
FEDERAL KA MANJAN

*Academy*

# Chemistry: Grade 9 Notes & Conceptual

*A Comprehensive Guide for Grade 9 Students(Federal Board)*

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*From Atoms to Understandingg*

# Table of Contents

# CONTENTS

# 1. CHEMISTRY NOTES: UNIT 1 - NATURE OF SCIENCE IN CHEMISTRY

## 1.1. What is Chemistry? (The Big Picture)

Imagine you're trying to understand how everything around you works. This includes the air you breathe, the food you eat, and even the phone you hold. That's what **Chemistry** helps us do!

Think of Chemistry as a special detective science. It helps us figure out:

- **What stuff is made of:** What are the tiny particles that build everything?
- **How stuff behaves:** Why does ice melt when it gets warm? Why does wood burn?
- **How stuff changes:** When you bake a cake, flour, eggs, and sugar turn into something new. Chemistry explains *how* this transformation happens.
- **How stuff interacts with energy:** For example, how burning wood gives off heat, or how sunlight helps plants grow.

**Why do we study Chemistry?** Because understanding matter helps us do amazing things. We can create new medicines, invent new materials like plastics, and build better technologies.

**A Special Note on "Green Chemistry"**

This is like "eco-friendly" chemistry. It focuses on making chemicals and products in ways that are safer for people and the planet. It aims to reduce pollution and waste. It's about being smart and responsible with our chemical knowledge to protect the environment.

## 1.2. Different "Departments" of Chemistry

Chemistry is a very broad field. So, it's divided into smaller areas or "departments." Each department focuses on different types of chemical questions and problems.

### Major Branches

(a) **Organic Chemistry:** This area is very interested in **carbon**. If a substance contains carbon (and many living things and man-made materials do), an organic chemist will study it. Think of it as the "carbon club."

**Simple Idea**

Most things from living beings, like your body, as well as fuels and plastics, are studied in organic chemistry.

(b) **Inorganic Chemistry:** This is the "everything else" department! If a substance doesn't mainly involve carbon, it likely falls under inorganic chemistry. This includes metals, rocks, and many minerals.

**Simple Idea**

Examples include table salt, iron metal, and the soil beneath your feet.

(c) **Physical Chemistry:** This department connects chemistry with physics. It uses rules and math from physics to explain *why* chemicals act the way they do. It looks at the deep scientific reasons behind chemical reactions.

**Simple Idea**

Why does water boil at 100 degrees Celsius? How much heat comes out when something burns?

(d) **Analytical Chemistry:** This department acts like a "chemical detective" lab. Its main job is to find out: "What is this substance?" and "How much of it is there?" They use special tools to identify unknown chemicals or measure exact amounts.

**Simple Idea**

Imagine testing water to make sure it's clean, or checking food for specific ingredients.

(e) **Biochemistry:** This department studies the amazing chemical reactions that happen inside **living things**. It's all about the chemistry of life!

**Simple Idea**

How does your body break down food for energy? How do plants use sunlight to grow? These are questions for biochemistry.

(f) **Environmental Chemistry:** This department looks at how chemicals affect our planet and us. They study pollution, climate change, and how we can protect our environment.

**Simple Idea**

Why is smog bad for our health? How do farm chemicals affect soil and water?

## More Specialized Branches

There are even more specialized areas within chemistry:

(g) **Industrial Chemistry:** Focuses on making chemical products on a very large scale for factories and businesses.

(h) **Medicinal Chemistry:** Works on creating and improving new medicines and understanding how they work in our bodies.

(i) **Polymer Chemistry:** Specializes in "polymers," which are very large molecules made from many small, repeating units. Examples include plastics, rubber, and synthetic fibers.

(j) **Geochemistry:** Studies the chemistry of the Earth itself, including rocks, minerals, soil, and water.

(k) **Nuclear Chemistry:** Deals with changes that happen in the center (nucleus) of atoms,

like in nuclear power or radioactive materials.

(l) **Astrochemistry:** Explores chemical processes that occur in outer space, such as on planets, stars, and comets.

## 1.3. Big Questions Each Chemistry Department Asks

To understand what each "department" is interested in, let's look at some key questions they try to answer:

### Physical Chemistry

- What are the tiniest parts of everything (atoms) made of?
- How do chemicals stick together (form bonds) to create different materials?

### Organic Chemistry

- Why is carbon so special that it's in almost all living things?
- How do different arrangements of carbon atoms create totally different substances?

### Inorganic Chemistry

- What makes non-carbon compounds unique?
- How does the "Periodic Table" (the chart of elements) help us organize all the different building blocks of matter?

### Analytical Chemistry

- How can we accurately find out what an unknown sample is? How much of a substance is present?

### Biochemistry

- How does our body use the food we eat for energy and growth?
- What chemical steps keep living things alive and functioning?

### Environmental Chemistry

- How do human activities cause pollution? What are the risks of pollution?
- What are greenhouse gases, and how do they impact Earth's climate?

### Medicinal Chemistry

- How do scientists design drugs that specifically target and fix problems in the body?

### Polymer Chemistry

- What chemical structures make plastics flexible or strong?

### Geochemistry

- How do natural events affect where certain chemicals are found in the Earth's crust?

### Nuclear Chemistry

- How are changes in the center of atoms different from normal chemical reactions? What are their practical uses?

### Astrochemistry

- What types of chemical reactions happen in the vastness of outer space?

## 1.4. Chemistry in Your Daily Life (Real-World Examples!)

You use chemistry every single day, often without even realizing it!

- **Organic Chemistry in Action:** When you eat french fries, you are consuming carbohydrates, which are organic molecules. Organic chemists also figure out how to make cooking oils safe and efficient. Also, the medicines you take are created by organic chemists.
- **Inorganic Chemistry in Action:** The battery in your phone or laptop (a lithium-ion battery) is a wonderful example of inorganic chemistry at work.
- **Analytical Chemistry in Action:** Have you seen crime shows where tiny samples are analyzed? That's forensic analytical chemistry, used to identify substances like drugs or blood.
- **Physical Chemistry in Action:** The battery in your car works because of physical chemistry rules related to electricity and chemical changes.
- **Environmental Chemistry in Action:** Cleaning our drinking water using filters and special chemicals to remove dirt and germs is a key task of environmental chemistry.

## 1.5. The Dream Team: Science, Technology, and Engineering

These three fields work together like a super team to solve problems and make our lives better.

- **Science:** This is about **understanding** how the natural world operates. It answers the "why" and "how" questions. For example, *Why* does iron rust?
- **Technology:** This is about **applying** what we learn from science to create useful tools, machines, or methods. It takes the "why" and turns it into a "how to build it." For example, *How* can we make a coating that stops rust?
- **Engineering:** This involves **designing and building** practical solutions. Engineers use scientific knowledge and technological tools to turn ideas into real-world items. For example, a chemical engineer designs the *process* for making an anti-rust coating in a factory.

### Examples of the Team Working Together

- **Stopping Rust:**
  - **Science:** We learn that iron, water, and oxygen react together to form rust.
  - **Technology:** We develop special paints or coatings that can block water and oxygen from reaching the iron.
  - **Engineering:** Engineers design the factories and systems to produce these rust-proof coatings and apply them to things like cars or bridges.
- **Using Solar Energy:**

  - **Science:** Scientists discover that certain materials, like silicon, can turn sunlight directly into electricity.
  - **Technology:** We create solar panels that use these special materials.
  - **Engineering:** Electrical engineers design how to connect many solar panels to power homes or even whole cities. Civil engineers design the structures that hold these panels safely.

- **Cleaning Water:**
  - **Science:** We study the chemicals and germs that make water unsafe.
  - **Technology:** We develop filters and chemical treatments to remove these harmful substances. **Engineering:** Chemical engineers design complete water treatment plants. They figure out the best steps, like settling, filtering, and adding chemicals, to make water safe to drink.

- **Making Plastic Bags:**
  - **Science:** Scientists discover how tiny molecules called "monomers" can link together to form long, strong chains called "polymers." Polyethylene, which is plastic, is one such polymer.
  - **Technology/Engineering:** Using this knowledge, engineers design machines that can take these polymers and shape them into thin, useful plastic bags.

So, whenever you see something new or amazing in the world, it's likely that science helped us understand it, technology helped us create the tools, and engineering helped us build and put it into use! These three fields are always connected and push our world forward.

# 2. REVIEW QUESTIONS: SOLVED

## 2.1. Multiple Choice Questions (MCQs)

### Question (i)

Which branch of chemistry is the study of elements and their compounds except for organic compounds?

(a) Physical Chemistry
(b) Organic Chemistry
(c) **Inorganic Chemistry**
(d) Geochemistry Chemistry

**Correct Answer: C**

Inorganic Chemistry specifically deals with elements and their compounds, excluding organic ones.

### Question (ii)

Which branch of chemistry helps to protect water that has been poisoned by soil?

(a) **Environmental Chemistry**
(b) Organic Chemistry
(c) Inorganic Chemistry
(d) Geochemistry Chemistry

**Correct Answer: A**

Environmental Chemistry is directly concerned with protecting the environment, including water pollution.

### Question (iii)

Which area of Chemistry improves to gauge the behavior of pollutants and develop techniques for pollution control?

(a) Analytical Chemistry
(b) Organic Chemistry
(c) **Environmental**
(d) Geochemistry

**Correct Answer: C**

Environmental Chemistry is the branch dedicated to studying pollutants and developing control methods.

### Question (iv)

The branch of chemistry that helps to treat diseases, organic and to synthesize new medicines.

(a) Physical
(b) **Organic**

(c) Inorganic
(d) Environmental

**Correct Answer: B**

Organic Chemistry is fundamental to synthesizing new medicines, a core part of drug development.

### Question (v)

The branch of science helps to understand chemical products and processes that reduce the use of hazardous substances:

(a) Analytical Chemistry
(b) Physical Chemistry
(c) **Green Chemistry**
(d) Astrochemistry

**Correct Answer: C**

Green Chemistry focuses on designing safer and more sustainable chemical processes.

### Question (vi)

To identify the concentration of a particular solution through titration is an application of:

(a) Astrochemistry
(b) **Analytical Chemistry**
(c) Geochemistry
(d) Organic chemistry

**Correct Answer: B**

Analytical Chemistry is concerned with identifying substances and determining their quantities (concentration).

### Question (vii)

The batteries in our vehicles are built on the principle of electrochemistry. It is the application of:

(a) Astrochemistry
(b) Analytical Chemistry
(c) Organic chemistry
(d) **Physical chemistry**

**Correct Answer: D**

Electrochemistry, which deals with the relationship between electricity and chemical reactions, is a core area of Physical Chemistry.

### Question (viii)

The branch of chemistry that is concerned with the large-scale production of chemical substances is:

(a) **Industrial chemistry**
(b) Physical chemistry
(c) Inorganic chemistry
(d) Environmental Chemistry

**Correct Answer: A**

Industrial Chemistry focuses on the processes and technologies for producing chemicals on a large scale.

### Question (ix)

The branch of chemistry that focuses on the study of polymers, their types, properties, uses is called:

(a) Industrial chemistry
(b) **Polymer Chemistry**
(c) Organic Chemistry
(d) Astrochemistry

**Correct Answer: B**

Polymer Chemistry is the specialized field dedicated to the study of polymers.

### Question (x)

The study of the interaction between drugs and biological targets, as well as the development of new medicinal agents.

(a) Organic chemistry
(b) **Medicinal Chemistry**
(c) Inorganic chemistry
(d) Environmental Chemistry

**Correct Answer: B**

Medicinal Chemistry precisely defines the study of drug interactions and development.

## 2.2. Short Answer Questions

### Question 2(i)

**How does chemistry help a doctor to know about the chemical nature of medicine?**

**Solution for Question 2(i)**

Chemistry helps doctors understand medicines in important ways. It teaches them what a medicine is made of. It also explains how the medicine works inside the body. For example, chemistry shows how a drug can target a specific part of a disease. It also helps doctors understand how the body uses, changes, and removes the medicine. This knowledge is important for doctors to pick the right medicine and give the correct amount to patients.

### Question 2(ii)

**In what ways does technological innovation help to understand the development of new materials?**

**Solution for Question 2(ii)**

New technology helps a lot in making new materials. First, it gives us special tools. These tools, like powerful microscopes, let us see materials at a very tiny level. This helps us understand what they are made of and how they are structured. Second, technology offers better ways to make materials. Machines can now create materials with great precision and speed. Third, computers can run simulations. This means we can test new material ideas on a computer before making them for real. This saves time and money.

### Question 2(iii)

**Differentiate between geochemistry and astrochemistry.**

**Solution for Question 2(iii)**

Geochemistry and astrochemistry are both about chemistry, but they study different places.

- **Geochemistry:** This branch studies chemicals found right here on **Earth**. It looks at rocks, soil, water, and the air around our planet. For example, it might study how metals are found in the ground.
- **Astrochemistry:** This branch studies chemicals found in **space**. It looks at what stars, planets, comets, and giant gas clouds in space are made of. For example, it might study what gases are in the atmosphere of a distant planet.

Simply put, geochemistry is Earth's chemistry, and astrochemistry is space chemistry.

### Question 2(iv)

**With the help of an example correlated the use of science, technology and engineering.**

**Solution for Question 2(iv)**

Let's look at how **solar panels** show the link between science, technology, and engineering.

- **Science:** First, scientists discovered that certain materials, like silicon, can turn sunlight directly into electricity. This was a basic discovery of how nature works.
- **Technology:** Next, this scientific idea was used to create the *technology* of solar panels. These panels are special devices that actually do the job of turning light into power.
- **Engineering:** Finally, engineers step in. They design how to connect many solar panels together to build a large solar power plant. They also figure out how to make sure the electricity gets to homes and businesses safely. This shows how all three work together to create something useful.

## Question 2(v)

**With the help of the Venn diagram compare and contrast organic and inorganic chemistry.**

**Solution for Question 2(v)**

Imagine two circles for "Organic Chemistry" and "Inorganic Chemistry." They have a small part where they overlap.

- **Organic Chemistry:** This branch mostly studies things that contain **carbon atoms linked to hydrogen atoms** (C-H bonds). Many living things, plastics, and fuels are organic. For example, sugar and gasoline are organic compounds.
- **Inorganic Chemistry:** This branch studies almost **all other chemicals**. This includes metals, salts, and minerals that do not have C-H bonds. For example, table salt and iron metal are inorganic.

**How they are similar (the overlap):** Both are branches of chemistry. Both study what chemicals are made of, what they are like, and how they react. Both are very important for making things we use every day.

## Question 2(vi)

**What are the uses of nuclear chemistry?**

**Solution for Question 2(vi)**

Nuclear chemistry looks at changes happening inside the very center of atoms. It has several important uses:

- **Making Electricity:** Nuclear power plants use nuclear reactions to create a lot of electricity.
- **In Medicine:** Special radioactive materials from nuclear chemistry are used in hospitals. They help doctors see inside the body (like with PET scans) and treat diseases such as cancer.
- **Dating Old Things:** Scientists use nuclear chemistry to find out how old very old objects are, like ancient bones or tools. This is called carbon dating.
- **Making Things Clean:** Radiation from nuclear processes can be used to kill germs. This helps to clean medical tools and keep food fresh.

## Question 3

**Define chemistry and its interactions with other matter and energy.**

**Solution for Question 3**

**Chemistry** is the science that studies all the "stuff" around us, which we call **matter**. It tries to understand:

- What matter is made of.
- What properties it has (like color or how it melts).
- How its tiny parts are arranged.
- How it changes from one thing to another.

Chemistry also looks at how matter works with **energy**.

- **Matter and its Changes:** When things change, like wood burning into ash, chemistry explains why. It's about how the tiny pieces of matter move around and form new things.
- **Energy and its Role:** Changes in matter often involve energy. Some changes give off energy, like a fire making heat and light. Other changes need energy to happen, like plants using sunlight to grow. Chemistry helps us understand these energy transfers.

## Question 4

**Describe the applications of inorganic chemistry and its importance in our daily lives?**

**Solution for Question 4**

Inorganic chemistry studies chemicals that mostly do not contain carbon-hydrogen bonds. It is very important in our daily lives.

- **Building Materials:** It helps make things like steel, aluminum, cement, and glass. These are used to build our homes, roads, and cars.
- **Batteries:** The batteries in our phones, laptops, and electric cars often use inorganic chemicals.
- **Food Growth:** Inorganic chemicals are used to make fertilizers. These help farmers grow more food.
- **Clean Water:** Chemicals used to clean our drinking water are often inorganic. They help remove dirt and kill germs.
- **Electronics:** Many parts inside our computers and electronic devices are made from inorganic materials like silicon.

So, inorganic chemistry is very important. It gives us the basic materials for much of our modern world.

## Question 5

**With the help of few examples highlight the relation between science, technology and engineering.**

**Solution for Question 5**

Science, Technology, and Engineering work together like a team.

- **Science:** This is about **understanding** how nature works. It answers "why" and "how."
- **Technology:** This is about **using** that understanding to create tools or products.
- **Engineering:** This is about **designing and building** real solutions using science and technology.

**Example 1: Making Medicines**

- **Science:** Scientists learn how diseases affect our bodies. They find tiny targets that drugs can attack.
- **Technology:** New lab tools and methods are made to create and test many possible drug compounds quickly.
- **Engineering:** Chemical engineers then design big factories to make these medicines safely and in large amounts.

**Example 2: Making Smartphones**

- **Science:** Scientists discover how certain materials can control electricity very well (semiconductors).
- **Technology:** This leads to tiny computer chips and touchscreens that are part of smartphones.
- **Engineering:** Engineers design all the different parts of the phone to work together. They make the circuits, the body of the phone, and the software that runs it.

This shows how science helps us understand, technology gives us tools, and engineering builds the final product.

## Question 6

**Evaluate the role of chemistry in environmental science.**

**Solution for Question 6**

Chemistry is very important in environmental science. It helps us understand and solve problems related to our planet.

- **Understanding Pollution:** Chemistry helps us know what pollutants are, where they come from, and how they move in air, water, and soil. For example, it tells us what chemicals cause acid rain.
- **Finding Pollution:** Chemists create ways to test for pollution. They can measure even tiny amounts of harmful chemicals in the environment. This helps us know if water is safe to drink or air is clean.
- **Cleaning Up Pollution:** Chemistry helps design ways to clean up polluted areas. This includes making water filters or finding ways to treat waste safely.
- **Climate Change:** Environmental chemistry helps us study gases that cause climate change, like carbon dioxide. This helps us find ways to reduce global warming.

Simply put, chemistry gives us the knowledge and tools to keep our planet healthy.

## Question 7

**How does geochemistry help us to solve the problems such as pollution and climate change?**

### Solution for Question 7

Geochemistry, which studies the chemistry of the Earth, helps us with pollution and climate change:

- **Tracking Pollution:** It helps us understand how harmful chemicals move through soil, rocks, and water underground. This knowledge is important for stopping pollution from spreading and for cleaning up contaminated areas.
- **Understanding Natural Cycles:** Geochemistry studies how elements (like carbon) naturally move through the Earth, air, and water. This helps us see when human actions disrupt these cycles, which can lead to problems like climate change.
- **Storing Carbon Dioxide:** Geochemists look for safe places deep underground to store carbon dioxide. This gas causes climate change, so storing it helps reduce its amount in the air.

By studying Earth's chemistry, geochemistry helps us find solutions to big environmental challenges.

## Question 8

**How is organic chemistry applied in medicines, biochemistry and industrial science?**

### Solution for Question 8

Organic chemistry is very important in many fields:

- **In Medicines:** Most medicines we use are made of organic compounds. Organic chemists design and create these drug molecules. They understand how these drugs interact with our bodies to treat diseases. For example, pain relievers and antibiotics are organic chemicals.
- **In Biochemistry:** Biochemistry is the chemistry of living things, and living things are made of organic compounds. Organic chemistry helps us understand how important biological molecules work. These include sugars, proteins, fats, and DNA, all of which are organic.
- **In Industrial Science:** Organic chemistry is key for many industries.
  - It's used to make **plastics** and other polymers (like nylon).
  - It helps us refine **fuels** like gasoline.
  - It's used to create many **paints, glues, and dyes**.
  - It's also involved in making many **food products, soaps, and perfumes**.

So, organic chemistry is all around us, from the medicines we take to the products we use daily.