria** 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 compound called **sulphanilamide,** which is the real active compound. Thus the sulpha drugs were discovered. A large range of sulphonamide analogues wa synthessised. One of the most effective is sulphapyridine.



Salvarsan



Prontosil

Sulpha drugs - Drugs which can be used in place of antibiotics to delimit the grown of micro-organism. Some person who are allergic to certain antibiotics like pencillin, can be given supha drugs.

Despite the success of sulfonamides, the real revolution in antibacterial therapy began with the discovery of penicillin by Alexander Fleming in 1929, of the antibacterial properties of a Penicillium fungus. Isolation and purification of active compound to accumulate sufficient material for clinical trials took thirteen years.

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

The range of bacteria or other microorganisms that are affected by a certain antibiotic is expressed as its **spectrum of action.** Antibiotics which kill or inhibit a wide range of Gram-positive and Gram-negative bacteria are said to be **Broad spectrum antibiotics.** Those effective mainly against Gram-positive or Gram-megative bacteria are **narrow spectrum antibiotics.** If effective against a single organism or disease, they are refered to as **limited spectrum** antibiotics. Penicillin G has a narrow spectrum . Ampicillin and Amoxycillin are synthetic modifications of penicillin. 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.

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 typhold, dysentery, 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.

(b) Antiseptics are chemicals: Applied to the living tissues such as wounds, cuts, ulcers and diseased skin surfaces to either kill or prevent the growth of micro-organisms. 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 bithional) 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** is also used as an antiseptic for wounds. Boric acid in dilute aqueous solution is weak antiseptic for eyes.

(c) Disinfectants are chemicals applied to inanimate objects such as floors, drainage system, instruments, etc to kill micro-organism but are not safe to living tissues. 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 of phenol 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.

Antifertiility Drugs

Chemical substances which are used to check pregnancy in woman are called anti-fertility drugs on birth control pills . These control the menstrual cycle and ovulation.

Brith control pills essentially contain a mixture of synthetic estrogen and progesterone derivaties. Both of these mixture of synthetic estrogen and progesterone derivatives. Both of these compounds are hormones.**Norethindrone** is an example of synthetic progesterone derivative most widely used as antifertility drug. The estrogen dervative which is used in combination with progesterone derivative is **ethynylestradiol (novestrol).**

Chemicals in Food

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

(i) Food colours

(ii) Flavours and sweeteners

(iii) Fat emulsifiers and stabilising agents

(iv) Flour improvers-antistaling agents and bleaches

(v) Antioxidants - Substances added to food to prevents the oxidation of fat and oil.

(vi) Preservatives

(vii) Nutritional supplements such as minerals, vitamins and amino acids.

Artificial sweetening Agents

Natural sweeteners, e.g., sucrose add to calorie intake and therefore many people prefer to use artificial sweeteners.

Ortho-sulphobenzimide, also called **saccharin(1879)**, is the first popular 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 intert and harmless when taken. Its use is of great value to diabetic persons and people who need to control intake of calories.

Aspartame is the most successful and widely used artificial sweetener. It 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.

Alitame is high potency sweetener, although it is more stable than aspartame, the control of sweetness of food is difficult while using it.

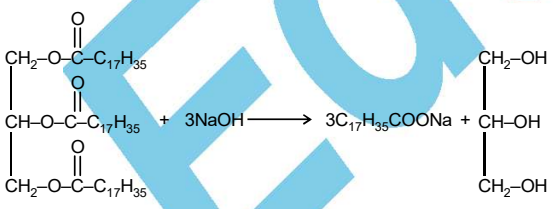
Sucrolose is trichloro derivative of sucrose. It is 600 times as sweet as cane sugar. Its appearance and taste are like sugar. It is stable at cooking temperature. It does not provide calories.

Food Preservatives

Food preservatives prevent spoilage of food due to microbial growth. The most commonly used preservatives include table salt. sugar, vegetable oils and sodium benzoate. C_6H_5COONa. Sodium benzoate is used in limited quantities and is metabolised in the body. Salts of sorbic acid and propanoic acid are also used as preservatives.

Cleansing Agents.

Soaps :



Glyceryl ester of stearic acid (Fat) — Sodium hydroxide — Sodium stearate — Glycerol (or Glycerine)

Soaps 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.**

During seponification soap is formed that remained in colloidal form. It is precipitated by adding sodium chloride. The remaining solution cantains glycerol. which can be recovered by fractional distillation. Only sodium and potassium soaps are soluble in water and are used for cleaning purposes. Generally potassium soaps are soft to the skin than sodium soaps. These can be prepared by using potassium hydroxide solution in place of sodium hydroxide.

Types of soaps

Toilet soaps are prepared by using better grades of fats and oils and care is taken to remove excess alkali. Soaps that float in water are made by heating tiny air bubbles before their hardening. **Transparent soaps** are made by dissolving the soap in ethanol and then evaporating the excess solvent.

In **medicated soaps**, substance of medicinal value(bithionol) are added. In some soaps, deodorants are added. **Shaving soaps** contain glycerol to prevent rapid drying. A gum called, rosin is added while making them. It forms sodium rosinate which lathers well. **Laundry soaps** contain fillers like sodium rosinate, sodium silicate, borax and sodium carbonate.

Soap powders and **scouring soaps** contain some soap, a scouring agent (abrasive) such as powdered pumice or finely divided sand, and builders like sodium carbonate and trisodium phosphate. Builders make the soaps act more rapidly.

Why do soaps not work in hard water?

Hard water contains calcium and magnesium ions. These ions form insoluble calcium and magnesium soaps respectively when sodium or potassium soaps are dissolved in hard water.

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

Soap — Hard water — Insoluble calcium stearate (Soap)

These insoluble soaps seperate as scum in water and are useless as cleansing agent. In fact these are hinderance to good washing, because the precipitate adheres into the fibre of the cloth as gummy mass. Hair washed with hard water looks dull because of this sticky precipitate. Dye does not absorb evenly on cloth washed with soap using hard water, because of this gummy mass.

Syntheic Detergents

These can be used both in soft and hard water as:

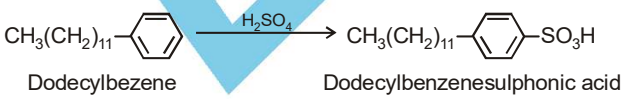
(i) Anionic Detergents: Anionic detergents are sodium salts of sulphonated long chain alcohols or hydrocarbons.

$CH_3(CH_2)_{10}CH_2OH \xrightarrow{H_2SO_4} CH_3(CH_2)_{10}CH_2OSO_3H$

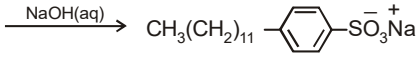
Lauryl alcohol — Lauryl hydrogensulphate

$\xrightarrow{NaOH(aq)} CH_3(CH_2)_{10}CH_2OSO_3^-Na^+$

Sodium laurylsulphate (Anionic detergent)



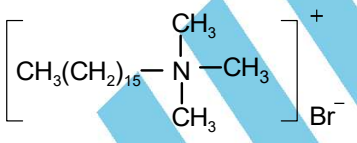
Dodecylbezene — Dodecylbenzenesulphonic acid



Sodium dodecylbenzenesulphate

In anionic detergents, the anionic part of the molecule is involved in the cleansing action.

(ii) Cationic Detergents: Cationic detergents are quarternary ammonium salts of amines with acetates, chlorides or bromides as anions. Cetyltrimethylammonium bromide is a popular cationic detergent and is used in hair conditioners. Cationic detergents have germicidal properties and are expensive.



(iii) Non-ionic Detergents: These do not contains any ion in their constitution. One such detegent is formed when staric acid react with poly ethylene glycol.

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

Stearic acid — Polyethyleneglycol

Liquid dishwashing detergents are non-ionic type. These also remove grease and oil by micelle formation.

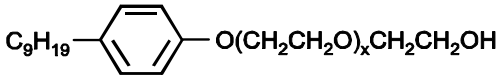
Disadvantage of using detergents

Main problem that appears in the use of detergents is that if their hydrocarbon chain is highly branched, then bacteria cannot degrade.

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

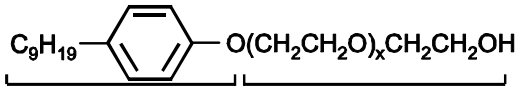
SOLVED PROBLEMS

Q.1 Following type of non-ionic detergents are present in liquid detergents, emulsifying agents and wetting agents. Label the hydrophilic and hydrophobic parts in the molecule. Identify the functional group(s) present in the molecule.



(x = 5 to 10)

Sol.



Hydrophobic or non-polar part — Hydrophilic or polar part

Functional group: – OH (alcohol).

Q.2 Why do we need to classify drugs in different ways?

Sol. We need to classifydrugs in different ways:
(i) To provide doctors the whole range of drugs available fot the treatment of a particular type of problem.
(ii) To provide medicinal chemists a range of drugs those act on a particular and molecular target.
(iii) To provide drugs which share common structural features and similar pharmacological activities.
(iv) To provide drugs for inhibition of disorders in a particular biological process.

Q.3 What are target molecules or drug targets.

Sol. Drug target : Drugs usually interact with biological marcomolecules such as carbohydrates, lipids, proteins and nucleic acids. Theses biological macromolecules are called targets. The correct choice of the molecular target for a for a drug is important to obtain its desired therapeutic effect.

Q.4 What is meant by the term 'broad spectrum antibiotics' ? Explain.

Sol. The whole range of microorganisms attacked by an antibiotic is called its spectrum. An antibiotic which effective on several type of microorganisms simultaneously is called a broad spectrum antibiotic. For example, chloramphenicol is a broad spectrum antibiotic which is used in the treatment of typhoid, dysentery, acute fever, meningitis, penumonia and certain forms of urinary infections. Tetracycline, vancomycin, ofloxacin etc. are other examples.

Q.5* How do antiseptics differ from disinfectants? Give examples of each.

Sol.

Antiseptics	Disinfectants
1. Kill micro-organisms.	1. Kill micro-organisms.
2. Do not harm the living tissues.	2. Toxic living tissues.
3. These are applied to wounds, ulcers and instruments, diseased skin etc Floors, toilets drains etc. (inaminate objects)	3. These are used to disinfected
4. Examples : Phenol (0.2 %), boric acid,	4. Examples : Phenol(1%), chlorine, DDTe. etc. mercuric chloride,

Q.6 Why are cimetidine and rantidine better antacids than sodium hydrogencarbonate or magnesium or aluminium hydroxide?

Sol. Excessive use of sodium bicarbonate or a mixture of aluminium and magnesium hydroxide can make the stomach alkaline and trigger the production of even more acid. On the other hand, ranitidine and cimetidine prevent the interaction of histamine with the receptors present in the stomach wall. This resulted in release of lesser amount of acid. Thus these are better antacids.

Q.7* Name a substance which can be used as an antiseptic as well as disinfectant.

Sol. Phenol: 0.2 percent solution of phenol is an antiseptic while its one percent solution is disinfectant.

Q.8* What are the main constituents of dettol?

Sol. Dettol is a mixture of (i) Chloroxylenol (ii) Terpineol

Q.9* What is tincture of iodine ? What is its use?

Sol. Iodine is a powerful antiseptic. Its 2-3 percent solution in alcohol-water solution is known as tincture of iodine. It is applied on wounds as an antiseptics.

Q.10 What are biodegradable and non-biodegradable detergents? Give one example of each.

Sol. The detergents which are decomposed by the bacteria are called non-biodegradable detergents e.g., detergents having branched chains.

The synthetic detergents which are broken by bacteria present in sewage into carbon dioxide are called bio-detergents which are broken by bacteria present in sewage into carbon dioxide are called bio-degradable detergents. They do not pose pollution problems e.g., linear chain detergents.

Q.11 Why soaps not work in hard water? (a) Why hair dull and Dye do not absorb evenly in hard water.

Sol. Metallic ions other sodium and potassum form a candy precipitate that separates as scum. **Hard water contains calcium and magnesium ions. These form insoluble calcium and magnesium soaps respectively.**

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

Soap Calcium chloride

Insoluble calcium stearate (in hard water) (scum)

These insoluble soaps are useless as cleansing agent. In fact these are hindrance to good washing, because this precipitate adheres onto the fibres of the cloth as gummy mass.

Hair washed with hard water looks dull because of this sticky precipitate. Dye does not absorb evenly on cloth washed with soap and using hard water, because of this gummy mass.

Q.12 How are antiseptics distinguished from disinfectants? Give two examples of each of the substances.

Ans. **Antiseptics** are those chemical substances which prevent the growth of micro – organisms or kill them but are not harmful to the living human tissues e.g., dettol, bithional, iodine, genations violet, methylene blue, salicylic acid, picric acid, resorcinol, phenol (0.2 % soln.), savlon.

Disinfectants are those chemical substances which are used for killing micro – organisms or to stop their growth but are harmful to human tissues. They are used to disinfect floors, toilets etc. but can not be used directly to clean wounds e.g., phenol (1%), SO_2, $KMnO_4$, bleaching powder.

Q.13* What is an antibiotic? Give the name of the first antibiotic discovered.

Ans. **Antibiotic** is a chemical substance that is produced by micro – organisms (such as moulds, and bacteria) and is capable of destroying other micro – organisms e.g., Penicillin, Ampicillin, Amoxycillin etc.

The first antibiotic discovered is Penicillin.

Q.14 List two major classes of antibiotics with an example of each class.

Ans. The antibiotics can either be **bactericidal** or **bacteriostatic.**

Examples:

Bactericidial. Penicillin, Aminoglycosides, Ofloxacin.

Bacteriostatic. Erythromycin, Tetracycline, Chloramphenical.

Q.15* What are antacids? List some of the compounds, which are used as antacids.

Ans. **Antacids.** The chemical substances which neutralize enough of acid in the gastric juices and give relief from acid indigestion, acidity, heart burns and gastric ulcers are called antacids e.g., Baking soda, aluminium hydroxide, magnesium carbonate, potassium bicarbonate, aluminium phosphate, dihydroxy aluminium amino acetate, magnesium oxide etc.

Q.16* Describe the following with suitable examples:

(i) Tranquilizers (ii) Antifertility drugs

(iii) Antihistamines.

Ans. **(i) Tranquilizers.** Those chemical substance which are used for the cure of mental diseases are known as tranquilizers. They reduce anxiety and tension and act on higher centers of nervous system. They re constituents of sleeping pills. They are called psycho – therapeutic drugs e.g., Barbituric acid and its derivative such as seconal, luminal, equanil etc.

(ii) Anti – fertility drugs. These are chemical substances used to control the Pregnancy. These are called **oral contraceptives.** Progestrogens either alone or in combination with oestrogens steroids are commonly used as anti – fertility drugs e.g., norgestrel, ethynodil, norethistereone, iyenestrenol (all thee are progestrogens).

Estrogens used are mestranol, ethylestradiol**.**

(iii) Antihistamines. These are the chemical substances which diminish or abolish the main action of histamine released in the body and hence prevent allergic reaction such as hay

fever, mild asthma, nasal discharge etc. commonly used histamines are diphenylhydramine (Benadryl), pheniramire maleate (avil), chlorophemiramine maleate (zeet), triprolidine (actidil), antazoline (antistine), dimethindene (forsital).

Q.17 Present a scheme of classification of dyes based on their application.

Ans. On the basis of their application, dyes are classified as**:**

(i) Acid dyes. They have affinity with wool, silk, nylon, polycuethane fibres. They are normally salts of sulphonic acids e.g., Methyl red, Methyl orange.

(ii) Basic dyes. They contain – NH_2 or $-NR_2$ group as chromosphere or auxochrome. These are used to dye nylon, polyester, wool, cotton, leather, paper etc. e.g., aniline yellow, butter yellow, crysodine.

(iii) Direct dyes. They are applied directly to the fabrics from an aqueous solution and are useful for those fabrics which can form hydrogen bonds e.g., martins yellow, Congo red, etc.

(iv) Disperse dyes. They are those dyes wherein minute particles of the dye are dispersed or spread from a suspension into the fabric, where they diffuse. This class of dyes is used for dyeing polyesters, nylon, polyacrylonitrile etc.

(v) Fibre reactive dyes. These are the dyes which attach themselves to the fibre by an irreversible chemical reaction. The dying is 'fast' and the colour is retained for a long time.

(vi) Insoluble azo dyes. These are adsorbed on the surface of a fabric with a diaoznium salt. They can be directly synthesized on the fibre. They can be used to dye cotton, silk, polyester etc. e.g., nitroaniline red.

(vii) Vat dyes. These are the dyes derived from coupling of a phenol or a naphthol adsorbed on a surface of a fabric with a diazonium salt, cotton, silk, polyester and nyclon can be dyed by such dyes e.g., Indigo.

(viii) Mordant dyes. These are the mainly used for wool. These are applied to the fabric after treating it with a metal ion. Depending on the mordant used the dyes give different colours e.g., Alizarin gives a rose red colour with aluminium and blue colour with barium.

Q.18 Give an examples of:

(i) Tripenylmethane dye

(ii) Azo dye

(iii) Anthraquinone dye.

Ans. **(i)** Magent dye **(ii)** Methyl orange **(iii)** Alizarine dye.

Q.19 What is a mordant dye? How is it applied to the fabric?

Ans. **Mordant dyes.** These are the mainly used for wool. These are applied to the fabric after treating it with a metal ion. Depending on the mordant used the dyes give different colours e.g., Alizarin gives a rose red colour with aluminium and blue colour with barium.

Q.20 Bring out the essential point of difference between acidic dyes and basic dyes.

Ans. The points of difference are listed in tabular form.

Q.21 What are the essential components of a talcum powder? What is the role of broic acid in talcum powder?

Ans. The essential components of Talcom powder are talc ($Mg_3(OH)_2Si_4O_{10}$), Chalk, Zinc oxide, Zinc stearate and suitable perfume.

Q.22 What are deodorants and what is their specific role in cosmetics.

Ans. Boric acid is added for antiseptic purposes:

Deodorants. These are the chemical substances which are used to mask, remove or control the perspiration odours and prevent their development. Some of the deodorants are **antiperspirants** also.

Q.23 What are the essential components of a perfume? How does the function of a perfume differ from cream?

Ans. **Perfumes** are prepared by mixing various **essential oils** with **alcohol** and **glycerine.** The three essential components of perfume are**:**

(i) Vehicle. It is a solvent. Ethanol and water mixture is most commonly used as vehicle in the industry.

(ii) Fixative. Its function is to eualize the rate of evaporation of various odouriferrous components of perfume by suitably adjusting the volatility**. Sandal wood** is used as fixative. Some other substances used as fixatives are benzoin, glyceryl diacetate, esters of cinnamic alcohol.

(iii) Odourous substances. They impact odour to the perfume. Terpenoids such as linalool and synthetic compounds such as anisaldehyde are used for this purpose.

Difference between the function of perfume

and cream. The cream gives moisturing effect where as perfume gives smell.

Perfume provides fragrance by vaporization where as cream is paste which has volatile

Acidic dyes	*Basic dyes*
(i) These dyes are usually salts of sulphonic acids.	**(i)** These dyes contains amino groups which in acid form water soluble salts.
(ii) These dyes attach to the fabric through hydrogen bonding.	**(ii)** These dyes get attached to the anionic sites present on the fabrics.
(iii) These are used for wool, silk, poly – urethane fibres and nylon. **Examples:** Orange – 1	**(iii)** These are used to dye reinforced nylons and polyesters. **Examples:** Aniline yellow and malachite green.

odour producing substances.

Q.24 What are carbon fibres? How are they designed? Write two important uses of carbon fibres.

Ans. Carbon Fibres. These are high strength material containing at least 90% carbon. These are obtained by controlled pyrolysis of synthetic fibres or asphalt and pitch materials. These fibres are stronger than steel, stiffer than titanium and lighter than aluminium.

Types of carbon fibres

(i) PAN (Polyacrylonitrile) type. These are obtained by burning special acrylic fibres.

(ii) Pitch – type. These are manufactured from pitch (the residual product of distilled petroleum or coal).

So they can be designated in an number of ways depending upon the variety of starting materials or precursors such as viscose rayon, polyacrylonitrile, pitch, resins, gases such as methane etc.

Uses: Two important uses are**:**

(i) Used in making of nose **–** tips of missiles.

(ii) Used in making of head **–** shields of missiles.

Q.25 List various type of ceamics and their uses.

Ans. Type of ceramics and their uses

(i) Clay. It is formed by weathering of igneous rocks and feldspar rocks and mainly contains aluminium silicate like $Al_2Si_2O_7.2H_2O$. It is used for making bricks, tiles and porcelain and China pottery.

(ii) Refractory materials. These are the substances capable of withstanding high temperatures without softening or undergoing deformation. These are of the following types**.**

(a) Acidic refractories. They contain Al_2O_3.

(b) Basic refractories. They contain CaO, MgO etc.

(c) Neutral refractories. They contain chromite (FeO, CrO_2) zirconia (ZrO_2).

Refractories are used for making lining of furnace tanks, convertors, kilns and crucibles.

(iii) Glass. It is an amorphous, hard brittle super cooled liquid having very high viscosity. Various types of glass are

(a) Soft glass

(b) Hard glass

(c) Flint glass etc**.**

(iv) Abrasive ceramics. These are used in making cutting and grinding tools e.g., silicon.

Q.26 What are superconducting ceramics? Write some uses of superconductor ceramics.

Ans. Super conducting ceramics are those which are super conductors at a temperature as low as 77 K.

Uses: This type of ceramics are used

(i) In electrical power transmission

(ii) In magnets for high energy particle accelerators

(iii) In high speed switching and signal transmission for computers

(iv) In liquid speed magnetically levigated trains.

Q.27 Write a brief note on micro alloys.

Ans. Micro – alloys. These are materials obtained by adding amounts of alloying elements to steel to improve its mechanical properties.

The common alloying elements used are vanadium, tellurium, bismuth, boron etc.

Micro – alloyed gold contains 99.55% gold and can be used for making ornaments. Its properties are similar to platinum**.**

Q.28* Describe the following with suitable examples

(i) Preservative

(ii) Artificial Sweeteners

(iii) Antioxidants (iv) Edible colours

Ans. (i) Preservatives. These are the chemical substances which are added to the food material to prevent their spoilage and to retain their nutritive value for long periods. The most common preservative used is sodium benzoate. It is metabolized by conversion to hippuric acid which ultimately is excreted in urine, salts of propionic acid and sorbic acid are also used as preservatives.

(ii) Artificial Sweeteners. These are the substances that are used as sweeteners in place of table sugar. They contain negligible calories and are recommended even for diabetics e.g., aspartame, saccharine, acesulfane – K, sorbitol and mannitol. Saccharine is about 300 times more sweeter than cane sugar.

(iii) Antioxidants. These are chemical substances which prevent oxidation and subsequent spoilage of food e.g., **BHA** (Butyl hydroxy anisole) and **BHT** (Butylated hydroxy toluene). They retard the chemical reactions which breaks down food when they come in contact with oxygen, light, heat and certain metals.

(iv) Edible Colours. These are the chemical substances which are used for imparting colour to the food and increase the eye appeal and compliment a definite flavour. They are essentially dyes and are used to colour every thing from meat to fruit.

The natural colouring substances present in plants are chlorophyll, β – carotene, alizarin, indigo etc.

Synthetic dyes are **Amaranths** (an azodye), which is reddish brown in colour. It dissolves in water giving a magneta colour. Some other synthetic colours used in food products are

Indigo Caramine	–	blue
Tetrazine	–	yellow
Erythrosine	–	fast red
Carmorisine	–	fast red
Poncean	–	fast green
Sunset yellow	–	yellow

Q.29 What are detergents? Give their scheme of classification. Why are detergents preferred over soaps.

Ans. **Detergents** are the materials which are used for cleaning purposes. They are also called **soapless soap.** They are the synthetic material of the type sodium benzene sulphonates.

Types of detergents

(i) Anionic detergents. Alkyl benzene sulphnate

(ii) Cationic detergents. Cetyltrimethyl ammonium chloride

(iii) Non – ionic. $CH_3(CH_2)_{16}(CH_2CH_2O)_n CH_2CH_2OH$.

Advantages of detergents over soaps

(i) They work well even with hard water

(ii) They are more effective than soap

(iii) They can work well even with acidic water

(iv) They can be used even for woolen garments.

Q.30 What are biodegradable and nonbiodegradable detergents? What are the consequences of using latter class of detergents?

Ans. **Biodegradable detergents** are those which are decomposed by microorganisms into harmless products. They do not create water pollution. Detergents having linear alkyl chains are biodegradable.

Non – biodegradable detergents are those which are not decomposed by microorganisms in sewage. They cause water pollution.

Non – biodegradable detergents have a great deal of branching in the hydrocarbon tail. The hydrocarbon side chain stops bacteria from attacking and breaking the chains. This results in slow degradation of the molecules leading to their accumulation.

Q.31 What are pheromones? Why are pheromones said to be action specific agents ?

Ans. **Pheromones.** These are chemical substances secreted by one individual of a species that brings forth a response to another individual of the same species. They are six attractants which are usually emitted by females and can attract males over two miles away.

They are highly specific agents because each animal has its own attractants.

Q.32 What are a propellant? How are various rocket propellants classified?

Ans. **Propellant.** It is a combination of an oxidizer and a fuel. A propellant on ignition undergoes combustion to release great quantities of hot gases.

Classification. They are classified as follows**:**

(a) Solid propellants. Such propellants are mixture of solid hydrocarbons and an oxidizing agent which is stable at room temperature e.g., A mixture of paraffin and potassium nitrate which is used as a solid propellant in rockets.

(b) Liquid propellants (Monopropellants). Liquid hydrogen is an important liquid propellant. It is used along with liquid oxygen.

(c) Double base propellant. It mainly consists of nitroglycerine and nitrocellulose. Nitrocellulose gel in nitroglycerine sets in as a solid mass.

(d) Bi – liquid propellants. They consists of a combination of an oxidizer such as liquid oxygen, nitrogen tetra oxide (N_2O_4) or nitric acid and a fuel such as kerosene, alcohol, hydrazine or liquid oxygen. They give higher thrust.

(e) Composite propellant. It is a blend of polymeric binder such as polymetane or polybutadiene as fuel and ammonium per chlorate as oxidizer alongwith certain metals like magnesium or aluminium in finely divided form to modify the performance of the propellant.

(f) Hybrid propellant. They consist of a solid fuel and a liquid oxidizer e.g., liquid N_2O_4 and acrylic rubber.

Q.33 What propellants have been used in PSLV – C4 rocket?

Ans. PSLV – C4 rocket is a four stage vehicle. It has twin engine using liquid propellants. Each engine uses monomethyl hydrazine (MMH) as a fuel and mixed oxides of nitrogen as oxidizer. The various propellants used in different stages are **1st stage.** Solid hydroxyl terminated poly Butadiene (HTPB) based propellant.

2nd stage. Liquid propellant, unsymmetrical dimethyl hydrazine (UDMH) as a fuel and nitrogen tetraoxide (N_2O_4) as an oxidizer.

3rd stage. HTPB – based solid propellants.

4th stage. Unsymmetrical monomethylhydrazine (UMMH) as a fuel and mixed oxides of nitrogen as oxidizer.

Q.34 Describe the following with examples:
(i) Doube – base propellant
(ii) Biliquid propellant
(iii) Monoliquid propellant
(iv) Hybrid propellant

Ans. **(i) Double base propellant.** It mainly consists of nitroglycerine and nitrocellulose. Nitrocellulose gel in nitroglycerine sets in as a solid mass.

(ii) Bi – liquid propellants. They consists of a combination of an oxidizer such as liquid oxygen, nitrogen tetra oxide (N_2O_4) or nitric acid and a fuel such as kerosene, alcohol, hydrazine or liquid oxygen. They give higher thrust.

(iii) Monoliquid propellant. Liquid hydrogen is an important liquid propellant. It is used along with liquid oxygen.

(iv) Hybrid propellant. They consist of a solid fuel and a liquid oxidizer e.g., liquid N_2O_4 and acrylic rubber.

Q.35 Discuss the role of redox phenomenon in the context of rocket propellants.

Ans. In rocket propellants, fuel acts as reducing agent and the oxidizer acts as an oxidizing agent. The combustion of fuel occurs rapidly and produces a large volume of gases. It involves redox phenomenon because oxidation of fuel and reduction of oxidizer occurs simultaneously.

EXERCISE-I UNSOLVED PROBLEMS

Q.1 Sleeping pills are recommended by doctors to the partients suffering from sleeplessness but it is not advisable to take it doese without consultation with the dector. why?

Q.2 With reference to which classification has the statement "Rantidine is an antacid" been given ?

Q.3 Why do we require artificial sweetening agents?

Q.4 Name the macromolecules that are chosen as drug targets.

Q.5 Which forces are involved in holding the drugs to the active site of enzymes?

Q.6 Low level of noradrenaline is the cause of depression. What type of drugs are needed to cure thier problem ? Name two drugs.

Q.7 Give an example of a sulpha drug.

Q.8 Name one synthetic sweetening agent.

Q.9 What is an antibiotic? Give the name of the first antibiotic discovered.

Q.10 What is a pathogen?

Q.11 What is the difference between antiseptic and antibiotic?

Q.12 Why are detergents prefered over soaps?

Q.13 What are the consequences of using non-biodegreedeble detergents?

Q.14 Why is bithional added to soap?

Q.15 What is the name given to medicines used for getting relief from kam ?

Q.16 What are taningtsens? Give an example.

Q.17 Explain the terms with one example in each case food presentives energyes percyents ?

Q.18 What are the following substance ? Give an example of each of them
(i) Cetiric (ii) Sengmes (iii) Swectenving agents

EXERCISE-II BOARD PROBLEMS

Q.1 Describe the following with suitable examples:
(i) Preservatives (ii) Tranquilizers.

Q.2 How are antiseptics distinguished from disinfectants ? Give two examples of each.

Q.3 Describe the following with example in each case:
(i) Antioxidants. (ii) Biodegradable detergent.

Q.4 Describe the following with example in each case:
(i) Edible colours (ii) Antifertility drugs

Q.5 State the function along with one example each of :
(i) Antihistamines (ii) Antioxidants.

Q.6 Describe antiseptics with suitable examples.

Q.7 Describe the following with an example each:
(i) Antimicrobials (ii) Analgesics.

Q.8 Describe the following with suitable examples:
(i) Antioxidants (ii) Analgesics.

Q.9 Define tranquilizers and give one example.

Q.10 Define the following give one example of each
(i) Antipyretics (ii) Antibiotics

Q.11 Name a food preservative which is most commonly used by food producers.

Q.12 Describe and illustrate with an example, a detergent.

Q.13 (i) What class of drug is ranitidine ?
(ii) If water contains dissolved Ca^{2+} ions, out of soaps and synthetic detergents, which will you use for cleaning clothes ?
(iii) Which of the following is an antiseptic ?