SAMPLE CONTENT

Challenger

NEET - UG & JEE (Main) CHEMISTRY Vol - II

As per latest syllabus issued by NMC & NTA

2212 MCQs with Hints

For all Medical and Engineering Entrance Examinations held across India.



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Challenger NEET (UG) & JEE (Main) Chemistry Vol. II

Now with more study techniques

Updated as per latest syllabus for: NEET (UG) 2024 issued by NMC on 6th October, 2023 JEE (Main) 2024 issued by NTA on 1st November, 2023

Salient Features

- Concise theory for every topic
- Eclectic coverage of MCQs under each sub-topic
- Exhaustive coverage of questions including selective questions from previous NEET (UG) and JEE (Main) examinations updated upto year 2023:
 - 2212 MCQs
 - **105** Numerical Value type (NVT)
 - Solutions to the questions are provided for better understanding
- Inclusion of 'Problems To Ponder' to engage students in scientific enquiry.
- Multiple Study Techniques to Enhance Understanding and Problem Solving.
- Includes Question Papers and Answer Keys (Solutions through Q.R. code) of:
 - NEET (UG) 2022

- JEE (Main) 2022 25th July (Shift I)
- NEET (UG) 2023
- JEE (Main) 2023 24th Jan (Shift II)

- Q.R. codes provide:
 - Video links for boosting conceptual retention
 - Question Paper along with Answers and Solutions of NEET (UG) 2023 (Manipur)

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PREFACE

'Challenger Chemistry Vol - II' is a compact guidebook, extremely handy for preparation of various competitive exams like NEET, JEE (Main). This edition provides an unmatched comprehensive amalgamation of theory with MCQs. The chapters are aligned with the syllabus for NEET (UG) and JEE (MAIN) examinations and runs parallel to NCERT curriculum. The book provides the students with scientifically accurate context, several study techniques and skills required to excel in these examinations.

Each chapter in the book consists of:

- **Concise theory** covering concepts that form a vital part of preparation any competitive examination in the form of pointers, tables, charts and diagrams.
- Concept Building Problems section is designed to boost prerequisite understanding of concepts.
- **Practice Problems** section contains questions crafted for thorough revision.
- **Diagram Based Problems** section contains questions that facilitate students' conceptual understanding and enhance their spatial thinking ability.
- Numerical Value Type section cater to newly added NVT questions in JEE (Main).
- **Problems to Ponder** section offers MCQs of diverse pattern created to instill the attitude of concentrating on the problems and to understand the application of various concepts in Chemistry.

All the questions included in a chapter have been specially created and compiled to enable students solve complex problems which require strenuous effort with promptness.

All the features of this book pave the path of a student to excel in examination. The features are designed keeping the following elements in mind: Time management, easy memorization or revision and non-conventional yet simple methods for MCQ solving.

To keep students updated, selected questions from examinations of NEET (UG) and JEE (Main) till year 2021 are covered exclusively.

Previous Years' Question Papers:

To keep students updated, Question Papers along with Answers and Solutions (through Q.R. code) of following papers have been provided to offer students glimpse of the complexity of questions asked in entrance examination. These papers of latest competitive examinations have been provided and split unit-wise to let the students know which of the units were more relevant as per latest Question paper.

- NEET (UG) **2022, 2023** and **2023 (Manipur)**
- JEE (Main) **2022** 25th July (Shift I), **2023** 24th January (Shift II)

We hope the book benefits the learner as we have envisioned.

A book affects eternity; one can never tell where its influence stops.

From,

Publisher

Edition: Fourth

The journey to create a complete book is strewn with triumphs, failures and near misses. If you think we've nearly missed something or want to applaud us for our triumphs, we'd love to hear from you.

Please write to us on: mail@targetpublications.org

Disclaimer

This reference book is based on the NEET-UG and JEE (Main) syllabus prescribed by National Testing Agency (NTA). We the publishers are making this reference book which constitutes as fair use of textual contents which are transformed by adding and elaborating, with a view to simplify the same to enable the students to understand, memorize and reproduce the same in examinations.

This work is purely inspired upon the course work as prescribed by the National Council of Educational Research and Training (NCERT). Every care has been taken in the publication of this reference book by the Authors while creating the contents. The Authors and the Publishers shall not be responsible for any loss or damages caused to any person on account of errors or omissions which might have crept in or disagreement of any third party on the point of view expressed in the reference book.

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KEY FEATURES



KEY FEATURES



Frequently Asked Questions

Why Challenger Series?

Gradually, every year the nature of competitive entrance exams is inching towards conceptual understanding of topics. Moreover, it is time to bid adieu to the stereotypical approach of solving a problem using a single conventional method.

To be able to successfully crack the NEET/JEE (Main) examinations, it is imperative to develop skills such as data interpretation, appropriate time management, knowing various methods to solve a problem, etc. With Challenger Series, we are sure, you'd develop all the aforementioned skills and take a more holistic approach towards problem solving. The way you'd tackle advanced level MCQs with the help of hints, Smart tips, Smart codes and Thinking Hatke would give you the necessary practice that would be a game changer in your preparation for the competitive entrance examinations.

> What is the intention behind the launch of Challenger Series?

The sole objective behind the introduction of Challenger Series is to severely test the student's preparedness to take competitive entrance examinations. With an eclectic range of critical and advanced level MCQs, we intend to test a student's MCQ solving skills within a stipulated time period.

What do I gain out of Challenger Series?

After using Challenger Series, students would be able to:

- a. assimilate the given data and apply relevant concepts with utmost ease.
- b. tackle MCQs of different pattern such as match the columns, diagram based questions, multiple concepts and assertion-reason efficiently.
- c. garner the much needed confidence to appear for competitive exams.
- d. easy and time saving methods to tackle tricky questions will help ensure that time consuming questions do not occupy more time than you can allot per question.

How to derive the best advantage of the book?

>

To get the maximum benefit of the book, we recommend :

- a. Go through brief theory given at the beginning of a chapter for a quick revision. Commit Smart Tips into memory and pay attention to Caution.
- b. Know all the Formulae compiled at the end of theory by heart.
- c. Using subtopic wise segregation as a leverage, complete the Concept Building Problems at your own pace. Questions from JEE (Main), NEET (UG) examinations are tagged and placed along the flow of subtopic. Mark these questions specially to gauge the trends of questions in various exams.
- d. Be extra receptive to Thinking Hatke, Alternate Method and application of Smart Tips. Assimilate them into your thinking.
- e. After mastering stimulating questions, take up Practice Problems as self-assessment and verify answers as well as methods. Check if you could apply smart tips, alternate method, etc., as mentioned in hint. Find out if you have invented ingenious solution mapping to thinking hatke explicated in hints.
- f. Watch the linked video for an efficient revision of chapter theory.
- g. Ruminate over questions from Problems To Ponder and appreciate aesthetics of the concepts.
- *Can the Questions presented in Problems to Ponder section be a part of the NEET Examination?* No, the questions would not appear as it is in the NEET Examination. However, there are fair chances that these questions could be covered in parts or with a novel question construction.

Best of luck to all the aspirants!

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 Complete chapter excluded from the NEET (UG) and JEE (Main) 2024 syllabus (in index)

Scan the adjacent QR Code in Quill - The Padhai App to view Question Paper and Solution of NEET (UG) 2023 (Manipur).



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- The above table contains the list of chapters/subtopics/question numbers that are excluded from the latest syllabus of NEET (UG) and JEE (Main) 2024. These questions are covered to give an idea about the variety and difficulty levels of questions asked in the examination over the years. Note: i.
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- 16.0 Introduction
- 16.1 Classification of drugs
- 16.2 Designing of a drug and action of drug on targets
- 16.3 Chemicals in medicines
- 16.4 Chemicals in food
- 16.5 Cleansing agents

16.0 INTRODUCTION

- i. Chemistry has an important role in all aspects of everyday life such as, food, clothes, medicines, etc.
- ii. Medicinal chemistry involves the study of drugs, for the treatment and cure of disease.

> Drugs:

Drugs are chemicals having low molecular masses ($\sim 100 - 500 u$) which interact with macromolecular targets and produce a biological response.

> Medicines:

- i. Drugs are called as **medicines** when the biological response produced by them is therapeutic and useful.
- ii. Drugs when taken in higher doses than recommended harm the body and are potential poisons.
- iii. The treatment, which involves the use of powerful chemicals to produce therapeutic effect, is called **chemotherapy**.

16.1 CLASSIFICATION OF DRUGS

Classification of drugs:

Several criteria are used in the classification of drugs. Some of them are discussed below:

i. Classification based on pharmacological effects of drugs:

The pharmacological effect is the physiological and/or biochemical changes in the body produced by a drug in therapeutic concentration. To treat a particular problem, a whole range of drugs is available based on their pharmacological effect. This classification is useful for doctors.

- **E.g.** a. Analgesics are used as painkillers.
 - b. Antacids reduce pain and irritation of stomach.
 - c. Tranquilizers affect central nervous system.
 - d. Antibiotics and antiseptics reduce the growth of bacteria or they kill bacteria.

ii. Classification based on action of drug on a particular biochemical process:

This classification is based on the action of a drug on a particular biochemical process.

E.g. All antihistamines inhibit the action of the compound, histamine which causes inflammation in the body. The action of histamines can be blocked in many ways.

iii. Classification based on chemical structure:

- a. This classification is based on the chemical structure of the drugs.
- b. Compounds having similar chemical structure have similar biological properties.
 - E.g. 1. Sulphonamides have common structure and are antibacterial.
 - 2. Barbiturates are sedative.

iv. Classification based on molecular targets:

- a. The drugs are classified on the basis of the drug targets or target molecules with which they interact.
- b. The target molecules are biomolecules such as carbohydrates, proteins, nucleic acids, lipids, etc.
- c. Many enzymes and receptors in the cells have molecular targets.
- d. Drugs having similar structural features may have the same mechanism of action on targets.
- e. This type of classification is most helpful for medicinal chemists.



16.2 DESIGNING OF A DRUG AND ACTION OF DRUG ON TARGETS

Designing of a drug:

Drug target and drug metabolism are the two main considerations for designing of a drug.

Drug target:

Drug target is the biological macromolecule with which the drugs interact.

- i. Carbohydrates, proteins, lipids, fats and nucleic acids are macromolecules and perform various functions in the body. For example, carbohydrates and lipids forms the structural component of cell membrane, carrier proteins carry polar molecules across cell membrane while some other proteins act as biological catalysts (or enzymes), nucleic acids code genetic information for the cell, etc.
- ii. Proteins that perform the role of biological catalysts in the body are called **enzymes** while those proteins that are crucial to the communication system in the body are called **receptors**.
- iii. The correct choice of the drug target is very important for the desired pharmacological effect.

Action of drugs on targets:

The target can be an enzyme molecule or a receptor.

- Enzymes as drug target:
- i. To explain the catalytic activity of enzymes, **lock and key model** is used. In this model, enzyme acts as lock and substrate acts as key. Substrate (key) fits into the enzyme (lock).



- ii. Active site is that part of the enzyme where substrate is held and the chemical reaction takes place.
- iii. The size and shape of the active site is such that it properly holds the substrate in right position.
- iv. Substrate is attached to the enzyme by different intermolecular forces such as ionic bond, covalent bond, hydrogen bond, van der Waals forces, dipole-dipole interaction, etc.
- v. Enzymes provide functional groups such as –OH, –COOH, –SH which attack the substrate and carry out the chemical reaction.
- vi. The substrate molecule is held in a suitable position by the enzyme so that, reagent can attack it effectively.

vii. Drug-enzyme interaction:

- a. To understand drug-enzyme interaction, it is necessary to know about the interaction between substrate, enzyme and drug.
- b. Drugs which makes the enzyme ineffective in such a way that the substrate cannot bind to the active site of the enzyme are called enzyme inhibitors. This is done in two ways, either by **competitive inhibition** or by **non-competitive inhibition**.
- c. In competitive inhibition, drugs compete with substrate for the active site. Drugs bind to the active site of the enzyme and block it in such a way that the substrate cannot bind to the active site. Such drugs are called as **competitive inhibitors.**



d. In non-competitive inhibition, drug binds to some other side of the enzyme. Due to this, the size and shape of the active site is changed and thus substrate cannot bind to the active site of the enzyme. This is known as **allosteric effect** and the site at which drug binds is known as **allosteric site**.



Note: If the drug, i.e., inhibitor forms a strong covalent bond with the enzyme, then the enzyme is blocked permanently. Body degrades the enzyme-inhibitor complex and synthesizes the new enzyme.

- Receptors act as drug targets:
- i. Receptors are proteins, which are crucial for communication system in the body. Most of these are embedded in cell membranes in such a way that their small part having active site projects out of the surface of cell membrane.
- ii. In the body, message between two neurons and that between neurons to muscles is communicated through certain chemicals known as **chemical messengers**.
- iii. Chemical messengers bind to the active site of the receptor, due to which the shape of the receptor is changed and the message is delivered. Thus, chemical messenger gives message to the cell without entering the cell.
- iv. The active sites of receptors have different shapes, structures and amino acid composition. Thus, they are highly selective towards a particular chemical messenger.





- v. Drugs either disturb the function of receptor or activate the receptor.
- vi. The drugs, which bind the receptors and disturb their functions, are called **antagonists.** These drugs are useful when a particular message is to be blocked.
- vii. The drugs, which stimulate or activate the receptor to initiate a physiological response or mimic the natural messenger by switching on the receptor, are called **agonists.** These drugs are useful when there is a lack of natural chemical messenger.

16.3 CHEMICALS IN MEDICINES

Medicines can be classifed into major classes such as analgesics, tranquilizers, antimicrobials, antifertility drugs, antacids, antihistamines, etc.

> Neurologically active drugs:

Analgesics and tranquilizers are neurologically active drugs. These affect the message transfer mechanism from nerve to receptor.

• Analgesics:

The chemical substances which are used to relieve pains without causing impairment of conciousness, mental confusion, incoordination or paralysis or some other disturbances of nervous system are called **analgesics**.

Analgesics can be further classified into narcotic analgesics and non-narcotic analgesics.

- i. Narcotic analgesics:
 - a. Narcotic analgesics instantly relieve pain and produce depression of the central nervous system. **E.g.** Morphine, codeine, heroin, marijuana, etc., are narcotic analgesics.
 - b. Narcotic analgesics reduce the pain caused due to fracture of bones, post-operative pain, pain due to burns, cardiac pain, pains related to child birth and terminal cancer.
 - c. They produce sleep and cause addiction. Excessive doses are poisonous and produce stupor (a state of reduced consciousness) coma, convulsions and ultimately lead to death.
 - d. Morphine is more potent analgesic than codeine and produces depression of respiration. Heroin is a diacetyl derivative of morphine and is more addictive. Morphine narcotics are also known as opiates because they are derived from the opium poppy.



- **Note:** 1. Narcotic and psychotropic drugs carry text "NR_X" on the medicine strip. These drugs require doctor's prescription.
 - 2. Lysergic acid (LSD) is a non habituating narcotic drug which causes hallucination, a false impression of being happy.

ii. Non-narcotic (non-additive) analgesics:

- a. Non-narcotic analgesics are non-addictive in nature and they do not produce depression of central nervous system.
 - **E.g.** Aspirin, paracetamol, etc.
- b. Non-narcotic analgesics are anti-inflammatory (reduces the cause of inflammation) and antipyretic (reduce fever).
- c. The most commonly used anti-inflammatory drug is aspirin. It inhibits the synthesis of prostaglandins which stimulate inflammation in the tissue and cause pain. It is analgesic, anti-inflammatory, antipyretic and antirheumatic drug. Aspirin is used to relieve skeletal pain due to arthritis, reducing fever (antipyretic) and prevent platelet coagulation. Acetylation of salicylic acid gives aspirin. Other examples include, paracetamol, naproxen, methyl salicylate, novalgin, etc.



> Tranquilizers:

The chemical substances used to relieve or reduce the stress, irritability, excitement and anxiety leading to calmness are called **tranquilizers**.

E.g. Iproniazid, phenelzine (Nardil), equanil, valium, chlordiazepoxide, meprobamate, serotonin, etc.



i. There are various types of tranquilizers. They function by different mechanisms. Neurotransmitter noradrenaline can affect the mood of a person. Low levels of noradrenaline result in depression. Drugs such as iproniazid and phenelzine inhibit the enzymes which decrease the level of noradrenaline. These drugs are called antidepressent drugs.

- ii. The action of enzyme responsible for catalysing the degradation of noradrenaline is inhibited by antidepressent drugs. These neurotrasmitters are metabolised and attaches to the receptor overcoming the effect of depression.
- iii. Tranquilizers reduce mental tension (mild and severe) and induces a sense of well being by relieving stress, irritability and excitement, etc.
- iv. Mild tranquilizers such as chlorodiazepoxide and meprobamate is used for relieving tension. Equanil controls depression and hypertention. Some other substances used as tranquilizers are valium and serotonin.
- v. Barbiturates are the derivatives of barbituric acid. They control hypertension and depression. They are hypnotic drugs and produce sleep.

E.g. Veronal, seconal, luminal, nembutal, amytal, etc.



> Antimicrobials:

Antimicrobials are the chemical substances used to cure infections due to microorganisms like fungi, bacteria, viruses, etc., by destroying or inhibiting the pathohenic infection the microbes selectively.

Antimicrobials are further classified into antibiotics, antiseptics and disinfectants.

• Antibiotics:

Antibiotic refers to a substance (produced completely or partly by chemical synthesis) which in low concentration inhibits the growth or destroys microorganisms by intervening in their metabolic processes.

ЭΗ

i. The first effective treatment of syphilis was done by a compound **arsphenamine** (also known as **salvarsan**). It contains -As = As- linkage. It is toxic to human beings. But it has much higher effect on the bacteria, **spirochete**. There is another drug **prontosil** (antibacterial drug) which contains -N = N - linkage similar to -As = As- linkage in salvarsan.



ii. The antibacterial activity of prontosil is due to p-aminobenzene sulphonamide (sulphanilamide). In human body, prontosil is converted to sulphanilamide.



iii. One of the most effective antibiotics is the sulpha drug called **sulphapyridine**, which is used in the treatment of pneumonia, diphtheria, tuberculosis, etc.



Chapter 16: Chemistry in Everyday Life

iv. **Penicillin** was the first successful antibiotic produced. There are different types of penicillin based on various R groups present in them.



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

Antibiotics

Bactericidal Antibiotics

- Kill bacteria
- E.g. Penicillin,
- aminoglycosides, ofloxacin, etc.

Bacteriostatic Antibiotics

- Inihibit growth of bacteria
- E.g. Erythromycin, tetracycline, chloramphenicol, etc.

vi. Spectrum of action of antibiotics:

The complete range of bacteria or other microorganisms attacked by an antibiotic is called its spectrum.

Spectrum of actions of antibiotics

↓		\
Broad spectrum	Narrow spectrum	Limited spectrum
 Effective against a wide range of Gram positive and Gram negative bacteria E.g. Chloramphenicol, vancomycin, ofloxacin, synthetic derivatives of penicillin gual as ampigillin amouvaillin etc. 	• Effective against either Gram positive or Gram negative bacteria E g. Paniaillin C	• Effective against a single organism or disease

a. Chloramphenicol is used in the treatment of typhoid, dysentery, acute fever, meningitis, urinary infections, pneumonia, etc. It can be given orally to the patients since it is absorbed rapidly from the gastrointestinal tract.



(Bacteriostatic) (C₁₁H₁₂Cl₂N₂O₅)

- b. Dysidazirine is an effective antibiotic against certain strain of cancer cells.
- Note: Many antibiotics become ineffective over the period of time because bacteria develop resistance to antibiotics.
- Antiseptics:

Chemicals, which are applied to the living tissues to kill the bacteria and to stop their growth in wound, thus preventing its infection are called **antiseptics**.

- i. Antiseptics are not harmful to living tissues. However, these are not ingested like antibiotics. **E.g.** Furacine, soframicine, etc.
- ii. These are directly applied to wounds, cuts, ulcers, diseased skin surfaces, etc. They do not heal the wounds instead they prevent its infection.



- iii. Some commonly used antiseptics are dettol (mixture of terpineol and chloroxylenol), tincture iodine (2-3% solution in alcohol-water mixture), bithional (used in soap), iodoform, boric acid (dilute aqueous solution is used as weak antiseptic for eyes), phenol (used as dilute solution, i.e., 0.2%), thymol (obtained from oil of a spice plant), etc.
- iv. Amyl meta-cresol is used as antiseptic in mouthwash or gargles in infections of the mouth and throat.



Disinfectants:

The chemical substances, which are used to kill microorganisms but cannot be applied on living tissues, are called **disinfectants**.

Disinfectants are used in public health sanitation, water treatment, floors, sterilisation of instruments, etc.

E.g.

- i. Chlorine (0.2 to 0.4 ppm) is added to water to make it potable (clean and safe for drinking).
- ii. Sulphur dioxide in low concentration is used for the sterilization and preservation of squashes.
- iii. Few chemicals can be used as antiseptic as well disinfectants depending upon their concentration. Phenol in high concentration (1%) acts as a disinfectant whereas in low concentration (0.2%) acts as an antiseptic.
- iv. The disinfectant thymol is more powerful than phenol.

Antifertility drugs:

The chemical substances used to control the pregnancy are called **antifertility drugs** or **oral** contraceptives or birth control pills.

- i. These drugs are a mixture of derivatives of estrogen and progesterone (which are hormones). Progesterone suppresses ovulation.
- ii. Norethindrone is a synthetic progesterone derivative and is more potent than progesterone.
- iii. Novestrol (ethynylestradiol) is estrogen derivative. It is used in combination with progesterone derivative.
- iv. Mesteranol also acts as a birth control pill.



Antacids and antihistamines:

• Antacids:

The chemical substances, which neutralize excess acid in the gastric juices and give relief from acid indigestion, acidity, heart burns and gastric ulcers are called **antacids**.

- i. During digestion of food, hydrochloric acid is secreted in the stomach. Sometimes excessive secretion of hydrochloric acid results in hyperacidity. This excess acid can result in acid indigestion, heart burn, irritation or pain of gastric ulcers.
- ii. Commonly used antacids are baking soda (sodium bicarbonate), aluminium hydroxide (Al(OH)₃), magnesium hydroxide (Mg(OH)₂), magnesium oxide (MgO).
- iii. Antacids control the symptoms of hyperacidity. They cannot treat the cause of hyperacidity.

iv. A chemical, histamine, stimulates the secretion of hydrochloric acid and pepsin in stomach. The drugs cimetidine (Tegamet) and ranitidine (Zantac) were designed to prevent the interaction of histamine with the receptors present in the stomach wall as histamine was responsible for release of acid.



Antihistamines:

Antihistamines are chemical substances which diminish or abolish the main actions of histamine released in the body and hence, prevent the allergic reactions.

- i. Histamine is a potent vasodilator. It contracts smooth muscles in bronchi and relaxes the muscles of blood vessels of stomach walls.
- ii. Nasal congestion during common cold and an allergic response to pollen are associated with histamines.
- iii. Antihistamine drugs compete with histamine in binding with receptors. They prevent the interaction between histamine and receptors.
- iv. Antihistamines are used to treat allergy such as skin rashes, conjuctivities (inflammation of conjuctiva of eye) and rhinitis (inflammation of nasal mucosa). Hence, they are called **antiallergic drugs**.
- v. Some commonly used antihistamine drugs are terfenadine (seldane), brompheniramine (dimetapp or dimetane).



16.4 CHEMICALS IN FOOD

> Introduction:

Food additives are the various chemicals added to food to either preserve it or to enhance its appeal or to improve its nutritive value. Some of the food additives are preservatives, colouring agents, flavouring agents, stabilizing agents, fat emulsifiers, antioxidants, artificial sweeteners, flour improvers, antistaling agents, nutritional supplements such as vitamins, minerals and amino acids.

Food preservatives:

Food preservative is a substance, which when added to food is capable of inhibiting, retarding or arresting the process of fermentation, acidification or other decomposition of food caused by growth of microbes.



- i. Food preservatives prevent the rancidity of food. They either inhibit the growth or kill the microorganisms.
- ii. Commonly used preservatives are table salt, sugar, vinegar, vegetable oils, sodium benzoate in a limited quantity, salts of sorbic acid and propanoic acid.
- iii. Limited quantities of sodium benzoate acts as food preservative and it can be easily metabolised by the body too.

Artificial sweetening agents:

Certain chemicals, which do not occur in nature but are synthesized in the laboratory have sweet taste, but have no food value, are known as **artificial sweeteners**.

- i. Unlike natural sweeteners, artificial sweeteners provide only sweetness but provide no calories. Aspartame is an exception as it also provides calories. Hence, artificial sweeteners are also called **calorie-free sweeteners or low calorie sweeteners**. Other examples include saccharin, aspartame, sucralose, alitame, etc.
- ii. **Saccharin** (ortho-sulphobenzimide), is about 550 times more sweet than cane sugar It is highly inert and stable. It is excreted from body in the urine. Diabetic patients use it to control intake of calories.
- iii. **Aspartame** is methyl ester of dipeptide of aspartic acid and phenylalanine. It is about **100 times** sweeter than cane sugar. It is unstable at high temperatures; hence, used in cold foods and soft drinks.
- iv. **Sucralose** (Trichloro derivative of sucrose) is about 600 times sweeter than the cane sugar. Its taste and appearance are like sugar. It is stable at cooking temperature and it does not provide calories.
- v. Alitame is stable at high temperature and is about 2000 times sweeter than the cane sugar. It is very very sweet due to which it becomes difficult to control the sweetness of food.



Antioxidants:

Antioxidant is a substance which when added to food retards or prevents oxidative deterioration of food.

Commonly used antioxidants are butylated hydroxy toluene (BHT), butylated hydroxy anisole (BHA), ascorbic acid, sulphur dioxide (SO₂), sulphites and bisulphites.



16.5 CLEANSING AGENTS

Two types of cleansing agents viz., soaps and synthetic detergents are commonly used. Dirt, dust and other materials bind to the fats present on the fabric or the skin. These fats can be washed off by soaps and synthetic detergents.

➤ Soaps:

Soaps are sodium or potassium salts of higher fatty acids containing long chains of carbon atoms.

- i. Some of the fatty acids used in the preparation of soap are palmitic acid ($C_{15}H_{31}COOH$), stearic acid ($C_{17}H_{35}COOH$), oleic acid ($C_{17}H_{33}COOH$), etc.
- ii. Only sodium and potassium soaps are soluble in water and are used for cleaning purposes. Soaps used in shampoo, shaving cream and bathing soaps are potassium soaps. Potassium soaps are softer to skin than sodium soaps.

• Preparation of soaps (Saponification of oils and fats):

When oils and fats are heated with solution of sodium hydroxide or potassium hydroxide, they are hydrolysed to glycerol and sodium (or potassium) salt of fatty acid (known as soap). This process is called **saponification**.



- i. Oils and fats are esters of higher fatty acids with glycerol (i.e., glyceryl ester of fatty acid). They are called **glycerides.** Ester of stearic acid with glycerol is called **tristearin.** Ester of palmitic acid with glycerol is called **tripalmitin.**
- ii. After saponification, soap is obtained in the colloidal form. Addition of common salt (NaCl) to the aqueous solution decreases the solubility of soap due to which it precipitates. Soap being lighter, floats on the surface of water and can be separated.

E.g. Sodium stearate is prepared by saponification of tristearin.

 \circ

$$\begin{array}{c} CH_2 = O - \overset{O}{C} - C_{17}H_{35} \\ CH = O - \overset{O}{C} - C_{17}H_{35} \\ CH = O - \overset{O}{C} - C_{17}H_{35} \\ CH_2 = O - \overset{O}{C} - C_{17}H_{35} \\ CH_2 = O - \overset{O}{C} - C_{17}H_{35} \\ CH_2 = O - \overset{O}{C} - C_{17}H_{35} \\ Tristearin \\ \end{array}$$

- iii. Water soluble glycerol is recovered from aqueous solution by fractional distillation. It is used in drugs, cosmetics, explosives and paints.
- iv. Microorganisms present in sewage water can oxidise soap. Hence, soap is biodegradable and do not cause pollution.
- v. Soaps are insoluble in hard water. Hard water contains Ca²⁺ and Mg²⁺ ions. Soaps react with these ions to form insoluble magnesium and calcium salts. These salts precipitate out as gummy substances and stick to fabric and thus damaging it. Hence, soaps cannot remove oil and grease from fabric if used in hard water.

$$\begin{array}{c} O \\ \parallel \\ 2R - C - O^{-}Na^{+} + Ca^{2+}/Mg^{2+} \longrightarrow (RCOO)_{2}Ca/(RCOO)_{2}Mg + 2Na^{+} \\ Soap \qquad (From hard \\ water) \qquad Calcium/magnesium salt \end{array}$$

vi. Sticky precipitate formed by soap with hard water makes the hair look dull. Sticky or gummy mass is also responsible for uneven absorption of dye on the cloth.

|--|

Types of soaps: Various raw materials are used to prepare soaps and to give them desired properties.

	Types of soaps	Description
i.	Toilet soaps	Prepared by using better quality fats and oils and removing excess of alkali. Colour and
		perfumes are also added.
ii.	Transparent soaps	Prepared by dissolving the soap in ethanol and then excess solvent is evaporated.
iii.	Medicated soaps	Rich in substances of medicinal importance. Deodorants are added.
iv.	Shaving soaps	Contain glycerol to prevent drying. A rosin gum is added during their preparation. It
		forms sodium rosinate which enhances lathering property of soap.
V.	Laundry soaps	Prepared by adding fillers like sodium rosinate, sodium silicate, borax and sodium
		carbonate to soap.
vi.	Soap chips	Prepared by running a thin sheet of melted soap on a cool cylinder and removing off
		the soaps.
vii.	Soaps that float in	Prepared by beating tiny air bubbles into the soap mixture, before it is hardened.
	water	
viii.	Soap granules	These are minute soap bubbles that are dried.
ix.	Soap powders and	Made by adding scouring agent (abrasive) like powdered pumice or finely divided
	scouring soaps	sand, and builders like sodium carbonate and trisodium phosphate. Soaps are made to
		act more fast by these builders.

Synthetic detergents:

- i. Synthetic detergents are better than soaps as they work even in hard water. They contain builders which form soluble calcium and magnesium salts.
- ii. Detergents can be classified into anionic, cationic and non-ionic detergents.

• Anionic detergents:

- i. Anionic detergents are sodium salts of sulphonated long chains hydrocarbons or alcohols.
- ii. They contain anions at the soluble ends of chain. The cleansing action is due to this anionic part.
- iii. Long chain hydrocarbons (E.g. dodecylbenzene) or alcohols (E.g. lauryl alcohol) are treated with concentrated sulphuric acid and neutralized with sodium hydroxide to obtain anionic detergents.
 - **E.g.** a. Dodecylbenzene is treated with concentrated sulphuric acid to obtain n-dodecylbenzenesulphonic acid (alkylbenzene sulphonates). It is then neutralized with NaOH to obtain anionic detergent sodium n-dodecylbenzenesulphonate.



b. Lauryl alcohol is treated with sulphuric acid to obtain lauryl hydrogensulphate. It is then neutralized with NaOH to obtain sodium lauryl sulphate.

$$\begin{array}{c} CH_3 (CH_2)_{\overline{10}}CH_2OH \xrightarrow{H_2SO_4} & CH_3 (CH_2)_{\overline{10}}CH_2OSO_3H & \xrightarrow{NaOH} & CH_3 (CH_2)_{\overline{10}}CH_2OSO_3^-Na^+ \\ Lauryl alcohol & Lauryl hydrogen sulphate & Sodium lauryl sulphate \end{array}$$

iv. Anionic detergents are used in toothpaste and for cleaning purposes.

• Cationic detergents:

- i. **Cationic detergents** are quaternary ammonium salts of amines with chlorides, bromides or acetates as anions.
- ii. In cationic detergents, cations contain long chain hydrocarbons with positively charged nitrogen atom whereas anions are chloride, bromide or acetate. They contain cations at the soluble ends of chain.
- iii. Cationic detergents are quite expensive. They are used as germicides.
- iv. Commonly used cationic detergents are cetyltrimethyl ammonium bromide, etc. These are used in hair conditioners.



Cetyltrimethyl ammonium bromide (n-Hexadecyl ammonium bromide)

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• Non-ionic detergents:

- i. **Non-ionic detergents** contain polar groups such as hydroxyl group which can form hydrogen bonds. These groups are present at the soluble ends of the chain.
- ii. These detergents do not contain any ions as their constituents.
- iii. Liquid dishwashing detergents contain non-ionic type of detergents and are used for washing vessels.
- iv. Non-ionic detergents are either monoesters of polyhydric alcohols with long chain fatty acid or ethers of polyethylene glycol with alkyl phenol.

E.g. Pentaerythrityl stearate, polyglycol stearate, etc.

Pentaerythrityl stearate

b. Ethylene glycol reacts with ethylene oxide to form polyethylene glycol. Polyethylene glycol reacts with stearic acid to form non-ionic detergent polyglycol stearate.

$\mathrm{HOCH}_2\mathrm{CH}_2\mathrm{OH}$	$+ n CH_2 - CH_2 -$	\rightarrow HO(CH ₂ CH ₂ O) _n CH ₂ CH ₂ OH
Ethylene glycol	O Ethylene oxide	Polyethylene glycol

 $CH_3(CH_2)_{16}COOH + HO(CH_2CH_2O)_nCH_2CH_2OH$ Stearic acid Polyethylene glycol

 $CH_3(CH_2)_{16}COO(CH_2CH_2O)_n CH_2CH_2OH \leftarrow -H_2O$

Polyglycol stearate (Non-ionic detergent)

> Differences between soaps and synthetic detergents:

No.	Soaps	Synthetic detergents
i.	Soaps are sodium or potassium salts of long	Detergents are sodium salts of long chain alkyl sulphates
	chain fatty acids.	or long chain alkyl benzene sulphonates.
ii.	Soaps cannot be used in hard water or acidic	Detergents can be used in hard water and acidic
	solutions as they precipitate out.	solutions.
iii.	They are weak cleansing agents.	They are strong cleansing agents.
iv.	They have lower solubility in water.	They have higher solubility in water.
v.	Soaps are biodegradable. They do not cause	Detergents having highly branched hydrocarbon chain
	water pollution.	are non-biodegradable (or slow degradation occur). They
		cause water pollution

Concept Building Problems

16.0 INTRODUCTION

- 1. The treatment with chemicals for therapeutic effect is called _____.
 - (A) chemotherapy(B) radiotherapy(C) genetherapy(D) medical treatment
- 16.1 CLASSIFICATION OF DRUGS
- 1. The target molecule(s) for drug can be _____ (A) carbohydrates (B) lipids
 - (C) proteins (D) all of these
- 2. The classification, which is useful for medicinal chemists is _____.
 - (A) based on chemical structure
 - (B) based on drug action

- (C) based on molecular targets
- (D) based on pharmacological effect

16.2 DESIGNING OF A DRUG AND ACTION OF DRUG ON TARGETS

- 1. Which of the following statements is INCORRECT?
 - (A) Lock and key model is used to explain the catalytic activity of enzymes.
 - (B) Enzyme acts as a lock and substrate acts as a key.
 - (C) Proteins that are crucial to the communication system in the body are called enzymes.
 - (D) In competitive inhibition, drugs compete with substrate for the active site of the enzyme.

Challenger Chemistry Vol-II (Med. and Engg.) 2. 9. Drugs that enhance receptor activity are Among the following, the narrow spectrum antibiotic is [NEET (UG) 2019] ampicillin (A) amoxycillin antagonists (B) agonists (A) (B) (C) metabolites (D) enzymes chloramphenicol (D) penicillin G (C) 10. Which of the following is NOT true about The drugs that bind to the allosteric site of the 3. [NEET (UG) P-II 2020] enzyme and inhibits its activity are called chloramphenicol? (A) It is bacteriostatic. (A) competitive inhibitors **(B)** It inhibits the growth of only gram positive bacteria. (B) agonists It is a broad spectrum antibiotic. (C) non-competitive inhibitors (C) It is not bactericidal. (D) chemical messengers (D) The number of hydroxyl (-OH) groups in 11. **16.3 CHEMICALS IN MEDICINES** chloramphenicol is 2 1. The diacetyl derivative of morphine is (A) 1 (B) (C) 3 (D) 4 (A) cocaine (B) heroin caffeine (D) (C) nicotine 12. Mixture of chloroxylenol and terpineol acts as Drugs used to control fever are called **INEET (UG) 2017** 2. antiseptic (\mathbf{B}) antipyretic (A) (A) antacids (B) antipyretics antibiotic analgesic (C) (D) (C) antibiotics (D) antiseptics 13. Bithional is generally added to the soaps as an 3. Given below are two statements: additive to function as a/an Statement I: Aspirin and paracetamol belong to [AIPMT 2015] the class of narcotic analgesics. (A) softener (B) Statement II: Morphine and heroin are nondryer (C) buffering agent (D) antiseptic narcotic analgesics. In the light of the above statements, choose the 14. A weak antiseptic used for eyes is . correct answer from the options given below. (A) tincture iodine [NEET (UG) 2021] phenol in low concentration **(B)** Both statement I and statement II are (A) iodoform (C) false. (D) dilute aqueous solution of boric acid (B) Statement I is correct but statement II is 15. Which of the following acts as both antiseptic false. and disinfectant? (C) Statement I is incorrect but statement II is BHT **(B)** Chloroxylenol (A) true Bithional (D) Phenol (C) (D) Both statement I and statement II are true. 16. An antifertility drug is 4. The number of amide groups in equanil is (A) phenelzine iproniazid Ā) (B) 1 2 (C) 3 (B) (D) 4 norethindrone (C) 5. Salvarsan was first used in the effective chlordiazepoxide (D) treatment of 17. Which of the following is NOT an antacid? (A) syphilis (B) typhoid Sodium bicarbonate (A) AIDS Ē (C)(D) cancer (B) Magnesium oxide 6. The antimicrobial activity of prontosil is due to (C) Milk of magnesia the presence of (D) Sodium chloride (A) p-hydroxybenzene sulphonic acid Which of the following compounds is NOT an 18. p-methoxybenzene sulphonamide **(B)** antacid? [JEE (Main) 2015] (C) p-aminobenzene sulphonamide Aluminium hydroxide (A) p-hydroxybenzene sulphonamide (D) (B) Cimetidine 7. Derivative of penicillin is Phenelzine (C) (A) amoxycillin (B) streptomycin Ranitidine (D)

chloramphenicol

tetracycline

ofloxacin

(D)

(B)

(D)

19. Which of the following is an analgesic?

(A)

(C)

	-	[NEET P-I 2016]
Streptomycin	(B)	Chloromycetin
Novalgin	(D)	Penicillin

8.

(C)

(A)

(C)

ofloxacin

An example for bactericidal drug is

chloramphenicol

erythromycin

20. Which among the following is a tranquilizer? Valium (A) Aspirin (B) (C) Penicillin (D) Sulphanilamide **16.4 CHEMICALS IN FOOD** 1. Which of the following is a food preservative? Sodium benzoate (A) **(B)** Sucralose (C) Ascorbic acid (D) Citric acid 2 Natural sweetener is (A) sucralose (B) alitame (C) saccharin (D) sucrose 3. An artificial sweetener used in cold foods and soft drinks is (A) saccharin **(B)** sucralose (C) aspartame (D) alitame Molecular formula of aspartame is 4. $C_{14}H_{19}O_5N$ (A) $C_{12}H_{18}O_3N_2$ (B) (C) $C_{14}H_{18}O_5N_2$ (D) $C_{10}H_{18}O_5N_2$ 5. The artificial sweetener stable at cooking temperature and does NOT provide calories is [NEET (Odisha) 2019] alitame (A) (B) saccharin (C) aspartame (D) sucralose 6. The number of hydroxyl groups in sucralose is (A) 3 (B) 4 (C) 6 5 (D) 7. The sweetest of all artificial sweeteners is (A) sucralose **(B)** alitame (C) aspartame (D) sucrose 8. BHA and BHT prevent of food. (A) saponification (B) reduction (C) rancidification hydration (D) 9. Which of the following is the structure of BHT (butylated hydroxy toluene)? (A) ЭН $C(CH_3)_3$ $(CH_3)_3C$ CH₃ ЭH (B) C(CH₃)₃

 $(CH_3)_3C$

OCH₃

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16.5 CLEANSING AGENTS

- 1. Which of the following chemical formulae represents soap?
 - (A) C₁₇H₃₅COOK
 - (B) C₁₇H₃₅COOH
 - (C) $(C_{15}H_{31}COO)_2Mg$
 - (D) $(C_{17}H_{35}COO)_2Ca$
- 2. Glycerol is added to soap because it _____.
 - (A) acts as a filler
 - (B) increases lathering
 - (C) prevents rapid drying
 - (D) hardens the soap
- 3. ______ is used as a scouring agent in soap powders.
 - (A) Sodium carbonate
 - (B) Sodium rosinate
 - (C) Powdered pumice
 - (D) Borax
- 4. Identify an INCORRECT statement from the following.
 - (A) Toilet soaps are prepared by using better quality fats and oils and by removal of excess alkali.
 - (B) Soap granules are minute, dried soap bubbles.
 - (C) Laundry soaps are prepared by beating tiny air bubbles into the soap mixture, before it is hardened.
 - (D) Transparent soaps are prepared by dissolving soap in ethanol and evaporation of excess solvent.
- 5. Which of the following is a cationic detergent? [NEET (UG) P-I 2020]
 - (A) Sodium stearate
 - (B) Cetyltrimethyl ammonium bromide
 - (C) Sodium dodecylbenzene sulphonate
 - (D) Sodium lauryl sulphate
- 6. Which of the following is used in hair conditioners?
 - (A) Cationic detergents
 - (B) Anionic detergents
 - (C) Non-ionic detergents
 - (D) Soaps



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

(B)
$$C_{17}H_{35}COO^-Na^+$$

(C)
$$C_{9}H_{19} \longrightarrow O + CH_{2} - CH_{2} - O + CH_{2} - O$$

- 8. Which of the following is an anionic detergent? [JEE (Main) 2016]
 - (A) Sodium stearate
 - (B) Sodium laurylsulphate
 - (C) Cetyltrimethyl ammonium bromide
 - (D) Glyceryl oleate

MISCELLANEOUS

- 1. Antidepressant drugs belong to the class of
 - (A) antipyretics
 - (B) tranquilizers
 - (C) narcotic analgesics
 - (D) antihistamines
- 2. The drugs which increase stomach pH belong to the class of _____.
 - (A) antacids(B) antipyretics(C) analgesics(D) antibiotics
- 3. Which of the following drugs inhibit synthesis of prostaglandins?
 - (A) Ranitidine (B) Aspirin
 - (C) Iproniazid (D) Ampicillin
- 4. Match the following and select the most appropriate option.

	List-I		List-II
1.	Sodium benzoate	a.	Food
			preservative
ii.	Baking soda	b.	Soap
iii.	Penicillin	c.	Analgesic
iv.	Sodium stearate	d.	Antibiotic
		e.	Antacid

- (A) i-a, ii-e, iii-d, iv-b
- (B) i c, ii e, iii a, iv b
- (C) i-c, ii-d, iii-e, iv-b
- (D) i-a, ii-b, iii-c, iv-e
- 5. The compound that contains heterocyclic ring in its structure is _____.
 - (A) BHA (B) sulphanilamide
 - (C) iproniazid (D) phenelzine

Practice Problems

16.2 DESIGNING OF A DRUG AND ACTION OF DRUG ON TARGETS

- The CORRECT statements among the following are _____.
 - i. In competitive inhibition, drug competes with substrate to bind to the active site of enzyme.
 - ii. In non-competitive inhibition, drug binds to the other side of the enzyme and alters the shape of the active site.
 - iii. In non-competitive inhibition, the site at which drug binds is called allosteric site.
 - (A) i, ii (B) i, iii
 - (C) ii, iii (D) i, ii, iii
- 2. Which of the following statements is INCORRECT?
 - (A) Receptors interact with chemical messengers.
 - (B) Chemical messengers carry messages between neurons and muscles.
 - (C) The active site of receptors is present inside the cell membrane.
 - (D) The receptor shape is changed when chemical messenger binds to it.

3. Match the following:

	Column I		Column II							
i.	Agonists	a.	Signal transmission between							
			neurons and muscles							
ii.	Antagonists	b.	Stimulate receptor function							
iii.	Receptors	c.	Inhibit receptor function							
iv.	Chemical	d.	Crucial for body's							
	messengers		communication							

- (A) i-c, ii-b, iii-a, iv-d
- (B) i-b, ii-c, iii-d, iv-a
- (C) i-c, ii-b, iii-d, iv-a
- (D) i b, ii a, iii d, iv c

16.3 CHEMICALS IN MEDICINES

1. Match the classes of drugs to their pharmacological effects.

		Drugs		Pharmacological effects						
i		Analgesics	a.	Drugs used to relieve stress						
i	i.	Antacids	b.	Drugs used as painkillers						
i	ii.	Antibiotics	c.	Drugs that kill or inhibit growth of microbes						
i	v.	Tranquilizers	d.	Drugs that relieve stomach acidity						
		$ \begin{array}{ccc} (A) & i - b, ii - \\ (B) & i - d, ii - \\ (C) & i - d, ii - \\ (D) & i - b, ii - \\ \end{array} $	d, iii b, iii a, iii c iii	-c, iv - a -a, iv - c -b, iv - c -d, iv - a						

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- 2. Identify the drugs that belong to the class of non-narcotic analgesics.
 - i. Aspirin ii. Phenelzine iii. Novalgin iv. Paracetamol v. Chloramphenicol vi. Naproxen
 - (A) i, iii, iv, v (B) i, ii, iii, iv, vi
 - (C) i, iii, iv, vi (D) i, iii, iv, v, vi
- 3. Which of the following statements is CORRECT?
 - (A) Meprobamate is a non-narcotic analgesic.(B) Tranquilizers such as iproniazid inhibit
 - the enzymes which reduce the level of noradrenaline.
 - (C) Barbiturates are antihypnotic drugs.
 - (D) Tranquilizers reduce calmness and enhance anxiety.
- 4. Identify tranquilizers that are derivatives of barbituric acid.
 - i. Phenelzine ii. Valium iii. Veronal iv. Equanil v. Seconal vi. Luminal
 - (A) iii, v, vi (B) iii, iv, v, vi
 - (C) i, ii, iv (D) i, ii, v, vi
- 5. **Assertion:** Barbiturates are given to patients who suffer from anxiety.

Reason: Barbiturates suppress the activities of central nervous system.

- (A) Assertion and Reason are true. Reason is the correct explanation of Assertion.
- (B) Assertion and Reason are true. Reason is not the correct explanation of Assertion.
- (C) Assertion is true. Reason is false.
- (D) Assertion is false. Reason is true.
- 6. **Assertion:** Chloramphenicol is a broad spectrum antibiotic.

Reason: Chloramphenicol is effective against a wide range of Gram positive and Gram negative bacteria.

- (A) Assertion and Reason are true. Reason is the correct explanation of Assertion.
- (B) Assertion and Reason are true. Reason is not the correct explanation of Assertion.
- (C) Assertion is true. Reason is false.
- (D) Assertion is false. Reason is true.
- 7. Match the drugs to the class to which they belong.

	Drug		Class					
i.	Naproxen	a.	Antibiotic					
ii.	Codeine	b.	Non-narcotic analgesic					
iii.	Iproniazid	c.	Narcotic analgesic					
iv.	Ampicillin	d.	Antiseptic					
		e.	Tranquilizer					
(A) (B) (C)	i - b, ii - e i - b, ii - c i - c, ii - b	, iii - , iii - , iii -	$\begin{array}{l} -a, iv - c \\ -e, iv - a \\ -d, iv - a \\ -a, iv - e \end{array}$					



- 10. Which of the following statements is INCORRECT?
 - (A) 2-3% iodine solution in alcohol-water mixture is used as an antiseptic.
 - (B) 0.2 to 0.4 ppm chlorine is used as a disinfectant to clean drinking water.
 - (C) 0.2% Phenol acts as disinfectant.
 - (D) Dilute aqueous solution of boric acid is a weak antiseptic for eyes.

11. Match the drugs to their molecular formulae.

	Drug		Molecular formula
i.	Iproniazid	a.	$C_9H_{18}N_2O_4$
ii.	Phenelzine	b.	C ₉ H ₁₃ N ₃ O
iii.	Equanil	c.	C ₈ H ₁₂ N ₂
iv.	Meprobamate	d.	$C_{7}H_{14}N_{2}O_{4}$

(A) i-c, ii-a, iii-d, iv-b

Ð

- (B) i-c, ii-b, iii-a, iv-c
- (C) i-b, ii-d, iii-a, iv-c
- (D) i-b, ii-c, iii-d, iv-a

12. Match the drugs to their chemical structures.

	Drugs		Chemical structure
i.	Paracetamol	a.	NHNH ₂
ii.	Serotonin	b.	HO-NHCOCH3
iii.	Veronal	c.	HO HO N H
iv.	Phenelzine	d.	$H = C_{2}H_{5}$ $H = C_{2}H_{5}$ $H = C_{2}H_{5}$

- (A) i-b, ii-d, iii-c, iv-a
- (B) i-b, ii-c, iii-d, iv-a
- (C) i-d, ii-b, iii-a, iv-c
- (D) i-d, ii-c, iii-a, iv-b
- 13. The antacids used to control stomach acidity are
 - (A) $Mg(OH)_2$ and ranitidine
 - (B) seldane and nardil
 - (C) aspirin and sodium bicarbonate
 - (D) dimetapp and cimetidine
- Assertion: Antihistamines are preferred over usual antacids in the treatment of acidity.
 Reason: Usual antacids temporarily relieve the symptoms but not the cause.
 - (A) Assertion and Reason are true. Reason is the correct explanation of Assertion.
 - (B) Assertion and Reason are true. Reason is not the correct explanation of Assertion.
 - (C) Assertion is true. Reason is false.
 - (D) Assertion is false. Reason is true.
- 15. The number of drugs that contain carboxylic acid group among the following is _____.
 Aspirin, paracetamol, Equanil, veronal, morphine, penicillin
 (A) 2 (B) 3 (C) 4 (D) 5

(A) 2 (B) 3 (C) 4 (D)

16.4 CHEMICALS IN FOOD

- 1. Identify preservatives among the following.
 - i. Sodium stearate
 - ii. Sodium benzoate
 - iii. Sodium carbonate
 - iv. Sodium propanoate
 - v. Sodium sorbate
 - vi. Sodium palmitate
 - vii. Sodium thiosulphate
 - (A) i, ii, iii, iv, vi (B) ii, iii, v, vii
 - (C) ii, iv, v, vi, vii (D) ii, iv, v
- 2. Match the artificial sweetening agents to their strength of sweetness with respect to cane sugar.

	Artificial		Strength of sweetness						
	sweetening		with respect to						
	agent		sucrose						
i.	Saccharin	a.	100 times						
ii.	Alitame	b.	550 times						
iii.	Aspartame	c.	600 times						
iv.	Sucralose	d.	2000 times						

- (A) i-b, ii-d, iii-c, iv-a
- (B) i-b, ii-c, iii-d, iv-a
- (C) i-b, ii-d, iii-a, iv-c
- (D) i-a, ii-d, iii-b, iv-c
- 3. Which of the following statements is INCORRECT?
 - (A) Saccharin is not digested and is excreted through urine.
 - (B) Aspartame is unstable at high temperature.

- (C) Sucralose is a trichloroderivative of sucrose.
- (D) Alitame is unstable at high temperature.

16.5 CLEANSING AGENTS

1.

- Assertion:Aftersaponificationofatriglyceride, NaCl is added to soap.Reason:AdditionofNaClincreasesthesolubility of soap in aqueous solution.
 - (A) Assertion and Reason are true. Reason is the correct explanation of Assertion.
 - (B) Assertion and Reason are true. Reason is not the correct explanation of Assertion.
 - (C) Assertion is true. Reason is false.
 - (D) Assertion is false. Reason is true.
- 2. Fatty acids to glycerol ratio in triglyceride is

	·		
(A)	1:2	(B)	1:3
(C)	3:1	(D)	2:1

3. Match the cleansing agents to their uses.

	Cleansing agent		Use
i.	Cetyltrimethyl	a.	Dish washing
	ammonium chloride		
ii.	Sodium dodecyl	b.	Hair conditioners
	benzenesulphonate		
iii.	Polyglycol stearate	c.	Toothpaste
		d.	Shaving soaps

- (A) i-b, ii-d, iii-a
- (B) i-d, ii-c, iii-b
- (C) i-b, ii-c, iii-a
- (D) i-c, ii-a, iii-b
- 4. Which of the following statements is CORRECT?
 - (A) Sodium soaps are softer than potassium soaps.
 - (B) Polyethylene glycols are used in the preparation of cationic detergents.
 - (C) Soaps can only be used in hard water whereas detergents can only be used in soft water.
 - (D) In cationic detergents, cations contain long chain hydrocarbons with positively charged nitrogen atom while anions are chloride, bromide or acetate.

MISCELLANEOUS

1. Match the drugs to their pharmacological effects.

	Drug		Pharmacological effect							
i.	Paracetamol	a.	Analgesic and hypnotic							
ii.	Morphine	b.	Tranquilizer and hypnotic							
iii.	Barbiturates	c.	Antihistaminic and antacid							
iv.	Ranitidine	d.	Analgesic and antipyretic							
	(A) i – d, ii	– a,	iii – c, iv – b							
	(B) <i>i</i> – b, <i>ii</i>	- c,	iii - d, $iv - a$							
	(C) <i>i</i> – b, <i>ii</i>	(C) $i-b$, $ii-d$, $iii-a$, $iv-c$								
	(D) $i - d ii$	– a	iii - b iv - c							



Chapter 16: Chemistry in Everyday Life

- 2. Match the chemicals to their functions. Chemical Function i. Noradrenaline Supresses ovulation a. Counteracts ii. Progesterone b. the effects of depression iii. Histamine Inhibits secretion of c. HCl in stomach d. Produces allergic response to pollen
 - (A) i-c, ii-d, iii-a
 - (B) i-b, ii-a, iii-d
 - (C) i-b, ii-a, iii-c
 - (D) i-a, ii-b, iii-d

🔭 Diagram Based Problems

1. Which of the following image represents non-competitive inhibition of enzymes?



2. Which of the following is the CORRECT representation of signal transmission by chemical messengers?





3. The image of soap is as follows:



A and B are _____, respectively.(A) hydrophilic nonpolar, hydrophobic polar

- (B) hydrophobic polar, hydrophilic nonpolar
- (C) hydrophilic polar, hydrophobic nonpolar
- (D) hydrophobic nonpolar, hydrophilic polar

245 Numerical Value Type Questions

- 1. The number of chiral carbons in chloramphenicol is _____. [JEE (Main) Jan 2020] [Ans: 2]
- 2. Among the following, how many are bicyclic compounds? Veronal, penicillin, iproniazid, serotonin, sulphapyridine

[Ans: 2]

The amount of glyceryl triester of stearic acid required to prepare 153 g of sodium stearate soap is _____ mole(s).
(M.W. of sodium stearate = 306 g mol⁻¹)

[Ans: 0.17]

4. The number of nitrogen atoms in one molecule of prontosil is _____.

[Ans: 5]

5. If concentration of cetyltrimethylammonium bromide solution is 0.98 M at 303 K, the number of positively charged ions present in 0.5 L detergent solution is $(Y \times 10^{22})$. The value of Y is _____.

[Ans: 29.5]

🦨 Problems To Ponder

 A 300 mg aspirin tablet is dissolved in 40 mL alcohol. The solution is titrated with 0.1 M NaOH. It took 16.1 mL NaOH to reach the end point of titration. Calculate the percent purity of aspirin tablet.
 (A) 99.5 %
 (B) 96.6 %

(-)	,, <u>, ,</u>	(-)	
(C)	94 4 %	(D)	913%
(A)	99.5 %	(B)	90.0 %



Answers to MCQs

	C	onc	ept	Bui	ldir	ıg P	robl	ems	5												
16.0	:	1.	(A)																		
16.1	:	1.	(D)	2.	(C)																
16.2	:	1.	(C)	2.	(B)	3.	(C)														
16.3	:	1. 11.	(B) (B)	2. 12.	(B) (A)	3. 13.	(A) (D)	4. 14.	(B) (D)	5. 15.	(A) (D)	6. 16.	(C) (C)	7. 17.	(A) (D)	8. 18.	(D) (C)	9. 19.	(D) (C)	10. 20.	(B) (B)
16.4	:	1.	(A)	2.	(D)	3.	(C)	4.	(C)	5.	(D)	6.	(C)	7.	(B)	8.	(C)	9.	(A)		
16.5	:	1.	(A)	2.	(C)	3.	(C)	4.	(C)	5.	(B)	6.	(A)	7.	(C)	8.	(B)				
Misc	.:	1.	(B)	2.	(A)	3.	(B)	4.	(A)	5.	(C)										

	FIAC	VILCE	EIG	Inte:	111.5															
16.2 :	1.	(D)	2.	(C)	3.	(B)														
16.3 :	1. 11.	(A) (D)	2. 12.	(C) (B)	3. 13.	(B) (A)	4. 14.	(A) (A)	5. 15.	(A) (A)	6.	(A)	7.	(B)	8.	(A)	9.	(D)	10.	(C)
16.4:	1.	(D)	2.	(C)	3.	(D)														
16.5:	1.	(C)	2.	(C)	3.	(C)	4.	(D)												
Misc.:	1.	(D)	2.	(B)																

*	Dia	agram I	Based	. Prol	blems	
	1.	(C) 2.	(A)	3.	(D)	





Chapter 16: Chemistry in Everyday Life

- 10. Chloramphenicol is a broad spectrum antibiotics, which inhibit a wide range of gram-positive and gram-negative bacteria. It is bacteriostatic and not bactericidal.
- 11. Structure of chloramphenicol:

$$O_2N$$
 \longrightarrow H NHCOCHCl₂
O₂N \longrightarrow CH_2OH
OH H
Chloramphenicol
(CuHu2Cl2N2O2)

- 12. Mixture of chloroxylenol and terpineol is dettol which acts as an antiseptic.
- 15. Phenol has antiseptic (0.2% solution) as well as disinfectant properties (at 1% concentration).
- 16. Phenelzine, iproniazid and chlordiazepoxide are tranquilizers.
- 17. Baking soda (sodium bicarbonate), metal hydroxides such as Al(OH)₃, Mg(OH)₂, etc., act as antacids.

Thinking Hatke - Q. 17

A base can neutralize or acts against acid. Sodium chloride is a neutral salt. It cannot neutralize excess acid present in stomach.

- 18. Phenelzine is a tranquilizer.
- 19. Streptomycin, chloromycetin and pencillin are antibiotics.
- 20.

	Compound	Туре
(A)	Aspirin	Non-narcotic analgesic
(B)	Valium	Tranquilizer
(C)	Penicillin	Antibiotic
(D)	Sulphanilamide	Antibiotic

16.4 CHEMICALS IN FOOD

- 3. Aspartame on heating becomes unstable; hence, used in cold foods and soft drinks.
- 7. Alitame is 2000 times more sweeter than cane sugar.
- 8. Antioxidants such as BHT and BHA prevent the oxidation of oils and fats and prevent their rancidity.

16.5 CLEANSING AGENTS

 Soaps are the sodium or potassium salts of higher fatty acids.
 E.g. C₁₇H₃₅COOK (Potassium stearate)

- 4. Laundry soaps are prepared by adding fillers like sodium rosinate, sodium silicate, borax and sodium carbonate to soap.
- 6. Cetyltrimethyl ammonium bromide is a cationic detergent used in hair conditioners.
- 7. Non-ionic detergents are used as liquid dishwashing detergents. These detergents do not contain any ion in their constitution. Hence, option (C) is the correct answer.
- 8. Sodium stearate is a soap. Cetyltrimethyl ammonium bromide is a cationic detergent. Glyceryl oleate is a glyceride of oleic acid $(C_{17}H_{33}COOH)$ with glycerol and is a non-ionic detergent.

MISCELLANEOUS



Thinking Hatke - Q. 2 Antacids means against acid, i.e., an alkaline medium can neutralize acid in

3. Aspirin inhibits synthesis of prostaglandins, which stimulate inflammation in the tissue and cause pain.

Thinking Hatke - Q. 4

stomach by increasing its pH.

Penicillin is an antibiotic. Hence, only option A (having iii -d) is valid.

5. Structure of iproniazid is:



Practice Problems

16.2 DESIGNING OF A DRUG AND ACTION OF DRUG ON TARGETS

2. The active site of receptors is present outside the cell membrane.

16.3 CHEMICALS IN MEDICINES

2. Phenelzine is a tranquilizer. Chloramphenicol is a broad spectrum antibiotic. All others are non-narcotic analgesics.

^{4.}

- 3. Meprobamate acts as a tranquilizer. Barbiturates can act as a tranquilizer and also as a hypnotic drug which produce sleep. Tranquilizers are the chemical substances which reduce the stress, excitement and anxiety and induce calmness.
- 5. Barbiturates are sedative drugs. They produce a feeling of calmness and relaxation by depressing activities of central nervous system.
- 8. The given structure is of Penicillin V.
- 9. Bactericidal drugs kill bacteria present in the body. Penicillin, aminoglycosides and ofloxacin are bactericidal drugs.
- 10. 0.2% Phenol acts as an antiseptic while 1% phenol acts as a disinfectant.
- 11.

💑 Thinking Hatke - Q. 11

Phenelzine (tranquilizer) has only nitrogen atoms as the heteroatoms. It does not have oxygen atoms in its structure. Hence, only option D (having ii - c) is valid.

- 14. Usual antacids such as $Mg(OH)_2$ control the symptoms by neutralizing gastric acid while antihistamines supress the histamine responsible for the secretion of hydrochloric acid (gastric acid) and pepsin in stomach.
- 15. Aspirin and penicillin contain COOH group.

16.4 CHEMICALS IN FOOD

3. Alitame is stable at high temperature while aspartame is unstable at high temperature.

16.5 CLEANSING AGENTS

1. After saponification, soap is obtained in colloidal form. Addition of NaCl decreases the solubility of soap and therefore, soap gets precipitated from its aqueous solution.

2.
$$\begin{array}{c} CH_{2} - OH \\ CH - OH + 3R - COOH \\ Fatty acid \\ CH_{2} - OH \\ Glycerol \\ CH_{2} - O - C - R \\ CH_{2} - O - C - R \\ O \\ CH - O - C - R \\ O \\ CH_{2} - O - C - R \\ O \\ CH_{2} - O - C - R \\ O \\ CH_{2} - O - C - R \end{array}$$

General formula of triglycerides

 Potassium soaps are softer than sodium soaps. Polyethylene glycols are used in the preparation of non-ionic detergents. Soaps can only be used in soft water whereas detergents can be used in hard and soft water.

MISCELLANEOUS

2. Histamine produces allergic response. It also stimulates secretion of gastric acid (HCl) in stomach.

Problems

- 1. In non-competitive inhibition, drug binds to the site other than active site of enzyme, which changes the shape of active site and therefore, substrate cannot bind to enzyme.
- 2. When chemical messenger binds to the receptor, the shape of receptor changes and the message is delivered into the interior of cell. The chemical messenger does not enter the cell.
- 3. The ionic functional group is hydrophilic polar and the long carbon chain is hydrophobic nonpolar.

Numerical Value Type Questions

1. Structure of chloramphenicol is:

$$O_2N$$
 \longrightarrow H NHCOCHCl₂
 $*$ $*$ $*$ CH_2OH
OH H
Chloramphenicol
 $(C_{11}H_{12}Cl_2N_2O_5)$

Number of chiral carbon atoms = 2

- 2. A bicyclic compound has two joined rings. Penicillin and serotonin are bicyclic compounds.
- 3. 153 g of sodium stearate = $\frac{153}{306}$ = 0.5 mole

3 moles of sodium stearate soap is produced from 1 mole of glyceryl triester of stearic acid. 0.5 mole of sodium stearate soap will require

 $= 0.5 \times \frac{1}{3}$

÷.

 $+ 3H_2O$

= 0.17 mole of glyceryl triester of stearic acid

4. Structure of prontosil is:



Prontosil $(C_{12}H_{13}N_5O_2S)$ There are 5 nitrogen atoms in prontosil. 5. No. of moles of cetyltrimethylammonium bromide [CTAB] in I L of detergent solution = 0.98 mol
No. of moles of CTAB in 0.5 L solution = 0.49 mol

$$\begin{bmatrix} CH_{3} \\ H_{3} \\ H_{3} \\ CH_{3}(CH_{2})_{15} - N - CH_{3} \\ H_{3} \\ CH_{3} \end{bmatrix}^{+} Br^{-}$$

$$\xrightarrow{\text{ionization}} \begin{bmatrix} CH_{3} \\ H_{3} \\ CH_{3} + CH_{3} \\ H_{3} \end{bmatrix}^{+} Br^{-}$$

1 mol of CTAB gives 1 mol of positive ions. 0.49 mol of CTAB = 0.49 mol of positive ions No. of positive ions in 0.49 mol of CTAB = $0.49 \times N_A$ = $0.49 \times 6.022 \times 10^{23}$ ions = 2.95×10^{23} ions = 29.5×10^{22} ions

Problems To Ponder

1. The reaction of aspirin with NaOH is

COOH

$$OCOCH_3$$

 $+$ NaOH \rightarrow $OCOCH_3$
Thus, 1 mole aspirin require 1 mole NaOH.

Number of moles of NaOH = $\frac{0.1 \times 16.1}{1000}$ = 0.00161 mol No. of mol of NaOH = no of mol of aspirin = 0.00161 mol aspirin The molar mass of aspirin is 180 g/mol. Mass of aspirin = 180 × 0.00161= 0.2898 g

 $\therefore \text{ Mass of aspirin } = 180 \times 0.00161 = 0$ $\therefore \text{ Percent purity of aspirin tablet}$

$$= \frac{0.2898}{300 \times 10^{-3}} \times 100 = 96.6 \%$$

Alternate method:

No. of moles of aspirin = No. of moles of NaOH $M_{aspirin}V_{aspirin} = M_{NaOH}V_{NaOH}$ $M_1 \times 40 \text{ mL} = 0.1 \text{ M} \times 16.1 \text{ mL}$ $M_1 = 0.0402 \text{ M}$ $m_{aspirin} = \frac{(0.0402 \times 180)}{(40 \times 1000)} = 0.2898 \text{ g}$ Percent purity of aspirin tablet $= \frac{0.2898}{300 \times 10^{-3}} \times 100 = 96.6 \%$

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