

**SAMPLE CONTENT**

Perfect



# CHEMISTRY Vol. II



### Boyle's law

As pressure decreases with altitude, air becomes less denser. Hence, mountaineers carry supplementary oxygen in order to prevent the effects of severe hypoxia.

## STD. XI Sci.

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# PERFECT CHEMISTRY (Vol. II)

## Std. XI Sci.

### Salient Features

- ☞ Written as per the latest textbook
- ☞ Subtopic-wise segregation for powerful concept building
- ☞ Complete coverage of Textual Exercise Questions, Intext Questions and Numericals
- ☞ Extensive coverage of New Type of Questions
- ☞ ‘Solved Examples’ provided to cover numerical aspect of the topic in detail
- ☞ ‘Apply Your Knowledge’ section for application of concepts
- ☞ ‘Quick Review’ at the end of every chapter facilitates quick revision
- ☞ A compilation of all ‘Important Formulae’
- ☞ ‘Competitive Corner’ presents questions from prominent competitive examinations
- ☞ About the chapter, Reading Between the Lines, Enrich Your Knowledge, Gyan Guru, Strategy, Connections, Caution, NCERT Corner are designed to impart holistic education
- ☞ Topic Test at the end of each chapter for effective preparation
- ☞ Video links provided via QR codes for boosting conceptual retention
- ☞ QR Code to access the Solutions of Numericals for practice, Miscellaneous questions for Practice and Reduced Syllabus as per Board Notification

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## PREFACE

*“I never teach my pupils; I only attempt to provide the conditions in which they can learn.” – Albert Einstein*

‘**Perfect Chemistry Vol. II, Std. XI Sci.**’ forms a part of ‘**Target Perfect Notes**’ prepared as per the new textbook of Maharashtra State Board. It focuses on active learning along with making the process of education more interesting and builds up the students’ knowledge quotient in the process.

Every chapter in this book begins with ‘**About the Chapter**’ that offers a brief introduction of the chapter. The chapter is **segregated subtopic-wise** and encompasses all textual content in the format of Question-Answers. The questions titled under ‘Use your brain power’, ‘Can you tell’, ‘Can you recall’, ‘Problems’, ‘Try this’ and various similar titles pave the way for a robust concept building. For the students to gain a better understanding of the concept lying behind the answer, ‘**Reading between the lines**’ (*not a part of the answer*) has been provided as deemed necessary. Numericals along with their step-wise solutions are covered under the heading of ‘**Solved Examples**’ at the end of each subtopic. Few selected numericals have also been solved using log-tables. ‘**Quick Review**’ has been provided for instant revision. Formulae covered in the chapter are compiled together as ‘**Important Formulae**’ at the end of the chapter. ‘**Exercise**’, ‘**Multiple Choice Questions**’ and ‘**Topic Test**’ (as per latest paper pattern) are added to enable students assess their range of preparation and knowledge of each topic. QR codes have been provided for students to access the ‘Solutions to Numericals for practice, Miscellaneous questions for Practice’ and ‘Answers’ given for the Topic Test. **Notes** are introduced to cover additional bits of relevant information on each topic as seemed required. **Log-table** has been provided for students’ use at the end of the book.

*Our Perfect Chemistry Vol. II, Std. XI Sci. adheres to our vision and achieves several goals: **building concepts, developing competence to solve numerical, recapitulation, self-study, self-assessment and student engagement**—all while encouraging students toward cognitive thinking.*

The flow chart on the adjacent page will walk you through the key features of the book and elucidate how they have been carefully designed to maximize the student learning.

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

- Publisher

**Edition:** Third

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](mailto:mail@targetpublications.org)

### Disclaimer

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This work is purely inspired upon the course work as prescribed by the Maharashtra State Bureau of Textbook Production and Curriculum Research, Pune. 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

*'About the Chapter'* is a short introduction designed to stimulate students' appetite for the topic.

**About the chapter**

**Reading between the lines**

Reading between the lines provides elaboration or missing fragments of concept which is essential for complete understanding of the concept.

NCERT Corner covers information from NCERT textbook relevant to topic.

**NCERT Corner**

**Connections**

Connections enable students to interlink concepts covered in different chapters.

Caution helps students to be watchful against commonly made mistakes.

**Caution**

**Strategy**

Strategy provides a step-by-step process to break a complex numerical problem into simpler parts.

QR code provides:

- i. Access to a video/PDF in order to boost understanding of a concept or activity
- ii. Solutions of Numericals and Miscellaneous questions for Practice
- iii. Reduced Syllabus as per Board Notification

**QR Codes**

**Enrich Your Knowledge**

Enrich Your Knowledge presents fascinating information about the concept covered.

Continued...

## KEY FEATURES

Gyan Guru illustrates real life applications or examples related to the concept discussed.

**GG-Gyan  
Guru**

**Apply  
Your  
Knowledge**

Apply Your Knowledge includes challenging questions.

Quick review includes tables/ flow chart to summarize the key points in chapter.

**Quick  
Review**

**Important  
Formulae**

Important Formulae includes all of the key formulae in the chapter.

Competitive Corner includes selective questions from prominent [NEET (UG), JEE (Main), NEET (Odisha), MHT CET] competitive exams based entirely on the syllabus covered in the chapter.

**Competitive  
Corner**

## CONTENTS

Chapter No.	Chapter Name	Marks	Marks with option	Page No.
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16	Chemistry in Everyday Life	5	4	261
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	<p>• <b>For your own understanding, scan the given Q. R. Code in Quill - The Padhai App to access the Reduced Syllabus.</b></p>			

[Reference: Maharashtra State Board of Secondary and Higher Secondary Education, Pune - 04]

- Note:**
- \* mark represents Textual Exercise question.
  - # mark represents Intext question.
  - + mark represents Textual examples.
  -  symbol represents textual questions that need external reference for an answer.
  - This Reference Book is based on the Entire Textbook (Complete Syllabus) of Chemistry Prescribed by Maharashtra State Board.  symbol represents the content that belongs to the Reduced Syllabus as issued by State Board.
  - Table provided at the beginning of the chapter facilitates students to find out Textual Exercise Questions given in this book.
  - Chapters 1 to 9 are a part of Perfect Chemistry Vol. I, Std. XI Sci.





Soap micelle

**About the chapter...**

Chemistry has an important role in all aspects of everyday life such as food, clothes, medicines, cleansing agents, etc. In this chapter we will study on food chemistry and medicinal chemistry, i.e., chemical compounds or drugs used in food and for therapeutic purposes. We will also study chemical compounds used for cleansing purpose.

**CONTENTS AND CONCEPTS**

- 16.1 Basics of food chemistry
- 16.2 Compounds with medicinal properties
- 16.3 Cleansing agents

[**Note:** The textbook topics Introduction (Paragraph starting with “The life, the atmosphere...” and ending with “...structural features.”), 16.2.3-Traditional knowledge in medicine, Table 16.2-Active ingredients of some medicinal plants are part of reduced syllabus.]

**TEXTBOOK EXERCISE QUESTIONS**

Textbook Exercise Question No.	Target Notes			Textbook Exercise Question No.	Target Notes		
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<b>Q.3</b>	16.2	78	273	H	<i>Question missing in TextBook</i>		
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B	16.3	97	277	<b>Q.11 Answer the following</b>			
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### 16.1 BASICS OF FOOD CHEMISTRY

**Q.1. Can you recall?** (*Textbook page no. 261*)

**i. What are the components of balanced diet?**

**Ans:** Carbohydrates, proteins, lipids (fats and oil), vitamins, minerals and water are the components of balanced diet.

**ii. Why is food cooked? What is the difference in the physical states of uncooked and cooked food?**

**Ans:**

- Food is cooked in order to make it easy to digest.
- Also, the raw or uncooked food may contain harmful microorganisms which may cause illness. Cooking of food at high temperature kills most of these microorganisms.
- Raw/uncooked food materials like dried pulses, vegetables, meat, etc. are hard and thus, not easily chewable while cooked food is soft and tender, therefore, easily chewable.

**iii. What are the chemicals that we come across in everyday life?**

**Ans:** Detergents, shampoos, medicines, various food flavours, food colours, etc. are different types of chemicals that we come across in everyday life.

**Q.2. Write a note on nutrients.**

**Ans: Nutrients:**

- Nutrients are obtained from food and are used as a source of energy by the body.
- The main nutrients obtained from food are carbohydrates, lipids, proteins, vitamins, minerals and water. Most nutrients are organic macromolecules.
- Along with providing energy, these nutrients also regulate various body functions like growth, repair of damaged body tissues, etc.
- The following table consists of different types of nutrients and their major sources.

Type of nutrient	Sources
Carbohydrates	Grains, fruits, vegetables, etc.
Proteins	Meat, fish, eggs, dairy products, pulses, etc.
Lipids	Dairy products, vegetable oil, animal fats, etc.
Vitamins	Grains, fruits, vegetables, meat, fish, eggs, dairy products, pulses, etc.

**Q.3. What happens when proteins and carbohydrates present in foods are digested in presence of enzymes?**

**Ans:**

- Proteins and carbohydrates are organic polymeric macromolecules.
- When food is digested in presence of enzymes, the polymeric carbohydrates and proteins break down into monomers, i.e., glucose and  $\alpha$ -amino acids, respectively.

**\*Q.4. Explain the following: Cooking makes food easy to digest.**

**Ans:**

- During the cooking process, high polymers of carbohydrates or proteins are hydrolysed to smaller polymeric units.
  - The uncooked food mixture is a heterogeneous suspension which becomes a colloidal matter on cooking.
  - As a result, the constituent nutrient molecules present in cooked food are smaller in size and hence, easier to digest, than the uncooked food.
- Hence, cooking makes food easy to digest.

**Q.5. Just think** (*Textbook page no. 261*)

**i. Why is food stored for a long time?**

**Ans:** Food (like various cereals, pulses, pickles) is stored for a long time to make it available in all seasons.

**ii. What methods are used for preservation of food?**

**Ans:** Various physical and chemical methods are used for preservations of food.

- Physical methods like, addition of heat, removal of heat, removal of water, irradiation, etc., are used in order to preserve food.
- Chemical methods like, addition of sugar, salt, vinegar, etc. are employed for preservation of food.

**iii. What is meant by quality of food?**

**Ans:** Food quality can be described in terms of parameters such as flavour, smell, texture, colour and microbial spoilage.

Page no. **263** to **269** are purposely left blank.

To see complete chapter buy **Target Notes** or **Target E-Notes**



- c. Various phenols are used as antiseptics. A dilute aqueous solution of phenol (carbolic acid) is used as antiseptic; however, phenol is found to be corrosive in nature. Many chloro derivatives of phenols are more potent antiseptics than the phenol itself. They can be used with much lower concentrations, which reduce their corrosive effects.
- d. Two of the most common phenol derivatives in use are trichlorophenol (TCP) and chloroxylenol (which is an active ingredient of antiseptic dettol).
- e. Thymol obtained from oil of thyme (a spice plant) has excellent non-toxic antiseptic properties.

**\*Q.55. What is the tincture of iodine?**

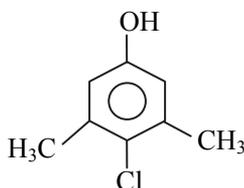
**Ans:** Tincture of iodine is a 2-3% solution of iodine in alcohol-water mixture.

**Q.56. Name the ingredients present in dettol.**

**Ans:** Chloroxylenol is the active ingredient of dettol. The other ingredients of dettol are isopropyl alcohol, pine oil, castor oil soap, caramel and water.

**\*Q.57. Draw the structure of chloroxylenol.**

**Ans:** Structure of chloroxylenol:



**Q.58. State whether the following statements are TRUE or FALSE. Correct the statement, if false.**

- i. A concentrated solution of boric acid is used as an antiseptic for eyes.
- ii. Iodoform is a powerful antiseptic.
- iii. The active ingredient present in dettol is chloroxylenol.

**Ans:**

- i. False  
A dilute aqueous solution of boric acid is used as an antiseptic for eyes.
- ii. True
- iii. True

**Q.59. Instead of phenol, it's chloro derivatives are used as antiseptics. Explain.**

**Ans:**

- i. A dilute aqueous solution of phenol has antiseptic properties but it is found to be corrosive in nature.
- ii. Many chloro derivatives of phenol are more potent antiseptic and have less corrosive effects than phenol, if used in lower concentrations.  
Thus, instead of phenol it's chloro derivatives are used as antiseptics.

**\*Q.60. Explain the following: A diluted solution (4.8% w/v) of 2,4,6-trichlorophenol is employed as antiseptic.**

**Ans:**

- i. 2,4,6-Trichlorophenol (TCP) is more potent antiseptic than phenol.
- ii. It has low corrosive effects as compared to phenol, if used in lower concentrations.  
Hence, diluted solution (4.8% w/v) of 2,4,6-trichlorophenol is used as antiseptic.

**\*Q.61. Explain with examples: Disinfectant**

**Ans:**

- i. Disinfectants are non-selective antimicrobials.
- ii. They kill a wide range of microorganisms including bacteria.
- iii. They are used on non-living surfaces for example, floors, instruments, sanitary ware, etc.
- iv. Various phenols can be used as disinfectants.  
**e.g.** p-Chloro-o-benzyl phenol is used as a disinfectant in all-purpose cleaners.



### CAUTION

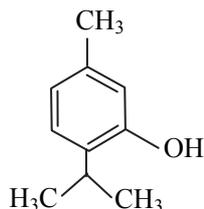
0.2 % solution of phenol acts as an antiseptic whereas its 1 % solution acts as disinfectant.



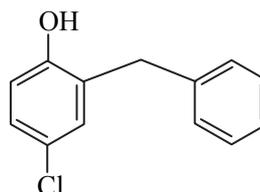
**Q.62. Draw the structures of the following compounds and name the class of antimicrobials to which they belong.**  
 i. Thymol                                      ii. p-Chloro-o-benzylphenol                                      iii. 2,4,6-Trichlorophenol

**Ans:**

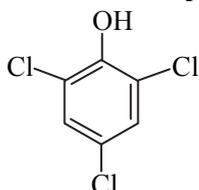
i. **Thymol:** It is an antiseptic.



ii. **p-Chloro-o-benzylphenol:** It is a disinfectant.



iii. **2,4,6-Trichlorophenol:** It is an antiseptic.



**\*Q.63. Give two differences between the following: Disinfectant and antiseptic**

**Ans:**

No.	Disinfectant	Antiseptic
i.	Disinfectants are applied on non-living surfaces like floors, instruments, sanitary ware, etc. to kill wide range of microorganisms.	Antiseptics are applied on the surface of living tissues in order to sterilise them.
ii.	Disinfectants cannot be applied on wounds.	Antiseptics can be directly applied on wounds.
e.g.	p-chloro-o-benzyl phenol	Iodine, boric acid, iodoform, dettol, etc.

**Q.64. What are antibiotics?**

**Ans:** Antibiotics are drugs which are purely synthetic or obtained from microorganisms like bacteria, fungi or moulds.

e.g. Salvarsan, Prontosil

**Q.65. Name the first effective drug used in treatment of syphilis.**

**Ans:** Salvarsan was the first effective drug used in treatment of syphilis.

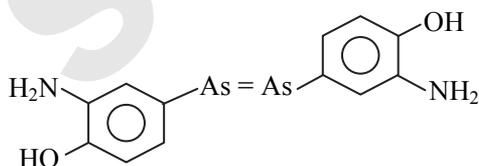
#### ENRICH YOUR KNOWLEDGE



Arsenic compounds were known to be highly poisonous to humans since long. Paul Ehrlich, German bacteriologist investigated arsenic based organic compounds in order to produce less toxic substances for the treatment of syphilis. He discovered the first effective treatment of syphilis, the synthetic antibiotic named salvarsan. He was awarded the Nobel prize for medicine (1908) for this discovery.

**\*Q.66. Draw the structure of salvarsan.**

**Ans:** Structure of salvarsan:



**Q.67. Name the following:**

i. An effective diazo antibacterial drug.

ii. One example of a sulpha drug.

**Ans:**

i. Prontosil

ii. Sulphapyridine

**Q.68. Name the diazo antibacterial, which gets converted to sulphanilamide in the body.**

**Ans:** Prontosil is an effective diazo antibacterial, which gets converted to a simpler compound, sulphanilamide, in the body.

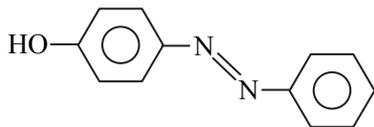


**Q.69. Draw the structure of the following:**

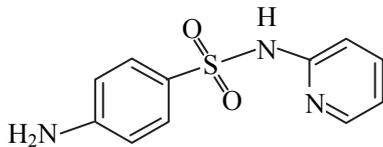
i. An azodye                      ii. Prontosil

**Ans:**

i. An azodye:

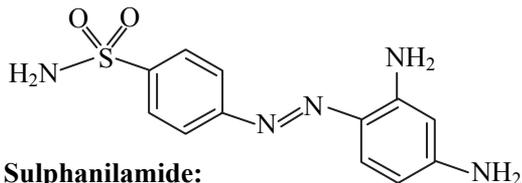


iii. Sulphapyridine:

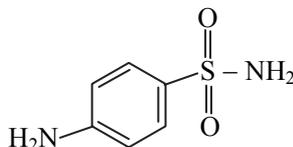


iii. Sulphapyridine      iv. Sulphanilamide

ii. Prontosil:



iv. Sulphanilamide:



**\*Q.70. Who discovered penicillin?**

**Ans:** Alexander Fleming discovered penicillin.

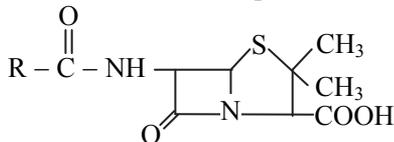
### READING BETWEEN THE LINES



*In 1929, Alexander Fleming discovered the antibacterial properties of a penicillium fungus. The clinical utility of the purified active ingredient, penicillin, as antibiotic drug was established in the next thirteen years. This is the first antibiotic of microbial origin. Chloramphenicol, isolated in 1947, is another antibiotic of microbial origin.*

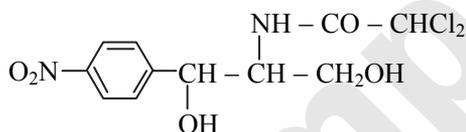
**Q.71. Draw the general structure of penicillin.**

**Ans:** General structure of penicillin:



**Q.72. Draw the structure of chloramphenicol.**

**Ans:** Structure of chloramphenicol:



**Q.73. Can you tell? (Textbook page no. 264)**

**What is meant by a broad spectrum antibiotic?**

**Ans:** Antibiotics which are effective against wide range of bacteria are known as broad spectrum antibiotic.



**GG - Gyan Guru**

**Prontosil became the first drug to treat bacterial infections!!**

*The observation on azo dyes led to assumptions that these dyes might become effective against bacteria. Numerous 'in vitro' experiments however, showed no antibacterial activity. Then, scientists decided to test dyes 'in vivo' on infected mice. Some dyes turned out to be effective against bacterial infections in mice. Prontosil (a least toxic of all dyes), became the first drug to treat bacterial infections!!*



**Q.74. Give classification of antibiotics.**

**Ans:** Antibiotics can be of three types, which are as given below:

- Broad spectrum antibiotics:** They are effective against wide range of bacteria.
- Narrow spectrum antibiotics:** They are effective against one group of bacteria.
- Limited spectrum antibiotics:** They are effective against a single organism.

[**Note:** Antibiotics can be synthetic, semisynthetic or of microbial origin.]



**\*Q.75. What is meant by broad spectrum antibiotic and narrow spectrum antibiotics?**

**Ans:** Antibiotics which are effective against wide range of bacteria are known as broad spectrum antibiotics, while antibiotics which are effective against one group of bacteria are known as narrow spectrum antibiotics.

**Q.76. State the disadvantage of broad spectrum antibiotics.**

**Ans:** The disadvantage of broad spectrum antibiotics is that they also kill the useful bacteria in the alimentary canal.

**\*Q.77. Write two examples of the following:**

- i. Analgesics                      ii. Antiseptics                      iii. Antibiotics                      iv. Disinfectant

**Ans:**

No.	Drug type	Examples
i.	Analgesics	Aspirin, paracetamol
ii.	Antiseptics	Dettol, thymol
iii.	Antibiotics	Penicillin, sulphapyridine
iv.	Disinfectant	Phenol, p-Chloro-o-benzyl phenol

[**Note:** Phenol in high concentration (1%) acts as a disinfectant whereas in low concentration (0.2%) acts as an antiseptic.]

**\*Q.78. Identify the functional groups in the following molecule:**

No.	Compound	Functional group present
i.	<p>Aspirin</p>	Ester $\left( \text{R} - \overset{\text{O}}{\parallel} \text{C} - \text{O} - \text{R} \right)$ and carboxylic acid $(-\text{COOH})$ group.
ii.	<p>Paracetamol</p>	Phenolic $(-\text{OH})$ group and secondary amide group $\left( \text{R} - \overset{\text{O}}{\parallel} \text{C} - \text{NH} - \right)$ .
iii.	<p>Penicillin</p>	Secondary amide group $\left( \text{R} - \overset{\text{O}}{\parallel} \text{C} - \text{NH} - \right)$ , tertiary amide group $\left( -\overset{\text{O}}{\parallel} \text{C} - \text{N} - \right)$ , carboxylic acid group $(-\text{COOH})$ and thioether $(\text{R} - \text{S} - \text{R})$ .
iv.	<p>Chloramphenicol</p>	Nitro group $(-\text{NO}_2)$ , secondary alcoholic group $\left( -\overset{\text{OH}}{\underset{ }{\text{C}}}- \right)$ , primary alcoholic group $(-\text{CH}_2\text{OH})$ , secondary amide group $\left( \text{R} - \overset{\text{O}}{\parallel} \text{C} - \text{NH} - \right)$ and halo group (chloro).
v.	<p>Sulphanilamide</p>	Primary amine group $(-\text{NH}_2)$ and sulphonamide group $(-\text{SO}_2\text{NH}_2)$ .
vi.	<p>Glycerine</p>	Primary alcoholic group $(-\text{CH}_2\text{OH})$ and secondary alcoholic group $\left( -\overset{\text{OH}}{\underset{ }{\text{C}}}- \right)$ .



**R \* Q.79. Explain the following: Turmeric powder can be used as antiseptic.**

**Ans:**

- Turmeric powder contains an active ingredient called curcumin.
- Curcumin has antiseptic properties; thus, it is used for wound healing or applied on bruise. Hence, turmeric powder can be used as antiseptic.

### ENRICH YOUR KNOWLEDGE



**Do you know?** (Textbook page no. 267)

**The turmeric patent battle:**

India won the legal against US patent and Trademark office (PTO) in 1997 and protected its intellectual property of traditional Indian knowledge about turmeric against patenting. Dr. Raghunath Mashelkar, then the Director General of the council of Scientific and Industrial Research, New Delhi, India led this case and upheld the national pride. In this yearlong battle, the CSIR argued that turmeric, a native Indian plant, had been used for centuries by its people for wound healing.

**R Q.80. Can you tell?** (Textbook page no. 264)

**What is the active principle ingredient of cinnamon bark?**

**Ans:** Cinnamaldehyde is the principle active ingredient of cinnamon bark.

**R Q.81. Complete the following table.**

Plant	Medicinal property	Active ingredient(s)
Cinnamon	Antimicrobial for cold	-----
-----	-----	Eugenol
Citrus fruits	Antioxidant	-----
Wintergreen	-----	-----
Indian gooseberry (amla)	Antidiabetic, antimicrobial, antioxidant	Vitamin C, Gallic acid

**Ans:**

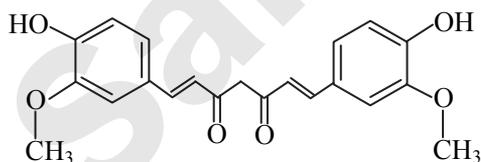
Plant	Medicinal property	Active ingredient
Cinnamon	Antimicrobial for cold	<b>Cinnamaldehyde</b>
<b>Clove</b>	<b>Antimicrobial and analgesic</b>	Eugenol
Citrus fruits	Antioxidant	<b>Vitamin C (ascorbic acid)</b>
Wintergreen	<b>Analgesic</b>	<b>Methyl salicylate</b>
Indian gooseberry (amla)	Antidiabetic, antimicrobial, antioxidant	Vitamin C, Gallic acid

**R Q.82. Draw the structures of following:**

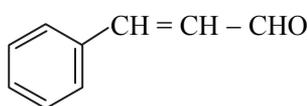
- Curcumin
- Cinnamaldehyde
- Vitamin C

**Ans:**

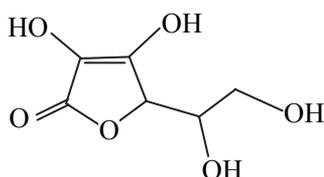
- Curcumin



- Cinnamaldehyde

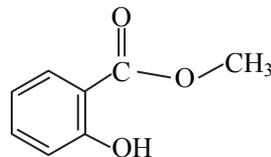


- Vitamin C

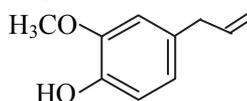


- Methyl salicylate
- Eugenol
- Gallic acid

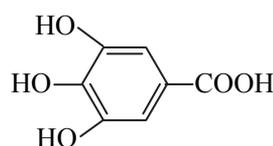
- Methyl salicylate



- Eugenol



- Gallic acid





## NCERT Corner

- i. **Narcotic analgesics:** They instantly relieve pain and produce depression of the central nervous system.  
e.g. Morphine, codeine, heroin, marijuana, etc.
- ii. **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, serotonin, etc.
- iii. **Antifertility drugs:** The chemical substances used to control the pregnancy are called antifertility drugs or oral contraceptives or birth control pills.  
e.g. Norethindrone, novestrol, etc.
- iv. **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.  
e.g. Baking soda (sodium bicarbonate), aluminium hydroxide  $[\text{Al}(\text{OH})_3]$ , etc.
- v. **Antihistamines:** These are chemical substances which diminish or abolish the main actions of histamine released in the body and hence, prevent the allergic reactions.  
e.g. Benadryl, seldane, etc.

## 16.3 CLEANSING AGENTS

## Q.83. What are cleansing agents?

**Ans:** Cleansing agents are substances which are used to remove stain, dirt or clutter on surfaces.

## Q.84. Can you tell? (Textbook page no. 268)

## i. Can we use the same soap for bathing as well as cleaning utensils or washing clothes? Why?

**Ans:** No, we cannot use the same soap for bathing as well as cleaning utensils or washing clothes due to the following reasons:

- a. Chemical composition of each type of soap or cleansing material is different.
- b. Nature, acidity, texture, reactivity towards water (i.e., hard water or soft water), reactivity towards microorganisms, stains are different for each type of soap.
- c. Depending on these qualities, soaps are classified and used accordingly.  
e.g. pH of soaps used for bathing purpose is different than that of the soap which is used for cleaning utensils.

Thus, we cannot use the same soap for bathing as well as cleaning utensils or washing clothes.

## ii. How will you differentiate between soaps and synthetic detergent using borewell water?

**Ans:** Borewell water is hard water. Soaps and synthetic detergents react differently with hard water.

- a. **Soap:** Soaps are insoluble in hard water. Borewell water (hard water) contains  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$  ions. Soaps react with these ions to form insoluble magnesium and calcium salts of fatty acids. These salts precipitate out as gummy substance or form scum.
- b. **Synthetic detergents:** Synthetic detergents can be used in hard water as well. They contain molecules (components) which form soluble calcium and magnesium salts.

Thus, soaps will form scum in borewell water but synthetic detergents will not.

## Q.85. What are the different types of cleansing agents?

**Ans:** Commercially cleansing agents are of the following two main types, depending on their chemical composition:

- i. Soaps
- ii. Synthetic detergents

[Note: Cleansing agents may be natural or synthetically developed.]

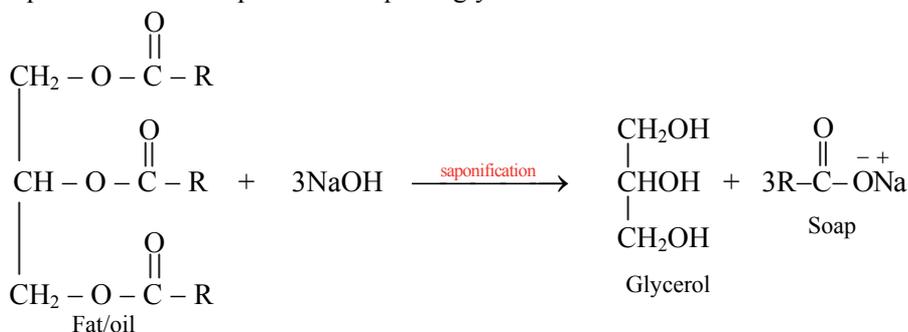
## Q.86. What are soaps? How soaps are prepared?

**Ans: Soaps:**

- i. Soaps are sodium or potassium salts of long chain fatty acids.
- ii. They are obtained by alkaline hydrolysis of natural oils and fats with NaOH or KOH. This is called saponification reaction.
- iii. Chemically, oils are triesters of long chain fatty acids and propane-1,2,3-triol (commonly known as glycerol or glycerin).



iv. Saponification of oil produces soap and glycerol as shown in the reaction below:



\*Q.87. Write a chemical equation for saponification.

Ans: Refer Q.86.

Q.88. Give reason: Potassium soaps can be used for bathing purpose.

Ans:

- The quality of soap depends upon the nature of oil and alkali used.
- Potassium soaps (toilet soaps) are prepared by using better grades of oil and KOH. Therefore, they are soft to skin.
- Also, care is taken to remove excess of alkali which may otherwise cause skin irritation. Hence, potassium soaps can be used for bathing purpose.

Q.89. Laundry soaps are made using which alkali?

Ans: Laundry soaps are made using alkali NaOH (sodium hydroxide).

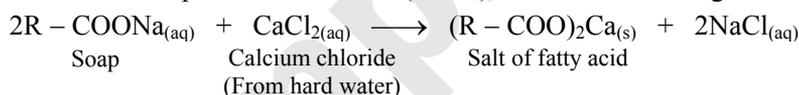
Q.90. Give examples of fillers used in making of laundry soaps.

Ans: Laundry soaps contain fillers like sodium rosinate (a lathering agent), sodium silicate, borax, sodium and trisodium phosphate.

Q.91. Explain why soaps become inactive in hard water.

Ans:

- Soaps form scum in hard water and become inactive.
- This is because, hard water contains dissolved salts of calcium and magnesium. Soaps react with these salts to form insoluble calcium and magnesium salts of fatty acids.
- This insoluble substance is termed as scum which sticks to the fabric.
- Reaction of soap with calcium salt ( $\text{CaCl}_2$ ) from hard water is given below:



Q.92. Which chemical can be used for softening of hard water? Why?

Ans:

- Washing soda ( $\text{Na}_2\text{CO}_3$ ) can be used for softening of hard water.
- This is because, washing soda precipitates the dissolved calcium salts as carbonate and helps the soap action by softening of water.

Q.93. i. What are synthetic detergents?

ii. Mention their different types.

Ans:

- Synthetic detergents are manmade cleansing agents designed to use in soft water as well as in hard water.
- There are three types of synthetic detergents which are as follows:
  - Anionic detergents
  - Cationic detergents
  - Nonionic detergents

\*Q.94. Explain with examples.

i. Cationic detergents

ii. Anionic detergents

iii. Nonionic detergents

Ans:

- Cationic detergents:** These are quaternary ammonium salts having one long chain alkyl group.  
e.g. Ethyltrimethylammonium bromide:  $[\text{CH}_3(\text{CH}_2)_{15} - \text{N}^+(\text{CH}_3)_3]\text{Br}^-$
- Anionic detergents:** These are sodium salts of long chain alkyl sulphonic acids or long chain alkyl substituted benzene sulphonic acids.  
e.g. Sodium lauryl sulphate:  $\text{CH}_3(\text{CH}_2)_{10}\text{CH}_2\text{O} \text{SO}_3^- \text{Na}^+$



iii. **Nonionic detergents:** These are ethers of polyethylene glycol with alkyl phenol or esters of polyethylene glycol with long chain fatty acid.

e.g. a. Nonionic detergent containing ether linkage:



b. Nonionic detergent containing ester linkage:



**Q.95. Complete the following table:**

No.	Type	Example	Use
i.	-----	$\text{C}_9\text{H}_{19}-\text{C}_6\text{H}_4-\text{O}-(\text{CH}_2\text{CH}_2\text{O})_n\text{CH}_2\text{CH}_2\text{OH}$	-----
ii.	<b>Anionic detergent</b>	-----	-----
iii.		$\text{CH}_3(\text{CH}_2)_{16}-\text{COO}(\text{CH}_2\text{CH}_2\text{O})_n(\text{CH}_2)_2\text{OH}$	<b>Liquid dishwash</b>
iv.	-----	-----	<b>Hair conditioner</b>

**Ans:**

No.	Type	Example	Use
i.	<b>Nonionic detergent (an ether)</b>	$\text{C}_9\text{H}_{19}-\text{C}_6\text{H}_4-\text{O}-(\text{CH}_2\text{CH}_2\text{O})_n\text{CH}_2\text{CH}_2\text{OH}$	<b>Liquid detergent</b>
ii.	Anionic detergent	$\text{CH}_3(\text{CH}_2)_{10}\text{CH}_2\text{O SO}_3^- \text{Na}^+$	<b>Household detergent, Additive in toothpaste</b>
iii.	<b>Nonionic detergent (an ester)</b>	$\text{CH}_3(\text{CH}_2)_{16}-\text{COO}(\text{CH}_2\text{CH}_2\text{O})_n(\text{CH}_2)_2\text{OH}$	Liquid dishwash
iv.	<b>Cationic detergent</b>	$\text{CH}_3(\text{CH}_2)_{15}-\text{N}^+(\text{CH}_3)_3\text{Br}^-$	Hair conditioner

**Q.96. Give an example of detergent used as:**

i. **Additive in toothpaste**

ii. **Used as germicide**

**Ans:**

i. **Additive in toothpaste:** Sodium lauryl sulphate,  $\text{CH}_3(\text{CH}_2)_{10}\text{CH}_2\text{O SO}_3^- \text{Na}^+$ .

ii. **Used as germicide:** Ethyltrimethylammonium bromide,  $[\text{CH}_3(\text{CH}_2)_3\text{N}^+(\text{CH}_3)_3]\text{Br}^-$ .

**\*Q.97. Give two differences between the following: Soap and synthetic detergent**

**Ans:**

No.	Soap	Synthetic detergent
i.	Soaps can be broadly classified into two types, i.e., toilet soaps (prepared using KOH) and laundry soaps (prepared using NaOH).	Synthetic detergents are of three types, i.e., anionic, cationic and nonionic detergents.
ii.	Soaps cannot be used in hard water.	Synthetic detergents can be used in soft water as well as in hard water.

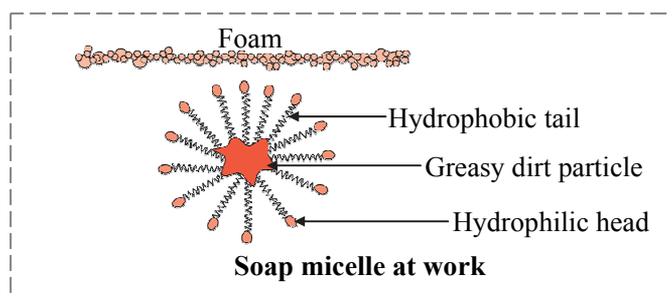
**Q.98. Explain cleansing mechanism of soaps and detergents.**

**Ans:**

- Soaps and detergents bring about cleansing of dirty, greasy surfaces by the same mechanism.
- Dirt is held at the surface by means of oily matter, and therefore cannot get washed with water.
- The molecules of soaps and detergent have two parts. One part is polar called head and the other part is long nonpolar chain of carbons called tail.
- The hydrophilic polar head can dissolve in water which is a polar solvent, while the hydrophobic nonpolar tail dissolve in oil/fat/grease.
- The molecules of soap/detergent are arranged around the oily droplet such that the nonpolar tail points towards the central oily drop while the polar head is directed towards the water.

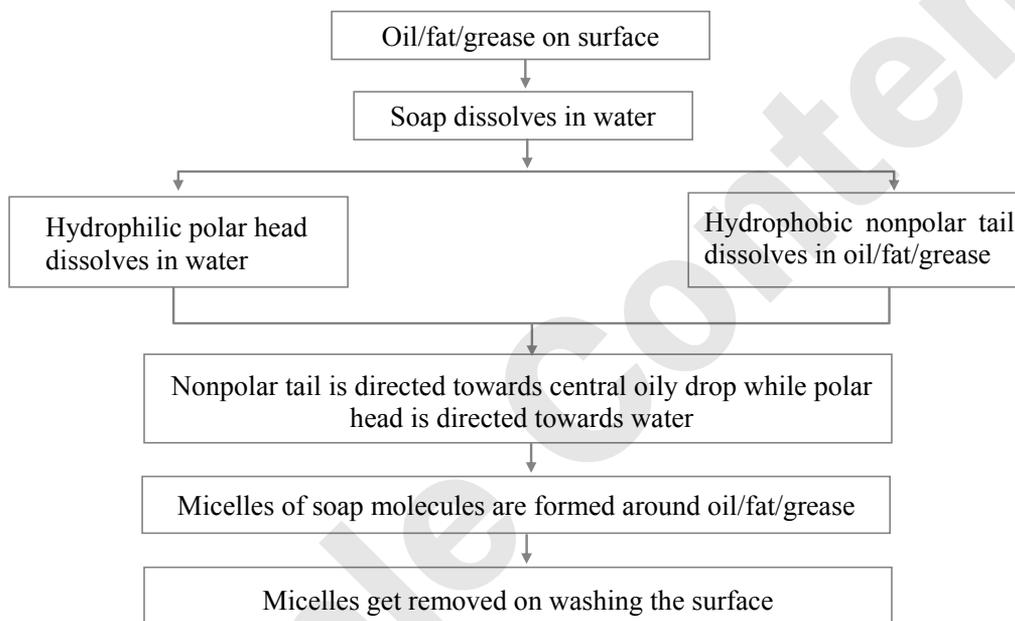


- vi. Thus, micelles of soap/detergent are formed surrounding the oil drops, which are removed in the washing process.



**\*Q.99. Explain: Mechanism of cleansing action of soap with flow chart.**

**Ans:** The following flow chart shows mechanism of cleansing action of soap:



**\*Q.100. Match the pairs.**

	A group		B group
i.	Paracetamol	a.	Antibiotic
ii.	Chloramphenicol	b.	Synthetic detergent
iii.	BHT	c.	Soap
iv.	Sodium stearate	d.	Antioxidant
		e.	Analgesic

**Ans:** i – e, ii – a, iii – d, iv – c

**\*Q.101. Activity:**

**Collect information about different chemical compounds as per their applications in day-to-day life.**

**Ans:**

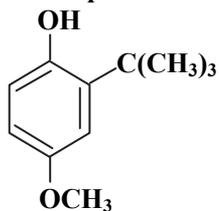
No.	Chemical compound	Applications
i.	Vinegar ( $\text{CH}_3\text{COOH}$ )	Preservation of food, salad dressing, sauces, etc.
ii.	Magnesium hydroxide [ $\text{Mg}(\text{OH})_2$ ]	Common component of antacids (used to relieve heartburn, acid indigestion and stomach upset.)
iii.	Baking soda ( $\text{NaHCO}_3$ )	Cooking, antacid, toothpaste, etc.
iv.	Sodium benzoate ( $\text{C}_6\text{H}_5\text{COONa}$ )	Used as food preservative

**[Note:** Students can use the above information as reference and collect additional information on their own.]



## APPLY YOUR KNOWLEDGE

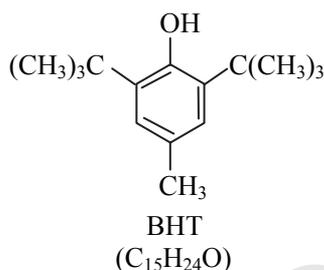
Q.102. Compound “X” having the following structure is used as synthetic antioxidant to increase the shelf life of packed foods.



- What is the molecular formula of compound “X”?
- Identify the structural unit responsible for antioxidant activity of “X”.
- Give one example of a compound with structure, similar to compound “X”, which is commonly used as synthetic antioxidant.
- Give the IUPAC name of compound “X”.

Ans:

- Molecular formula:  $C_{11}H_{16}O_2$
- Structural unit responsible for antioxidant activity of compound “X” is phenolic –OH group.
- Butylated hydroxytoluene (BHT) is commonly used synthetic antioxidant similar to compound “X”.



- The IUPAC name of compound “X” is 2-tert-butyl-4-methoxyphenol.

## QUICK REVIEW

➤ **Compounds with medicinal properties:**

Class of compound	Examples
Analgesics	Aspirin, paracetamol
Antiseptics	Iodine, boric acid, dettol, iodoform, tincture of iodine, trichlorophenol (TCP), chloroxylenol, thymol.
Disinfectant	p-chloro-o-benzylphenol
Antibiotics	Salvarsan, prontosil, sulphapyridine, sulphanilamide, penicillin, chloramphenicol

➤ **Cleansing agents:**

Cleansing agents		Examples
Soaps		Sodium or potassium salts of higher fatty acids (for example, sodium stearate)
Detergents	i. Cationic detergent	Ethyltrimethylammonium bromide: [ $CH_3(CH_2)_{15} - N^+(CH_3)_3$ ]Br <sup>-</sup>
	ii. Anionic detergent	Sodium lauryl sulphate: $CH_3(CH_2)_{10}CH_2OSO_3Na^+$
	iii. Nonionic detergent	a. Nonionic detergent containing ether linkage: $C_9H_{19} - \text{C}_6\text{H}_4 - O - (CH_2CH_2O)_nCH_2CH_2OH$ b. Nonionic detergent containing ester linkage: $CH_3(CH_2)_{16} - COO(CH_2CH_2O)_nCH_2CH_2OH$



## EXERCISE

## 16.1 Basics of food chemistry

1. How tannins are produced? Explain with chemical reaction.

**Ans:** Refer Q.11.

2. Give examples of agents that can be used to slow down the browning of chopped fruits and vegetables.

**Ans:** Refer Q.12. (i)

3. Lemon juice acts as an antioxidant for apple. Explain.

**Ans:** Refer Q.13.

4. Explain the term rancidity.

**Ans:** Refer Q.14.

5. Write a short note on oxidative rancidity.

**Ans:** Refer Q.18.

6. Unsaturated fats melt at lower temperature as compared to saturated fats. Justify.

**Ans:** Refer Q.21.

7. Give one point of difference between cis and trans forms of unsaturated fats.

**Ans:** Refer Q.23.

8. Explain the antioxidant nature of vitamin E.

**Ans:** Refer Q.30. (i) and Q.31. (i), (ii)

9. Name the sources from which tocopherol is obtained.

**Ans:** Refer Q.33.

## 16.2 Compounds with medicinal properties

10. Give an example of analgesic and draw its structure.

**Ans:** Refer Q.49. (Any one).

11. Write a short note on antiseptics.

**Ans:** Refer Q.54.

12. Name the active ingredient present in dettol.

**Ans:** Refer Q.56.

13. Draw the structure of antiseptic TCP and thymol.

**Ans:** Refer Q.62. (iii) and (i)

14. What is the difference between broad spectrum and narrow spectrum antibiotics?

**Ans:** Refer Q.75.

15. An active ingredient present in wintergreen has analgesic property. Name this ingredient.

**Ans:** Refer Q.81.

## 16.3 Cleansing agents

16. Explain the method for the preparation of soaps with chemical reaction.

**Ans:** Refer Q.86.

17. What is saponification reaction?

**Ans:** Refer Q.86. (ii)

18. Soaps form scum in hard water. Explain.

**Ans:** Refer Q.91.

19. Explain the following terms with examples.

- Cationic detergents
- Anionic detergents
- Nonionic detergents

**Ans:** Refer Q.94.

20. Explain how micelle formation by soap/detergent molecules removes stains/dirt in the washing process.

**Ans:** Refer Q.98.

## MULTIPLE CHOICE QUESTIONS

\*1. The chemical used to slow down the browning action of cut fruit is \_\_\_\_\_.

- (A)  $\text{SO}_3$  (B)  $\text{SO}_2$   
(C)  $\text{H}_2\text{SO}_4$  (D)  $\text{Na}_2\text{CO}_3$

\*2. The chemical responsible for the rancid flavour of fats is \_\_\_\_\_.

- (A) butyric acid (B) glycerol  
(C) protein (D) saturated fat

\*3. Oxidative rancidity is \_\_\_\_\_ reaction.

- (A) addition (B) substitution  
(C) free radical (D) combination

\*4. Health benefits are obtained by consumption of \_\_\_\_\_.

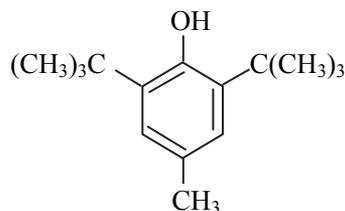
- (A) saturated fats  
(B) trans fat  
(C) monounsaturated fats  
(D) all of these

5. BHT as a food additive act as \_\_\_\_\_.

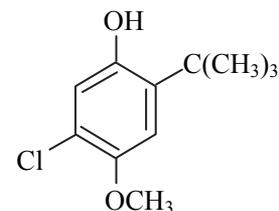
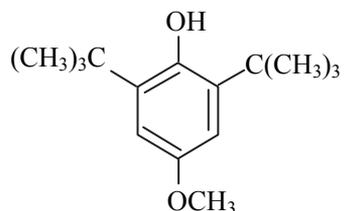
- (A) antioxidant (B) flavouring agent  
(C) colouring agent (D) emulsifier

6. The structure of antioxidant BHT is \_\_\_\_\_.

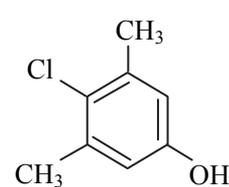
- (A) (B)



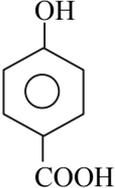
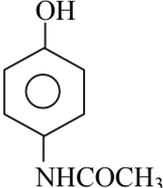
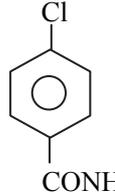
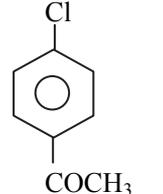
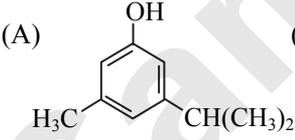
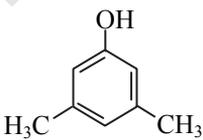
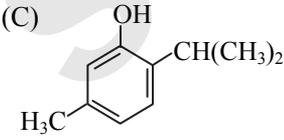
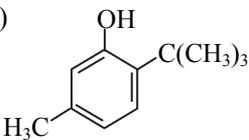
(C)



(D)





- \*7. Aspirin is chemically named as \_\_\_\_\_.  
(A) salicylic acid  
(B) acetyl salicylic acid  
(C) chloroxylenol  
(D) thymol
8. The molecular formula of aspirin is \_\_\_\_\_.  
(A)  $C_8H_8O_3$  (B)  $C_9H_8O_4$   
(C)  $C_9H_{10}O_4$  (D)  $C_9H_8O_3$
9. Aspirin is a/an \_\_\_\_\_.  
(A) antibiotic (B) analgesic  
(C) antimicrobial (D) disinfectant
10. The CORRECT structure of the drug paracetamol is \_\_\_\_\_.  
(A)  (B)   
(C)  (D) 
11. Which of the following is used as a weak antiseptic for eyes?  
(A) Tincture of iodine  
(B) Dilute solution of dettol  
(C) Iodoform  
(D) Dilute aqueous solution of boric acid
12. The structure of thymol is \_\_\_\_\_.  
(A)  (B)   
(C)  (D) 
- \*13. Find odd man out from the following.  
(A) Dettol (B) Chloroxylenol  
(C) Paracetamol (D) Trichlorophenol
14. Salvarsan is arsenic containing drug which was first used for the treatment of \_\_\_\_\_.  
(A) syphilis (B) typhoid  
(C) ulcer (D) dysentery
- \*15. Arsenic based antibiotic is \_\_\_\_\_.  
(A) azodye (B) prontosil  
(C) salvarsan (D) sulphapyridine
16. The linkage present in salvarsan is \_\_\_\_\_.  
(A)  $-N=N-$  (B)  $-As=As-$   
(C)  $-S-S-$  (D)  $-O-O-$
17. Which of following contains  $-N=N-$  in its structure?  
(A) Chloramphenicol  
(B) Sulphapyridine  
(C) Salvarsan  
(D) Prontosil
18. Which of the following contains  $-As=As-$  linkage?  
(A) Salvarsan  
(B) Prontosil  
(C) Sulphanilamide  
(D) Sulphapyridine
19. Which of the following element is NOT present in penicillin?  
(A) O (B) S  
(C) P (D) N
20. Methyl salicylate having analgesic properties is obtained from which of the following plant?  
(A) Clove  
(B) Indian gooseberry  
(C) Wintergreen  
(D) Cinnamon
21. Hydrolysis of oil by aqueous alkali is called \_\_\_\_\_.  
(A) esterification (B) saponification  
(C) acetylation (D) carboxylation
- \*22. Saponification is carried out by \_\_\_\_\_.  
(A) oxidation  
(B) alkaline hydrolysis  
(C) polymerisation  
(D) free radical formation
23. Sodium lauryl sulphate is an example of \_\_\_\_\_.  
(A) soap  
(B) cationic detergent  
(C) anionic detergent  
(D) nonionic detergent

## ANSWERS TO MULTIPLE CHOICE QUESTIONS

1. (B) 2. (A) 3. (C) 4. (C)  
5. (A) 6. (A) 7. (B) 8. (B)  
9. (B) 10. (B) 11. (D) 12. (C)  
13. (C) 14. (A) 15. (C) 16. (B)  
17. (D) 18. (A) 19. (C) 20. (C)  
21. (B) 22. (B) 23. (C)



## COMPETITIVE CORNER

- Which of the following is an anionic detergent? [JEE (Main) 2016]  
 (A) Sodium stearate (B) **Sodium lauryl sulphate**  
 (C) Cetyltrimethylammonium bromide (D) Glyceryl oleate
- Which of the following processes is NOT used to preserve the food? [MHT CET 2017]  
 (A) Irradiation (B) Addition of salts  
 (C) Addition of heat (D) **Hydration**
- The acid which contains both –OH and –COOH groups is \_\_\_\_\_. [MHT CET 2017]  
 (A) phthalic acid (B) adipic acid  
 (C) glutaric acid (D) **salicylic acid**
- Among the following, the narrow spectrum antibiotic is \_\_\_\_\_. [NEET (UG) 2019]  
 (A) ampicillin (B) amoxycillin  
 (C) chloramphenicol (D) **penicillin G**
- 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

Time: 1 Hour 30 Min

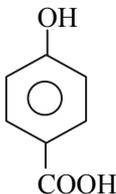
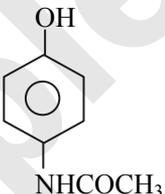
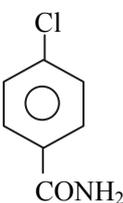
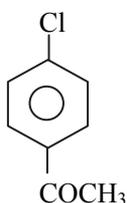
TOPIC TEST

Total Marks: 25

## SECTION A

Q.1. Select and write the correct answer:

[04]

- The linkage present in salvarsan is \_\_\_\_\_.  
 (A) –N=N– (B) –As=As– (C) –S–S– (D) –O–O–
- Oxidative rancidity is \_\_\_\_\_ reaction.  
 (A) addition (B) substitution (C) free radical (D) combination
- The CORRECT structure of the drug paracetamol is \_\_\_\_\_.  
 (A)  (B)  (C)  (D) 
- Saponification is carried out by \_\_\_\_\_.  
 (A) oxidation (B) alkaline hydrolysis  
 (C) polymerisation (D) free radical formation

Q.2. Answer the following:

[03]

- Name the two poly-unsaturated fats.
- What is the tincture of iodine?
- Give a chemical equation for saponification.

## SECTION B

Attempt any Four:

[08]

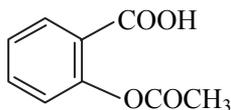
- Give two differences between the following: Rice flour and cooked rice
- What are antiseptics? Give two examples.
- Explain with examples: Nonionic detergents
- Turmeric powder can be used as antiseptic. Explain.
- Browning of cut apple can be prolonged by applying lemon juice.



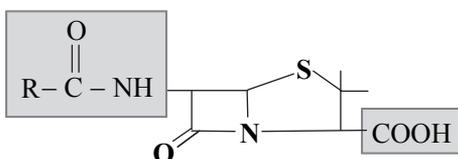
- Q.8. i. What is meant by broad spectrum antibiotic and narrow spectrum antibiotics?  
 ii. Draw the structure of BHT.

**SECTION C****Attempt any Two:****[06]**

- Q.9. i. Write the molecular formula and name of



- ii. Give two differences between the following: Soap and synthetic detergent.  
 Q.10. i. Identify the highlighted functional groups in the following molecule:



- ii. Complete the following table:

No.	Type	Example	Use
a.	Anionic detergent	-----	-----
b.	-----	-----	Hair conditioner

- Q.11. Explain: Mechanism of cleansing action of soap with flow chart.

**SECTION D****Attempt any One:****[04]**

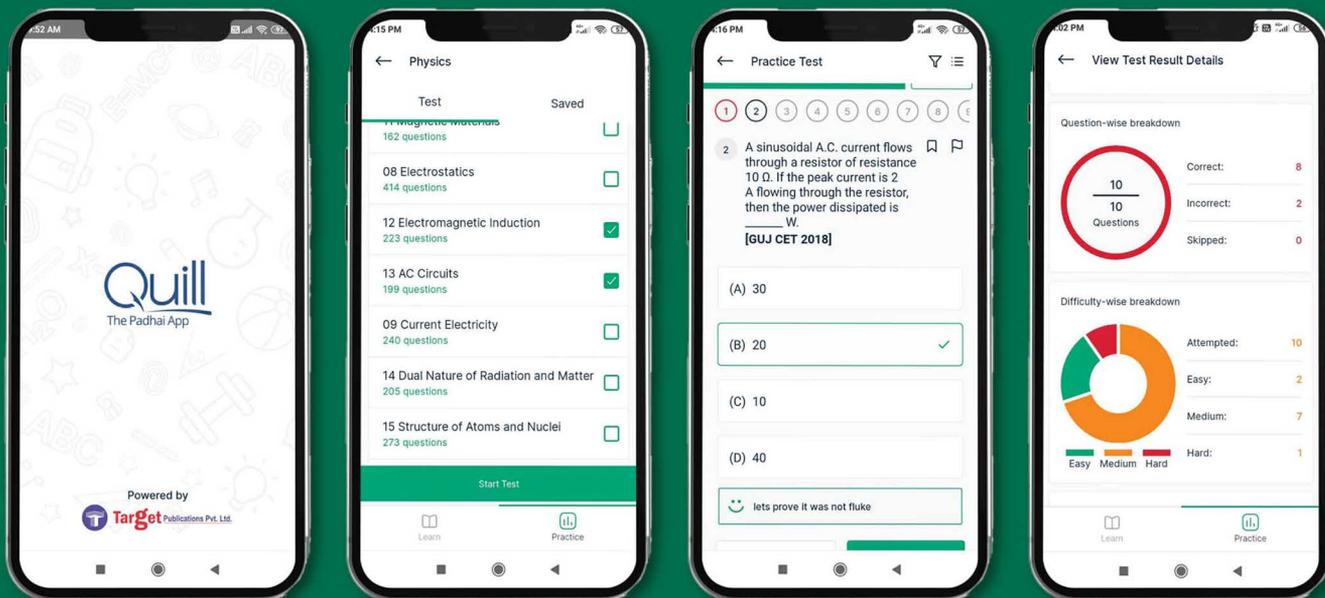
- Q.12. i. Explain: On cutting, some fruits and vegetables turn brown.  
 ii. Explain with examples: Disinfectant  
 Q.13. i. Explain why soaps become inactive in hard water.  
 ii. Give two differences between the following: Saturated and unsaturated fats

Download the answers of the Topic Test by scanning the given **Q.R. Code**.





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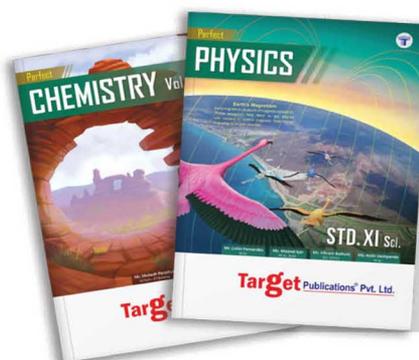
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