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Revised Multicolour Edition Based on CCE Pattern
As per NCERT/CBSE Syllabus

Science for Ninth Class
Part - 2

Chemistry

Containing
answers to NCERT
book questions and
value-based
questions

LAKHMIR SINGH
MANJIT KAUR



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This book has been revised according to the CCE pattern of school education based on NCERT syllabus prescribed by the Central Board of Secondary Education (CBSE) for Class IX

Science for Ninth Class

(PART – 2)

CHEMISTRY

As per NCERT/CBSE Syllabus
(Based on CCE Pattern of School Education)

Containing
answers to NCERT
book questions
and value-based
questions

Lakhmir Singh
And
Manjit Kaur



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A Division of S. Chand And Company Pvt. Ltd.

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First Published in 1980

Revised Edition 2014, 2016

Reprints 1981, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2015, 2016 (Thrice)

ISBN : 978-93-525-3026-7

Code : 1004G 294

PRINTED IN INDIA

By Vikas Publishing House Pvt. Ltd., Plot 20/4, Site-IV, Industrial Area Sahibabad, Ghaziabad-201010
and Published by S. Chand And Company Pvt. Ltd., 7361, Ram Nagar, New Delhi -110 055.



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MANJIT KAUR did her B.Sc., B.Ed. from Delhi University in 1970. Since then she has been teaching in a reputed school of Directorate of Education, Delhi. Manjit Kaur is such a popular science teacher that all the students want to join those classes which she teaches in the school. She has a vast experience of teaching science to school children, and she knows the problems faced by the children in the study of science. Manjit Kaur has put all her teaching experience into the writing of science books. She has co-authored more than 15 books alongwith her husband, Lakhmir Singh.

It is the team-work of Lakhmir Singh and Manjit Kaur which has given some of the most popular books in the history of science education in India. Lakhmir Singh and Manjit Kaur both write exclusively for the most reputed, respected and largest publishing house of India : S.Chand and Company Pvt. Ltd.

An Open Letter

Dear Friend,

We would like to talk to you for a few minutes, just to give you an idea of some of the special features of this book. Before we go further, let us tell you that this book has been revised according to the NCERT syllabus prescribed by the Central Board of Secondary Education (CBSE) based on new "Continuous and Comprehensive Evaluation" (CCE) pattern of school education. Just like our earlier books, we have written this book in such a simple style that even the weak students will be able to understand chemistry very easily. Believe us, while writing this book, we have considered ourselves to be the students of Class IX and tried to make things as simple as possible.

The most important feature of this revised edition of the book is that we have included a large variety of different types of questions as required by CCE for assessing the learning abilities of the students. This book contains :

- (i) Very short answer type questions (including true-false type questions and fill in the blanks type questions),
- (ii) Short answer type questions,
- (iii) Long answer type questions (or Essay type questions),
- (iv) Multiple choice questions (MCQs) based on theory,
- (v) Questions based on high order thinking skills (HOTS),
- (vi) Multiple choice questions (MCQs) based on practical skills in science,
- (vii) NCERT book questions and exercises (with answers), and
- (viii) Value based questions (with answers).

Please note that answers have also been given for the various types of questions, wherever required. All these features will make this book even more useful to the students as well as the teachers. "A picture can say a thousand words". Keeping this in mind, a large number of coloured pictures and sketches of various scientific processes, procedures, appliances, manufacturing plants and everyday situations involving principles of chemistry have been given in this revised edition of the book. This will help the students to understand the various concepts of chemistry clearly. It will also tell them how chemistry is applied in the real situations in homes, transport and industry.

***Other Books by Lakhmir Singh
and Manjit Kaur***

1. Awareness Science for Sixth Class
2. Awareness Science for Seventh Class
3. Awareness Science for Eighth Class
4. Science for Ninth Class (Part 1) PHYSICS
5. Science for Tenth Class (Part 1) PHYSICS
6. Science for Tenth Class (Part 2) CHEMISTRY
7. Science for Tenth Class (Part 3) BIOLOGY
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(A Question-Answer Book for Class X)
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PHYSICS and CHEMISTRY
12. Science for Tenth Class (Hindi Edition) :
PHYSICS, CHEMISTRY and BIOLOGY
13. Saral Vigyan (A Question-Answer Science
Book in Hindi for Class X)

We are sure you will agree with us that the facts and formulae of chemistry are just the same in all the books, the difference lies in the method of presenting these facts to the students. In this book, the various topics of chemistry have been explained in such a simple way that while reading this book, a student will feel as if a teacher is sitting by his side and explaining the various things to him. We are sure that after reading this book, the students will develop a special interest in chemistry and they would like to study chemistry in higher classes as well.

We think that the real judges of a book are the teachers concerned and the students for whom it is meant. So, we request our teacher friends as well as the students to point out our mistakes, if any, and send their comments and suggestions for the further improvement of this book.

Wishing you a great success,

Yours sincerely,

Lakhmir Singh
Manjit Kaur

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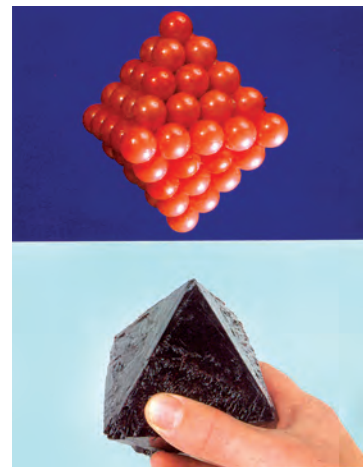
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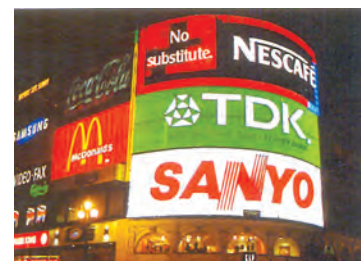
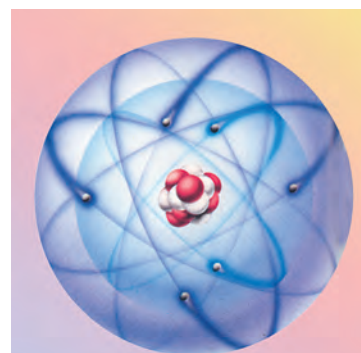


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LATEST CBSE SYLLABUS, CLASS 9 SCIENCE

(CHEMISTRY PART)

FIRST TERM

(April to September)

Matter : 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 ; Heterogeneous and homogeneous mixtures ; Colloids and suspensions

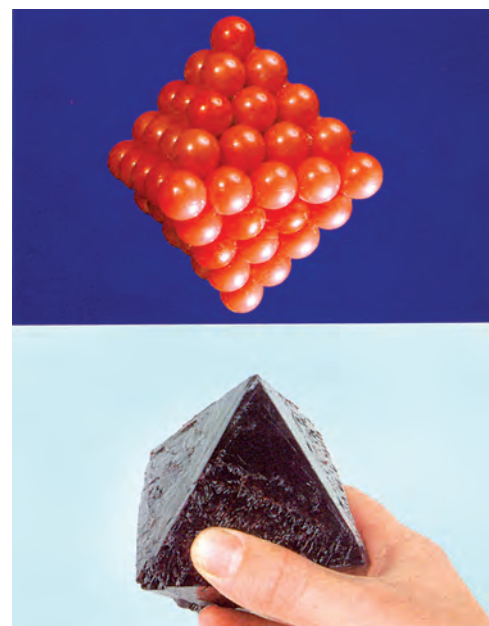
SECOND TERM

(October to March)

Particle nature, basic units : Atoms and molecules, Law of conservation of mass and law of constant proportions ; Atomic and molecular masses

Mole concept: Relationship of mole to mass of the particles and numbers ; Valency ; Chemical formulae of common compounds

Structure of atom : Electrons, protons and neutrons ; Isotopes and isobars



MATTER IN OUR SURROUNDINGS

Anything which occupies space and has mass is called **matter**. Air and water ; hydrogen and oxygen ; sugar and sand ; silver and steel ; copper and coal ; iron and wood ; ice and alcohol ; milk and oil ; kerosene and petrol ; carbon dioxide and steam ; carbon and sulphur ; rocks and minerals ; are all different kinds of matter, because all of them occupy space (that is, they have volume), and mass.

If we look around us, we can see a large number of things of different shapes, sizes and textures. Many of these things are used by us in our everyday life. For example, we eat food, drink water, breathe in air and wear clothes. We use table and chair for studying and bed for sleeping. We also see other human beings, various animals, plants, and trees around us. The things like food, water, air, clothes, table, chair, human beings, animals, plants and trees, etc., are all examples of matter.

The only conditions for 'something' to be 'matter' are that it should '*occupy space*' and '*have mass*'. Now, the things like friendship, love, affection, hatred, good manners, thoughts, ideas, taste and smell, etc., do not occupy space and do not have mass. So, from the point of view of chemistry, things like friendship, love, affection, hatred, good manners, thoughts, ideas, taste and smell are not considered 'matter' (though all these things matter a lot in our everyday life !).

Matter can be classified in a number of ways. Ancient Indian philosophers said that all the matter (*padarth*), living or non-living, was made up of five basic elements (*panch tatva*) : air, earth, fire, sky and water (*vayu, prithvi, agni, akash* and *jal*). Modern day scientists classify matter in two ways : on the basis of its **physical properties** and on the basis of its **chemical properties**. On the basis of physical properties, matter is classified as solids, liquids and gases. And on the basis of chemical properties, matter is classified as elements, compounds and mixtures. In this chapter, we will study the classification of matter on the basis of its physical properties. The classification of matter on the basis of its chemical properties will be described in the next chapter.

MATTER IS MADE OF PARTICLES

Everything around us is made of tiny pieces or *particles*. Our body is made of particles, our chair is made of particles, our table is made of particles and this book is also made of particles. The number of particles in everything is, however, very, very large. For example, a small rain drop (water drop) contains about 10^{21} particles of water in it ! The particles which make up matter are so small that we cannot see them even with a high power microscope. Even without seeing them, we have certain evidence which tells us that all the things (or all the matter) is made of tiny particles. We will now give some of the evidence which clearly shows that all the matter is made up of tiny particles. This evidence also shows that the particles which make up the matter are constantly 'moving' (they are in motion). Please note that **the particles which make up matter are atoms or molecules**.

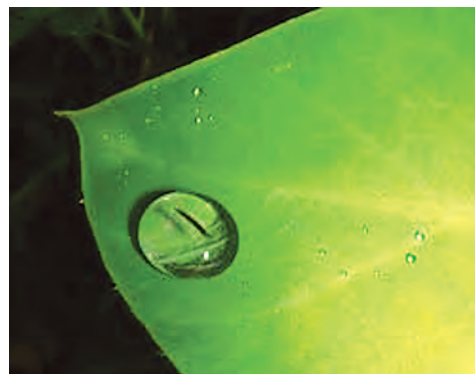


Figure 1. A small rain drop on this leaf of a plant is made up of about 1000,000,000,000,000,000,000 particles !

Evidence for Particles in Matter

Most of the evidence for the existence of particles in matter and their motion comes from the experiments on diffusion (mixing of different substances on their own), and Brownian motion. It is easy to explain 'what happens in several experiments' if we believe that matter is made up of tiny particles which are in motion. But without the concept of particles, things become very difficult to explain. We will now describe some simple experiments like 'dissolving of a solid in a liquid', 'mixing of two gases' and 'movement of pollen grains in water' which can only be explained by assuming that all matter is made up of tiny particles which are constantly moving.



Figure 2. This picture shows the diffusion of potassium permanganate in water.

1. Dissolving a Solid in a Liquid

Potassium permanganate is a purple coloured solid substance and water is a colourless liquid, so **we will first study the dissolving of potassium permanganate in water**. When a crystal of potassium permanganate is placed in a beaker of water, the water slowly turns purple on its own, even without stirring (see Figure 3). The spreading of purple colour of potassium permanganate in the whole water of beaker can be explained as follows.

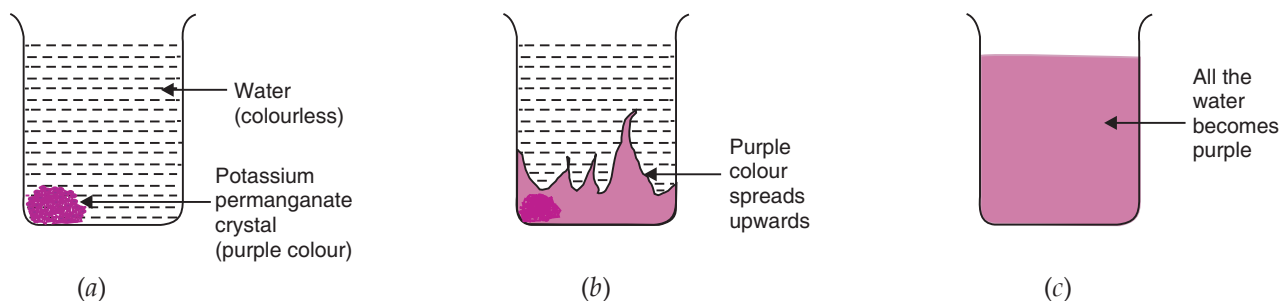


Figure 3. The colour of potassium permanganate spreads in the whole beaker of water on its own.

Both, potassium permanganate crystal and water are made up of tiny particles. The particles of potassium permanganate are purple coloured whereas the particles of water are colourless. When the potassium permanganate crystal is put in water, its particles separate from one another. These purple coloured particles of potassium permanganate spread throughout water making the whole water look purple (see Figure 4). Actually, on dissolving, the particles of potassium permanganate get into the spaces between the particles of the water.

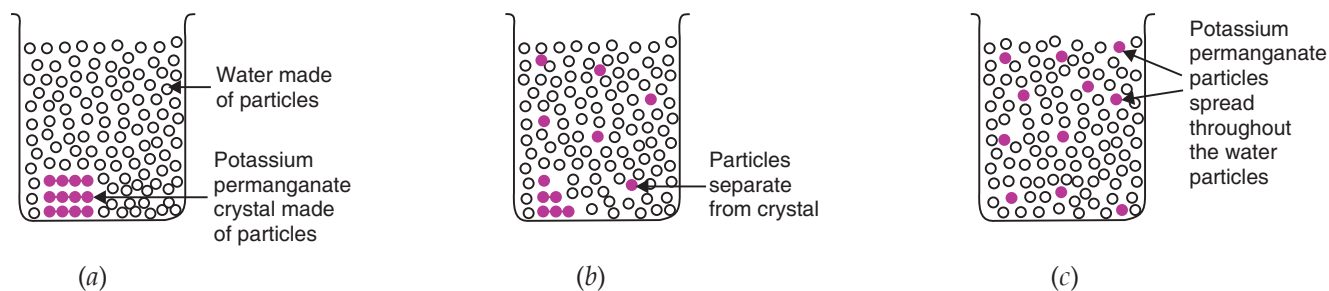


Figure 4. The particles of potassium permanganate crystal spread into the particles of water, making the whole water purple.

In this experiment, the particles of potassium permanganate and those of water mix on their own, without any external stirring. Since the particles of potassium permanganate and particles of water spread into each other and mix up on their own, it is concluded that ‘they are moving’ or ‘they are in motion’ [we can see this as the spreading of purple colour upwards in the beaker of water as shown in Figure 3(b)]. If the particles were not moving, the colour could not spread throughout the beaker on its own. This movement of different particles among each other (on their own), so that they become mixed uniformly, is called *diffusion*.

We will now discuss the case of sugar dissolving in water. When sugar is added to water and stirred, it dissolves quickly. The sugar seems to disappear. What happens to the sugar when it dissolves? Where does the sugar go? We can explain how the sugar dissolves and disappears in water by using the idea of particles.

Both sugar and water are made up of very small particles. These particles are too small to see even under a microscope. When sugar dissolves, tiny sugar particles break off from each solid sugar granule. These sugar particles go into the spaces between the particles of water, and mix with them. So, the sugar solution will taste sweet even though we cannot see the sugar in it. Please note that in this experiment we have dissolved sugar in water by ‘stirring’. This has been done just to dissolve the sugar quickly. Even if we don’t stir, sugar will dissolve in water, but quite slowly.

2. Mixing of Two Gases

Air is a colourless gas (or mixture of gases). When a gas jar is empty, it is actually filled with air. This is because since air is colourless, we cannot see it in the gas jar. Bromine is a red-brown liquid. It forms vapour easily. Bromine vapour (or bromine gas) is red-brown in colour, and it is heavier than air. Let us perform the experiment now.

A gas jar containing air is placed upside down on a gas jar of bromine vapour [see Figure 5(a)]. We will see that the red-brown vapours of bromine from the lower gas jar spread up into air in the upper gas jar. And after some time, the gas jar containing air also becomes completely red-brown in colour [see Figure 5(b)].

The spreading up of bromine vapour into air can be explained as follows: Both air and bromine vapour are made of tiny moving particles. The moving particles of bromine vapour and air collide with each other and bounce about in all directions, due to which they get mixed uniformly. This is another example of *diffusion*. Please note that though bromine vapour is heavier than air, even then it goes up (against gravity) and mixes with air in the upper jar because its particles are moving with high speeds due to which they have sufficient kinetic energy to

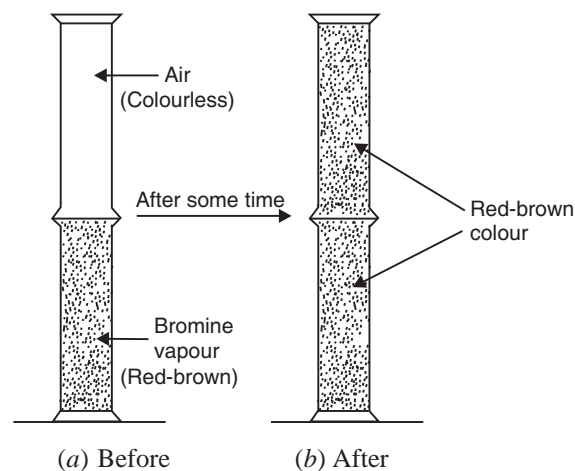
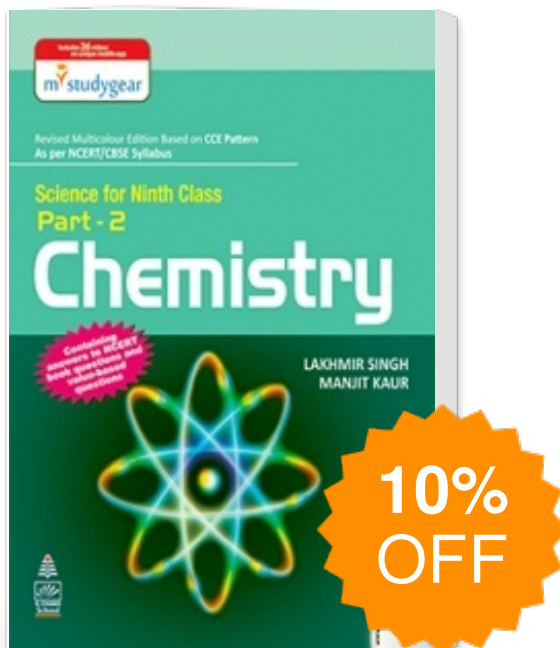


Figure 5. The diffusion of bromine vapour into air.

Science for Ninth Class Part 2 Chemistry



Publisher : SChand Publications ISBN : 9789352530267

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