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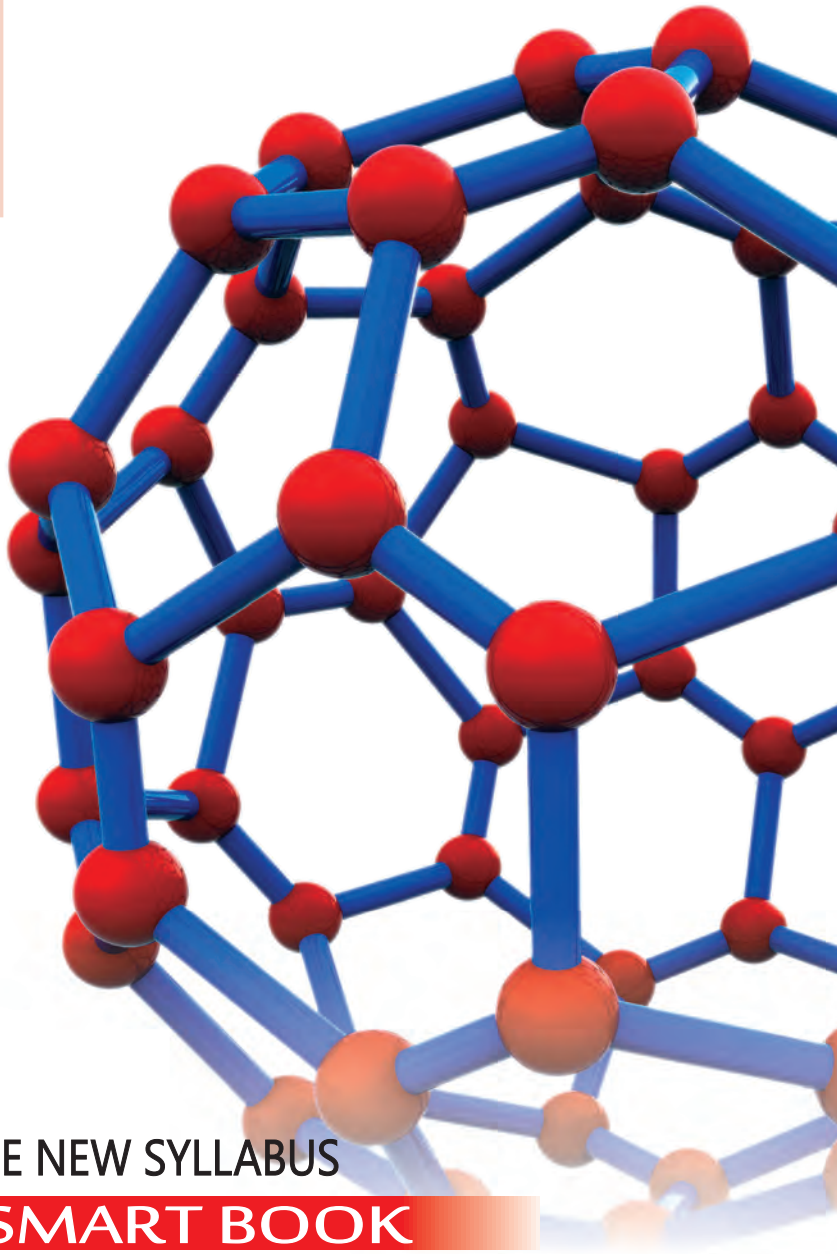

Dr. S.P. Jauhar
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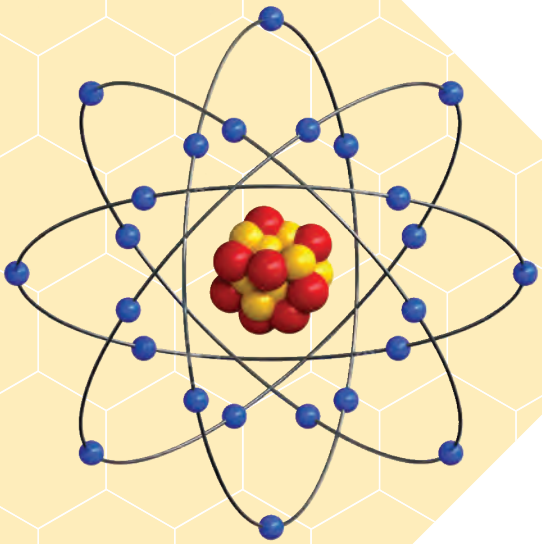

By

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Preface

Preface

We feel pleasure in bringing out our multicolour book **"Modern's abc + of Science (Chemistry)"** for class IX students. The book has been prepared according to the syllabus and the scheme of C.B.S.E.

Salient Features of the Book –

- Text matter has been presented in a simple language and interesting style and in tune with the N.C.E.R.T. textbook.
- The text has been supplemented with a large number of neatly well-labelled diagrams.
- The topics are supported by important notes, facts to know, do you know, key point that strengthen the fundamental concepts to young scholars.
- Assignments are provided in each chapter in the light of new pattern i.e., Practice Exercises, Suggested Projects/Activities, Seminars, Group Discussions, trips, etc.
- Assignments in each chapters provide specially designed questions (solved as well as unsolved) for covering all types of questions; very short answer type, short answer type, long answer type and multiple choice questions.
- **NCERT FILE** at the end of each chapter provides solutions to In-Text Questions, Exercise Questions and Exemplar Problems.
- A number of Higher Order Thinking Skills (**HOTS**) with answers are given at the end of each chapter.
- Value Based Questions (**VBQs**) are given at the end of each chapter.
- Multiple Choice Questions (**MCQs**) for competitive examinations such as NTSE are given in Competition File at the end of each chapter.
- The book provides complete coverage of previous years' CBSE Board Examinations with answers.

We hope that the book will be warmly received by the teachers and the students. Suggestions for further improvements of the book will be gratefully acknowledged.

Dr. S. P. Jauhar
R. Jauhar

SYLLABUS
Science-IX

Marks : 80

Unit No.	Units	Marks
I.	Matter – Its Nature and Behaviour	23
II.	Organisation in the Living World	20
III.	Motion, Force and Work	27
IV.	Our Environment	06
V.	Food; Food Production	04
	Total	80
	Internal assessment	20
	Grand Total	100

Note: Above weightage includes the weightage of questions based on practical skills.

THEME : MATERIALS

Unit I : Matter-Nature and Behaviour (50 Periods)

Definition of matter: Solid, liquid and gas; characteristics - shape, volume, density; change of state-melting (absorption of heat), freezing, evaporation (cooling by evaporation), condensation, sublimation.

Nature of matter: Elements, compounds and mixtures. Heterogenous and homogenous mixtures, colloids and suspensions.

Particle nature, basic units: Atoms and molecules. Law of constant proportions. Atomic and molecular masses. Mole concept: Relationship of mole to mass of the particles and numbers.

Structure of atom: Electrons, protons and neutrons, valency, chemical formula of common compounds. Isotopes and isobars.

THEME : THE WORLD OF THE LIVING

Unit II : Organization in the Living World (45 Periods)

Cell - Basic Unit of life: Cell as a basic unit of life; prokaryotic and eukaryotic cells, multicellular organisms; cell membrane and cell wall, cell organelles and cell inclusions; chloroplast, mitochondria, vacuoles, endoplasmic reticulum, Golgi apparatus; nucleus, chromosomes - basic structure, number.

Tissues, Organs, Organ System, Organism: Structure and functions of animal and plant tissues (only four types of tissues in animals; Meristematic and Permanent tissues in plants).

Biological Diversity: Diversity of plants and animals–basic issues in scientific naming, basis of classification. Hierarchy of categories /groups, major groups of plants (salient features) (Bacteria, Thallophyta, Bryophyta, Pteridophyta, Gymnosperms and Angiosperms). Major groups of animals (salient features) (non-chordates upto phyla and chordates upto classes).

Health and Diseases: Health and its failure. Infectious and non-infectious diseases, their causes and manifestation. Diseases caused by microbes (virus, bacteria and protozoans) and their prevention, Principles of treatment and prevention. Pulse polio programmes.

THEME : MOVING THINGS, PEOPLE AND IDEAS

Unit III: Motion, Force and Work (60 Periods)

Motion: Distance and displacement, velocity; uniform and non-uniform motion along a straight line; acceleration, distance-time and velocity-time graphs for uniform motion and uniformly accelerated motion, derivation of equations of motion by graphical method; elementary idea of uniform circular motion.

Force and Newton's laws: Force and Motion, Newton's Laws of Motion, Action and reaction forces, Inertia of a body, Inertia and mass, Momentum, Force and Acceleration. Elementary idea of conservation of Momentum.

Gravitation: Gravitation; Universal Law of Gravitation, Force of Gravitation of the earth (gravity), Acceleration due to Gravity; Mass and Weight; Free fall.

Floatation: Thrust and Pressure. Archimedes' principle, Buoyancy, Elementary idea of Relative Density.

Work, energy and power: Work done by a force, Energy, Power; Kinetic and potential energy; Law of conservation of energy.

Sound: Nature of sound and its propagation in various media, speed of sound, range of hearing in humans; Ultrasound; Reflection of sound; Echo and SONAR.

Structure of the Human Ear (Auditory aspect only).

THEME : NATURAL RESOURCES: BALANCE IN NATURE

Unit IV: Our Environment (15 Periods)

Physical resources: Air, Water, Soil. Air for respiration, for combustion, for moderating temperatures, movements of air and its role in bringing rains across in India.

Air, water and soil pollution (brief introduction). Holes in ozone layer and the probable damages.

Bio-geochemical cycles in nature : Water, Oxygen, Carbon and Nitrogen.

THEME : FOOD

Unit V: Food Production (10 Periods)

Plant and animal breeding and selection for quality improvement and management; Use of fertilizers and manures; Protection from pests and diseases; Organic farming.

CONTENTS

Chapter 1 Matter in Our Surroundings

As we look around our surroundings, we see a large variety of objects around us. The nature and behaviour of different types of substances around us are different. These substances differ in their shapes, sizes, colours, smells, textures etc. It is possible that two substances may have similar appearance but still they may be different. For example, sodium chloride (common salt) and powdered sugar on our dining table are white solids and have almost similar appearances, but both are different substances. As we all know, they have many different properties.

Do you ever thought that all the things around us are alike in one way. They all are made up of material to which the scientists have given the name matter. All the things around us; the air we breathe, the food we eat, the clouds, the stars, the plants and animals, the stone, sand, the everyday substances that we use like wood, salt, paper, steel, ice, water, etc. are matter. They all have mass and occupy space.

Anything that occupies space and has mass is called ***matter.***

Thus, we can say that all the objects around us are composed of matter. For example, a book occupies some space. If you pick up the book, you can feel its weight. Similarly, air, water, a cube of sugar, iron rod, have mass and occupy space.

Thus, to understand the world around you, it is *essential to know about matter.*

Since the early times, the human beings have been trying to understand their surroundings. The Greek and Indian philosophers and scientists have been trying to analyse and classify the matter. The early Greek philosophers suggested that there are four basic elements : fire, water, air and earth which constituted all materials.

Interestingly, almost same concept was developed by Indian philosophers. According to Indian philosophers, all matter (*padarth*), living or non-living, is made up of five basic elements called "*the panch tatva*". These are *sky*, *air*, *fire*, *water* and *earth*. According to them everything living or non-living is made up of these five basic elements.

In this chapter

However, in modern science matter can be classified in two types:

(*i*) The physical classification based on the physical properties of matter.

(*ii*) The chemical classification based on chemical composition of matter.

In the present unit, we shall learn about matter based on physical properties. The chemical aspects of matter will be learnt in next chapters.

PHYSICAL NATURE OF MATTER

Matter is made up of particles

The earlier philosophers believed that matter is continuous like a block of wood. They believed that everything like air, water, etc. is a single element as a whole. However, later work has shown that all matter is made up of tiny pieces or particles like sand. The particles which make up matter are so small that we cannot see them even with high power microscope. Even without seeing them, we have certain evidences which show that all the things are made up of very very large number of tiny particles. For example, even a small drop of rain water weighing about 0.05g contains about 10^{21} particles of water in it.

Let us perform an activity to understand the nature of matter; whether it is continuous or particulate (discontinuous).

Activity 1

❑ To demonstrate that matter is made up of particles

1. Take a 100 mL beaker.
2. Fill the beaker up to half with water and mark the water level.
3. Dissolve a small amount of sugar (or common salt) with the help of a glass rod.
4. Observe the change in water level and note your observation.

Now answer the following questions :

(*a*) What do you think has happened to sugar (or salt)?

(*b*) Where does it disappear?

(*c*) Does the level of water change?

We observe that the sugar (or common salt) has completely dissolved in water. Therefore, we are not able to see it. It must have spread completely in between water. This gives us the idea that matter must be made up of particles. The particles of sugar (or common salt) have spread throughout water. As we know, we can not spread the block of wood but we can easily spread saw dust obtained from the same block.

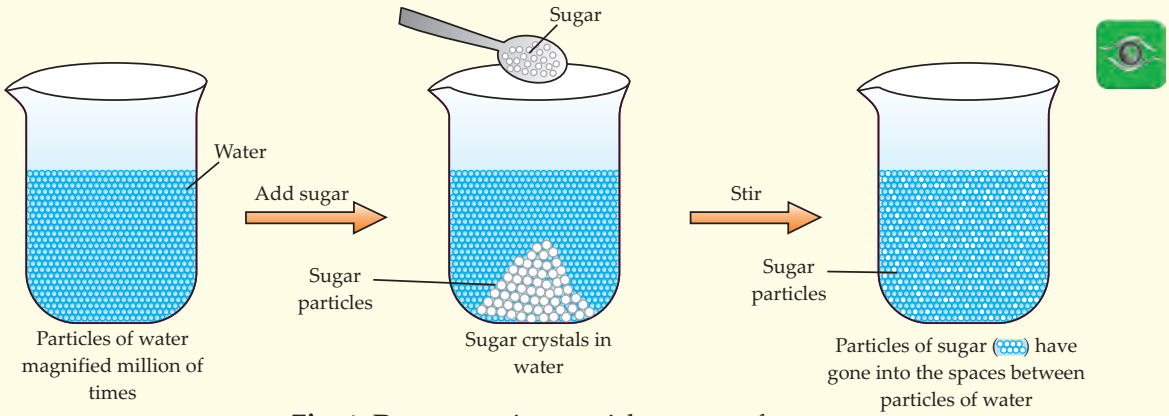


Fig. 1. Demonstrating particle nature of matter.

➡ Thus, we can say that sugar (or common salt) is a collection of a large number of particles. When we dissolve sugar (or salt) in water, its particles get into the spaces between particles of water. Both the sugar crystals and water are made up of particles. The particles of sugar leave the crystal and mix with the particles of water.

The spreading of particles of coloured crystal can be easily seen by repeating the above activity with a crystal of potassium permanganate. Potassium permanganate is purple coloured solid substance and water is colourless liquid. When we dissolve a crystal of potassium permanganate in water in a beaker, it is observed that water slowly turns purple on its own. The purple colour starts spreading through the water. This is because the particles of potassium permanganate go into the spaces between the particles of water.

Thus, we can say that matter is particulate in nature *i.e.*, made up of particles. So, we can say that

everything around us is made up of particles.

Our body is made up of particles. So are our desks, our chairs, our books, our pens and all other things.

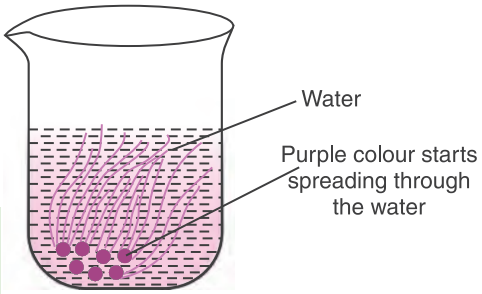


Fig. 2. Spreading of particles.

How small are the particles of matter?

The next question which comes to mind is "how small are the particles of matter?" This can be understood by the following activity :

Activity 2

- To demonstrate that the particles of matter are very small

1. Take a 100 mL of water in a beaker. Add 2–3 crystals of potassium permanganate in it and stir to dissolve. The solution will become dark pink colour.
2. Take out about 10 mL of this solution and put it into 90 mL of clear water in another beaker the total volume up to 100 mL.

   Place your two solutions side by side on the table.
3. Now take 10 mL of the solution prepared in step 2 and put it into another 90 mL of clear water in another beaker.
4. Keep diluting the solution like this about 5 to 8 times.

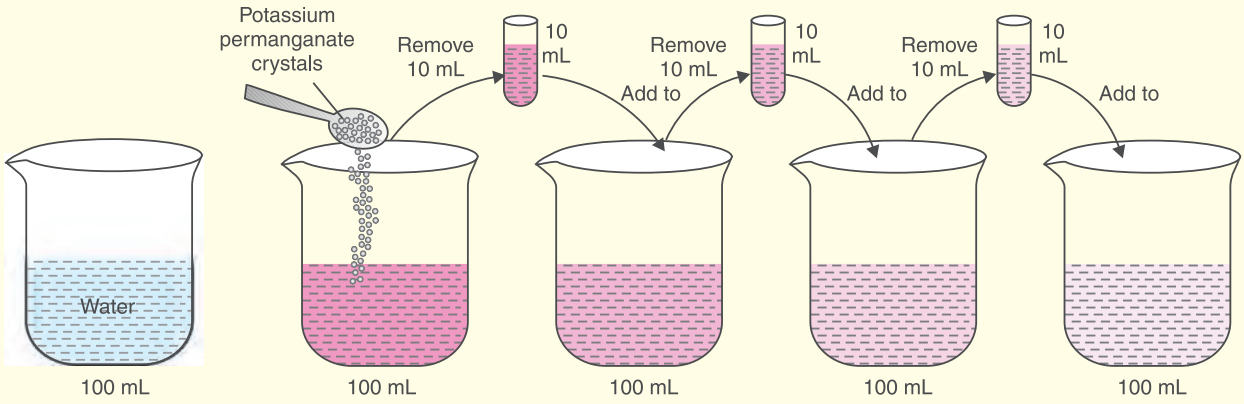


Fig. 3. Decrease in colour of potassium permanganate solution.

Now answer the following questions

(*a*) Is the solution still coloured?

(*b*) How many times you can dilute the solution so that you don't see the pink colour in the solution?

(*c*) What does this tell us about the particles in the crystal?

This experiment shows that a few crystals of potassium permanganate can colour a large volume of water as large as about 1000 L.

We may conclude that there must be million and million of tiny particles in just one crystal of potassium permanganate which keep on dividing themselves into smaller and smaller particles. Ultimately a stage may reach when these particle can not be divided further into smaller particles.

The same activity may be repeated by using about 2mL of Dettol instead of potassium permanganate. It is observed that the smell can be detected even on repeated dilution.

Thus, we may conclude that

the particles of matter are very small; they are small beyond our imagination.

CHARACTERISTICS OF PARTICLES OF MATTER

1. Particles of matter have spaces between them

The activities 1 and 2 show that particles of sugar, salt, potassium permanganate or Dettol get evenly distributed in water. Similarly, when we prepare tea, coffee or lemonade (*nimbu pani*) we observe that particles of one type of matter get into the spaces between particles of the other.

This show that there is large space between particles of matter.

2. Particles of matter are continuously moving

The particles of matter are continuously moving in all directions. Sometimes, when a beam of sunlight enters a dark room through a small hole, we can see tiny dust particles suspended in air which are moving in a haphazard way. The movement of particles can be understood by the following activities :

Activity 3

- To demonstrate that particles of matter are continuously moving

1. Take an incense stick (*agarbatti*) and place it in a corner of your classroom.
2. Smell this stick. How close do you have to go near it so as to get its smell ?
3. Now light the stick and note the observations.

Now answer the following question :

Do you get the smell of the incense stick sitting at a distance?

You will observe that when you light the incense stick, its smell spreads quickly and you can get its smell even sitting at a distance from it. This observation shows that particles of matter are not stationary but they are continuously moving in all directions. Due to the movement of particles, they possess what we call the kinetic energy. As the temperature rises, the particles move faster. So, we can say that with increase in temperature, kinetic energy of the particles also increases.

Intermixing of particles : Diffusion

The particles of perfume in the incense stick mix with the particles of air around us and spread out. Due to spreading of particles, the smell of the perfume goes all over the room. Therefore, we can get its smell even sitting at a distance from it.

The intermixing of particles of two substances on their own is called ***diffusion.***

Leakage of cooking gas in our homes is detected due to diffusion of a strong smelling substance that is mixed with the liquefied petroleum gas (LPG). Similarly, if a bottle of ammonia is opened in one corner of the laboratory, its small can be felt in other corner of the laboratory after sometime.

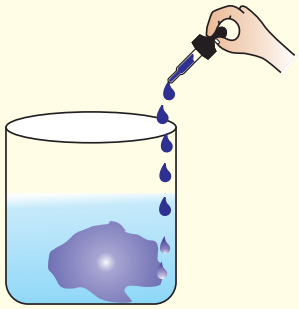
It may be noted that on heating the rate of diffusion increases. This is the reason that when incense stick is lighted we get its smell even sitting at a distance from it.

Let us learn more about diffusion by performing the following activities :

Activity 4

❑ To demonstrate that diffusion of different substances is different

1. Take two beakers filled with water.
2. Put a drop of blue (or red) ink slowly and carefully along the sides of first beaker and honey in the second beaker.
3. Leave the beakers undisturbed in a corner in the class.
4. Record your observations.



Now, answer the following questions :

? **(*a*) What do you observe immediately after adding the ink drop?**

(*b*) What do you observe immediately after adding a drop of honey?

(*c*) How many hours or days does it take for colour of ink to spread evenly.

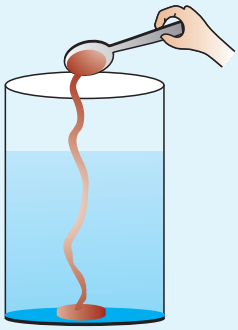
(*d*) How does diffusion vary with density of liquid?

You would observe that the ink spreads earlier than honey.

➡ The diffusion of honey is less than that of ink because honey has more density.

DO YOU KNOW?

The purity of honey can be checked by putting a drop of honey in water. If honey falls in the form of a streak, it is considered to be pure.



Gases have strong tendency to intermix or diffuse. When two gases are brought in contact, the particles of one gas go in between the empty spaces of the other gas. This can be shown by the following activity:

Activity 5

❑ **To demonstrate the diffusion of gases**

1. Take a gas jar containing bromine vapour. Its colour is brown red.
2. Place a jar containing air (colourless) upside down on the jar containing bromine vapour.

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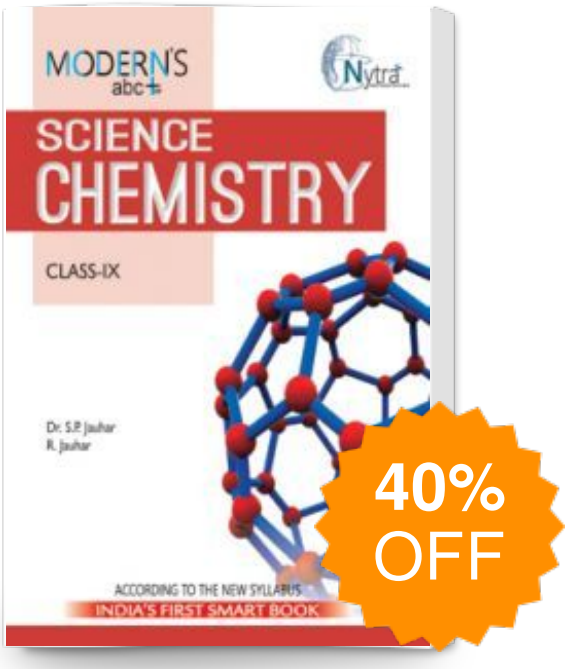

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