GRADE 8

CISCE

UNIVERSAL SCIENCE CHEMISTRY

Comprehensive Teachers' Resource Book

C Carbon

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INTRODUCTION

CISCE Universal Science is a blended learning solution that combines a pedagogically sound and comprehensive science course with innovative teaching and learning resources and seamlessly integrates technology with the syllabus to ensure learning in a learner-friendly environment. It is an ambitious endeavour that provides the right balance between theoretical concepts and hands-on scientific activities connected to the learner's everyday life. The course encourages and facilitates the cultivation of scientific temperament in the learners through observation, experimentation and analysis.

The complete course package has been designed to be every creative teacher's dream, which empowers them to maximise learning outcomes in the class. It provides resources that enable them to bring out the best in every child. The Comprehensive Teacher's Resource Book aim to help the teacher with many ideas and suggestions that can be developed and used throughout the course. Besides the detailed teaching notes, each book contains two worksheets per chapter based on the concepts learned.

Understanding CISCE Universal Science Course

Designed in accordance with the latest CISCE syllabus, this book takes a hands-on approach to learning science through deductive approach, activities and experiments connected to the learners' everyday life. The series caters to the young minds who have a passion for exploring their surroundings and discovering the 'why' and 'how' about everything.

The laws of Science are common and constant everywhere. In that sense, Science is Universal. CISCE Universal Science is built on a strong foundation of research obtained by classroom observation of the mindset of students and their learning needs as per their current age group.

Each chapter in this series have following features:

Learning outcomes: List what the student will be able to do after studying the chapter

Activities: Strengthen learning with hands on activities.

Quick Check: In-text questions that help in quick evaluation of learning

Remember: Quick tips and tricks to help students remember the learning.

Get it right: Fixes common misconceptions, as concluded from the experience of teachers across the globe.

Enunciation: Helps the students learn the correct pronunciation of important and new words.

Extra Ordinary Minds: Establishes admiration for the contributors of the subject.

Science in Action: Information about application of the concepts in real life

Roundtable: Topics for group discussion inside the classroom

Wonderment: Adds excitement to the subject by discussing interesting facts related to the topic

Exemplar: Questions that bring about higher order of thinking

Draw and Learn: An activity that enables learners to learn by drawing a diagram

Look-Observe-Interpret: Picture based questions that refine the observation skill of learners

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Value Add: Questions and text that touch the emotions of learners and provoke them to think with empathy

Subject Bridge: Questions that help in developing the reading and writing skills

Investigate: Activities to apply the concepts learnt in the chapter

Field Visit: observe and explore the application of concepts in diverse areas in real life

Science Lexicon: Index of scientific terms at the end of the book

Understanding the CISCE Universal Science Digital Book

The digital book is an intuitive and powerful e-learning resource that combines innovative and interactive teaching material with the flexibility to introduce the teacher's own resources—providing the teacher with a perfect solution for seamless lesson planning and exciting wholeclass teaching.

It is intended for use as a teaching aid for the course. All the pages of the coursebook are converted to a digital format for whiteboard use. Unit activities are made interactive and more resources are provided to the teacher for teaching convenience.

Additional information, including answers and teaching guidelines, worksheets and exercises are also embedded to further assist the teachers. Relevant animations and captivating videos (with pause, play, stop and replay options) make it a useful resource for the teachers.

Understanding the Digital Platform

The intuitive digital interface displays a top bar with section tabs, a bottom panel with useful tools to enhance user experience and the main page or 'stage', where study material texts are displayed.

Some interesting features of digital platform are:

Animation: Audio-visual tools to aid understanding and initiate discussions

Take Off: An activity that sets the context for the topics that are to follow

Picture Study: Picture-based exercise that inculcates the power of observation and enthuses interest in learners

Lesson plans: Suggestions for teachers to deal with all aspects of a chapter

Answer Key: Answer to all questions in coursebook

Worksheets: Assignments based on the topics learned with answers

Games: 'Play-and-learn' for informal revision of concepts

IA+: Additional activities to supplement textual exercises

Walk Through: Mind map for easy recapitulation of the chapter

Scientific enquiry: Distinct activity to inculcate scientific temperament

DQZ (Dynamic question zone): Helps to generate question papers

Simulation: Simulation based learning provide an effective learning environment

Scientists Videos: Videos on life incidences of various scientists that will inspire learners

Accidental Discoveries: Animations to share interesting anecdotes of accidental discoveries

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List of resources in the digital book

Theme No	Theme Name	Asset Description	Asset Icon	Asset Placement Page	Teacher/Student
1	Matter	Lesson plan of chapter matter.	LP	1	Teacher
1	Matter	A warm up activity that introduces concepts in an interesting way or refreshes the concepts already learnt.	TO	1	Both
1	Matter	An activity on matter.	IA+	2	Both
1	Matter	Discuss about the particle nature of matter.	A	2	Both
1	Matter	Picture study on interparticle spaces in three states of matter.	PS	2	Both
1	Matter	Enunciation audio of the words fragrance and kinetic.	AD	3	Both
1	Matter	Practice questions on matter and particle nature of matter.	W	5	Teacher
1	Matter	Quick question on change in state of matter.	Q	5	Teacher
1	Matter	An activity on particle nature of matter, and change in state of matter.	IA+	6	Both
1	Matter	Define and explain the law of conservation of mass.	A	6	Both
1	Matter	Quick question on law of conservation of mass.	Q	7	Teacher
1	Matter	Practice questions on particle nature of matter, change in state of matter and law of conservation of mass.	W	7	Teacher
1	Matter	Summary of chapter matter.	WT	8	Both
1	Matter	An activity on chapter matter.	G	8	Both
1	Matter	Answer key to all worksheets of chapter matter.	AK	11	Teacher
2	Physical and Chemical Changes	Lesson plan of chapter physical and chemical changes.	LP	12	Teacher
2	Physical and Chemical Changes	A warm up activity that introduces concepts in an interesting way or refreshes the concepts already learnt.	TO	12	Both
2	Physical and Chemical Changes	An activity on types of changes: natural and man-made changes, periodic and non-periodic changes, desirable and undesirable changes, reversible and irreversible changes, slow and fast changes.	IA+	14	Both
2	Physical and Chemical Changes	Quick question on types of changes.	Q	14	Teacher
2	Physical and Chemical Changes	Practice questions on types of changes.	W	14	Teacher
2	Physical and Chemical Changes	Discuss about physical changes.	A	14	Both
2	Physical and Chemical Changes	Picture study on characteristics of a physical change.	PS	15	Both
2	Physical and Chemical Changes	Quick question on physical changes.	Q	16	Teacher
2	Physical and Chemical Changes	Enunciation audio of the word curdling.	AD	16	Both
2	Physical and Chemical Changes	Explain the characteristics of a chemical change.	A	17	Both
2	Physical and Chemical Changes	An activity on physical and chemical changes.	IA+	18	Both

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Theme No	Theme Name	Asset Description	Asset Icon	Asset Placement Page	Teacher/Student
2	Physical and Chemical Changes	Discuss the differences between physical and chemical changes.	A	18	Both
2	Physical and Chemical Changes	Practice questions on physical and chemical changes.	W	18	Teacher
2	Physical and Chemical Changes	Summary of chapter physical and chemical changes.	WT	18	Both
2	Physical and Chemical Changes	Enunciation audio of the word fermentation.	AD	18	Both
2	Physical and Chemical Changes	An activity on chapter physical and chemical changes.	G	19	Both
2	Physical and Chemical Changes	Scientific inquiry worksheet on chapter physical and chemical changes.	SI	22	Both
2	Physical and Chemical Changes	Answer key to all worksheets of chapter physical and chemical changes.	AK	22	Teacher
3	Elements, Compounds and Mixtures	Lesson plan of chapter elements, compounds and mixtures.	LP	23	Teacher
3	Elements, Compounds and Mixtures	A warm up activity that introduces concepts in an interesting way or refreshes the concepts already learnt.	TO	23	Both
3	Elements, Compounds and Mixtures	Discuss about elements, compounds and chemical symbols.	A	23	Both
3	Elements, Compounds and Mixtures	Quick question on chemical symbols of elements.	Q	24	Teacher
3	Elements, Compounds and Mixtures	An activity on elements and chemical symbols.	IA+	24	Both
3	Elements, Compounds and Mixtures	Enunciation audio of the words colloid and emulsion.	AD	26	Both
3	Elements, Compounds and Mixtures	Enunciation audio of the word winnowing.	AD	28	Both
3	Elements, Compounds and Mixtures	Practice questions on elements, compounds, mixtures, need for separation of components of a mixture: separation of solid-solid mixture.	W	29	Teacher
3	Elements, Compounds and Mixtures	Explain the various methods used to separate solid-liquid mixtures.	A	29	Both
3	Elements, Compounds and Mixtures	Enunciation audio of the word ore.	AD	29	Both
3	Elements, Compounds and Mixtures	Enunciation audio of the word supernatant.	AD	30	Both
3	Elements, Compounds and Mixtures	An activity on compounds, mixtures and need for separation of components of a mixture.	IA+	31	Both
3	Elements, Compounds and Mixtures	Discuss about centrifugation.	3D	32	Both
3	Elements, Compounds and Mixtures	Discuss the different methods used to separate liquid-liquid mixtures.	A	32	Both
3	Elements, Compounds and Mixtures	Picture study on method of separation of a liquid-liquid mixture – chromatography.	PS	33	Both
3	Elements, Compounds and Mixtures	Enunciation audio of the word asphalt.	AD	33	Both
3	Elements, Compounds and Mixtures	Quick question on separation of mixtures.	Q	34	Teacher

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Theme No	Theme Name	Asset Description	Asset Icon	Asset Placement Page	Teacher/Student
3	Elements, Compounds and Mixtures	Practice questions on need for separation of components of a mixture: separation of solid-solid mixture, separation of solid-liquid mixture, separation of liquid-liquid mixture and combination of methods for separation.	W	34	Teacher
3	Elements, Compounds and Mixtures	Summary of chapter elements, compounds and mixtures.	WT	34	Both
3	Elements, Compounds and Mixtures	An activity on chapter elements, compounds and mixtures.	G	35	Both
3	Elements, Compounds and Mixtures	Scientific inquiry worksheet on chapter elements, compounds and mixtures.	SI	38	Both
3	Elements, Compounds and Mixtures	Answer key to all worksheets of chapter elements, compounds and mixtures.	AK	38	Teacher
4	Atomic Structure	Lesson plan of chapter atomic structure.	LP	39	Teacher
4	Atomic Structure	A warm up activity that introduces concepts in an interesting way or refreshes the concepts already learnt.	TO	39	Both
4	Atomic Structure	Enunciation audio of word philosopher.	AD	39	Both
4	Atomic Structure	Discuss about atomic theory of matter.	A	40	Both
4	Atomic Structure	Quick question on discovery of sub-atomic particles.	Q	40	Teacher
4	Atomic Structure	An activity on sub-atomic particles, and atomic models.	IA+	42	Both
4	Atomic Structure	Explain Rutherford's alpha scattering experiment.	3D	42	Both
4	Atomic Structure	Enunciation audio of the word alpha.	AD	42	Both
4	Atomic Structure	Describe the Bohr's model of an atom.	A	44	Both
4	Atomic Structure	Picture study on energy shells of an atom.	PS	45	Both
4	Atomic Structure	An activity on atomic number of elements.	IA+	47	Teacher
4	Atomic Structure	Practice questions on ancient views on atomic structure, sub-atomic particles, atomic models, and atomic number and mass number.	W	47	Teacher
4	Atomic Structure	Quick question on relationship between electronic configuration and valency.	Q	51	Teacher
4	Atomic Structure	Practice questions on atomic mass, electronic configuration, isotopes, valency, and radicals.	W	51	Both
4	Atomic Structure	Summary of chapter atomic structure.	WT	52	Both
4	Atomic Structure	An activity on chapter atomic structure.	G	52	Teacher
4	Atomic Structure	Answer key to all worksheets of chapter atomic structure.	AK	56	Teacher
5	Language of Chemistry	Lesson plan of chapter language of chemistry.	LP	57	Both
5	Language of Chemistry	A warm up activity that introduces concepts in an interesting way or refreshes the concepts already learnt.	TO	57	Teacher
5	Language of Chemistry	Quick question on symbols of elements.	Q	57	Both
5	Language of Chemistry	An activity on symbols of elements.	IA+	58	Both
5	Language of Chemistry	Discuss about the formation of ions, valency and the rules for writing a formulae.	A	60	Teacher
5	Language of Chemistry	Quick question on difference between oxygen and oxide.	Q	60	Teacher
5	Language of Chemistry	Practice questions on symbols of elements, valency, valency of ions and radical.	W	61	Both

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Theme No	Theme Name	Asset Description	Asset Icon	Asset Placement Page	Teacher/Student
5	Language of Chemistry	Explain balancing of a chemical equation with examples	A	65	Both
5	Language of Chemistry	Explain balancing of a chemical equation with examples	PD	65	Both
5	Language of Chemistry	Enunciation audio of the word coefficient.	AD	65	Both
5	Language of Chemistry	An activity on valency, valency of ions, chemical formulae, and chemical equations.	IA+	71	Teacher
5	Language of Chemistry	Practice questions on chemical formulae, chemical reactions, and chemical equations.	W	71	Both
5	Language of Chemistry	Summary of chapter language of chemistry.	WT	71	Both
5	Language of Chemistry	An activity on chapter language of chemistry.	G	72	Teacher
5	Language of Chemistry	Answer key to all worksheets of chapter language of chemistry.	AK	74	Teacher
6	Chemical Reactions	Lesson plan of chapter chemical reactions.	LP	75	Both
6	Chemical Reactions	A warm up activity that introduces concepts in an interesting way or refreshes the concepts already learnt.	TO	75	Both
6	Chemical Reactions	Explain the synthesis reaction of water.	A	76	Teacher
6	Chemical Reactions	Quick question on combination reaction.	Q	76	Both
6	Chemical Reactions	Enunciation audio of the word synthesis.	AD	76	Both
6	Chemical Reactions	Explain decomposition reactions with examples.	A	77	Both
6	Chemical Reactions	Enunciation audio of the word amphoteric.	AD	79	Teacher
6	Chemical Reactions	Quick question on types of oxides: amphoteric oxide and basic oxide.	Q	80	Both
6	Chemical Reactions	An activity on introduction of chemical reactions and types of chemical reactions.	IA+	80	Teacher
6	Chemical Reactions	Practice questions on chemical reactions, types of chemical reactions: combination reaction and decomposition reaction.	W	80	Both
6	Chemical Reactions	An activity on displacement reactions: reactivity series of metals.	IA+	81	Both
6	Chemical Reactions	Explain double decomposition reaction using an experiment.	A	82	Teacher
6	Chemical Reactions	Quick question on neutralisation reaction.	Q	82	Both
6	Chemical Reactions	Picture study on exothermic change.	PS	83	Teacher
6	Chemical Reactions	Practice questions on types of chemical reactions: displacement reaction, double decomposition reaction, exothermic and endothermic reactions, oxidation reactions and reduction reactions.	W	85	Both
6	Chemical Reactions	Summary of chapter chemical reactions.	WT	85	Both
6	Chemical Reactions	An activity on chapter chemical reactions.	G	85	Both
6	Chemical Reactions	Scientific inquiry worksheet on chapter chemical reactions.	SI	88	Teacher
6	Chemical Reactions	Answer key to all worksheets of chapter chemical reactions.	AK	88	Teacher
7	Hydrogen	Lesson plan of chapter hydrogen.	LP	89	Both
7	Hydrogen	A warm up activity that introduces concepts in an interesting way or refreshes the concepts already learnt.	TO	89	Both

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Theme No	Theme Name	Asset Description	Asset Icon	Asset Placement Page	Teacher/Student
7	Hydrogen	An activity on introduction on hydrogen, discovery of hydrogen, occurrence of hydrogen and hydrogen and metal reactivity series.	IA+	91	Both
7	Hydrogen	Enunciation audio of the word electrolysis.	AD	91	Both
7	Hydrogen	Discuss about preparation of hydrogen by electrolysis of acidulated water.	A	92	Both
7	Hydrogen	Discuss about electrolysis of water.	V	92	Both
7	Hydrogen	Picture study on electrolysis of water.	PS	92	Teacher
7	Hydrogen	Practice questions on discovery of hydrogen, occurence of hydrogen, hydrogen and metal reactivity series and preparation of hydrogen: preparation of hydrogen from water, preparation of hydrogen from acids, preparation of hydrogen from alkalis, and preparation of hydrogen in the laboratory.	W	94	Both
7	Hydrogen	Explain the production of ammonia by Haber-Bosch process.	A	98	Teacher
7	Hydrogen	Quick question on reaction of hydrogen with moist litmus paper.	Q	98	Teacher
7	Hydrogen	Quick question on hydrogen as reducing agent.	Q	99	Both
7	Hydrogen	An activity on preparation of hydrogen, chemical properties of hydrogen, oxidation and reduction reactions, and test for hydrogen.	IA+	100	Teacher
7	Hydrogen	Practice question on preparation of hydrogen: preparation of hydrogen by bosch's process, physical properties of hydrogen, chemical properties of hydrogen, oxidation and reduction reactions, test for hydrogen and uses of hydrogen.	W	101	Both
7	Hydrogen	Summary of chapter hydrogen.	WT	101	Both
7	Hydrogen	An activity on chapter hydrogen.	G	101	Both
7	Hydrogen	Enunciation audio of the word meteorology.	AD	101	Both
7	Hydrogen	Scientific inquiry worksheet on chapter hydrogen.	SI	105	Teacher
7	Hydrogen	Answer key to all worksheets of chapter hydrogen.	AK	106	Teacher
8	Water	Lesson plan of chapter water.	LP	107	Both
8	Water	A warm up activity that introduces concepts in an interesting way or refreshes the concepts already learnt.	TO	107	Both
8	Water	Enunciation audio of the word regelation.	AD	108	Both
8	Water	Discuss the reaction of water with sodium.	A	109	Teacher
8	Water	Practice question on introduction and properties of water.	W	110	Both
8	Water	Picture study on solution.	PS	113	Both
8	Water	An activity on introduction, properties of water, and water – a universal solvent.	IA+	114	Teacher
8	Water	Quick question on hygroscopic substances.	Q	115	Both
8	Water	Discuss about hard water, soft water and the disadvantages of hard water.	A	115	Both
8	Water	Enunciation audio of the word hygroscopic	AD	115	Teacher
8	Water	Quick question on hardness of water.	Q	116	Both
8	Water	Enunciation audio of the word scum.	AD	116	Both

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Theme No	Theme Name	Asset Description	Asset Icon	Asset Placement Page	Teacher/Student
8	Water	An activity on water of crystallisation, and hard and soft water.	IA+	117	Teacher
8	Water	Practice question on water - a universal solvent, suspensions, colloids, solutions, water of crystallisation, and hard and soft water.	W	117	Both
8	Water	Summary of chapter water.	WT	118	Both
8	Water	An activity on chapter water.	G	119	Both
8	Water	Scientific inquiry worksheet on chapter water.	SI	121	Teacher
8	Water	Answer key to all worksheets of chapter water.	AK	121	Teacher
9	Carbon and Its Compounds	Lesson plan of chapter carbon and its compounds.	LP	122	Both
9	Carbon and Its Compounds	A warm up activity that introduces concepts in an interesting way or refreshes the concepts already learnt.	TO	122	Teacher
9	Carbon and Its Compounds	Quick question on diamond.	Q	124	Both
9	Carbon and Its Compounds	Enunciation audio of the word allotropy.	AD	124	Both
9	Carbon and Its Compounds	An activity on introduction, allotropy, crystalline forms of carbon: diamond.	IA+	125	Both
9	Carbon and Its Compounds	Enunciation audio of the word fullerene.	AD	129	Both
9	Carbon and Its Compounds	Enunciation audio of the word anthracite.	AD	130	Both
9	Carbon and Its Compounds	Explain destructive distillation of coal using an activity	A	131	Teacher
9	Carbon and Its Compounds	Practice question on introduction, allotropy, crystalline forms of carbon, and amorphous forms of carbon.	W	134	Both
9	Carbon and Its Compounds	Discuss about fire extinguishers.	PD	141	Both
9	Carbon and Its Compounds	Explain the construction, principle and working of soda-acid fire extinguisher.	A	141	Both
9	Carbon and Its Compounds	Picture study on soda-acid fire extinguisher.	PS	141	Teacher
9	Carbon and Its Compounds	Quick question on carbon monoxide poisoning.	Q	145	Both
9	Carbon and Its Compounds	An activity on crystalline forms of carbon: graphite, amorphous forms of carbon: coal, carbon dioxide and carbon monoxide.	IA+	145	Teacher
9	Carbon and Its Compounds	Practice questions on carbon dioxide, greenhouse effect and global warming, and carbon monoxide.	W	146	Both
9	Carbon and Its Compounds	Summary of chapter carbon and its compounds.	WT	146	Both
9	Carbon and Its Compounds	An activity on chapter carbon and its compounds.	G	146	Both
9	Carbon and Its Compounds	Scientific inquiry worksheet on chapter carbon and its compounds.	SI	149	Both
9	Carbon and Its Compounds	Scientific inquiry worksheet on chapter carbon and its compounds.	SI	149	Teacher
9	Carbon and Its Compounds	Answer key to all worksheets of chapter carbon and its compounds.	AK	149	

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Allocation of Periods per Lesson

On an average, a lesson may be completed in about 9 periods of 35–40 minutes each.

Chapter No.	Chapter Name	No. of Periods
1	Matter	6
2	Physical and Chemical Changes	5
3	Elements, Compounds and Mixtures	9
4	Atomic Structure	9
5	Language of Chemistry	10
6	Chemical Reactions	9
7	Hydrogen	9
8	Water	8
9	Carbon and Its Compounds	16
Total No. of Periods		81

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2. Worksheets..... 45

3. Answer key of Coursebook..... 89

4. Answer key of Worksheets..... 127

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Lesson Plans

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Theme 1 Matter

Period	Materials required	Questions to be raised	Important topics and activities to be covered	Integrated life skills	Assessment
Period 1	• Model for inter particular space • Beaker, water, $KMNO_4$ crystals, Bunsen burner	• What is matter? • List the three states of matter and their characteristic. • Describe the particle nature of matter. • What is diffusion? • What is the effect of temperature on the kinetic energy of the particles?	• Using think pair share strategy the teacher can ask the students to identify the meaning of the term matter and list the three states of matter. • Discuss the general characteristics of the three states of matter. • Discuss that matter is made up of tiny particles. • Using the fig 1.1 in the text book or a model representing the same, discuss the inter particular space in solids, liquids and gases. • Conduct the following activity: take a beaker with 200 ml water, add a few crystals of potassium permanganate to the water, ask the students to make a note of the observation seen. Heat the beaker on the Bunsen burner and observe the changes in the solution. • Using the above activity, the teacher can discuss: space between particles, the constant movement of particles, concept of diffusion and the effect of temperature on the kinetic energy of the particles.	Collaboration, scientific skills and literacy, communication	Can use the draw and learn question from the exercise for discussion.

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			• The teacher can emphasise that kinetic energy is directly proportional to the temperature of the matter.		
Period 2	Coin, water and dropper	• How can we say that the particles of matter attract each other? • State the postulates of the kinetic theory of matter. • Distinguish between solids, liquids and gases based on: a. Inter particular space b. Inter particular attraction and c. Kinetic energy of particles.	• The teacher can conduct the following demonstration: take a coin and using a dropper, place a drop of water on the coin as seen in the image below: Now slowly place another drop of water on the coin, the water droplets stick to each other and do not fall off the coin. The teacher can ask the students to reason with this observation. • The teacher can discuss the attraction between particles of matter. Discuss other examples as given in the text book. • Using discussion method, the teacher can create a mind map/concept map of the postulates of the kinetic theory. • The teacher can use think pair share strategy to compare the three states of matter based on: inter particular space, inter particular attraction and the kinetic energy of the particles.	Communication, scientific skills and literacy, collaboration	Can Discuss the Quick Check 1 questions.

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Period 3	Particle models of liquids, solids and gases	• Describe the change in state due to change in temperature. • Describe the change in state due to change in pressure. • Define the following terms: melting, melting point, boiling, boiling point.	• The teacher can discuss the interconversion of states of matter, from solid, liquid and gases. • Using models of liquids, solids and gases – particle models, the teacher can discuss the what happens to the particles of matter as temperature increases and decreases. • The teacher can discuss the meaning of the terms melting, melting point, boiling and boiling point. • The teacher can discuss the effect of change in pressure on the change in state using various examples.	Critical thinking and communication	Ask the students to write down the effect of change in temperature and pressure on the change in the state of matter.
Period 4	• Materials required for activity 1 and 2 as given in the textbook	• State and explain the law of conservation of mass.	• Discuss Extraordinary minds given in the textbook. • Conduct Activity 1 and activity 2 as given in the textbook. • While conducting the activity, the teacher can help the students deduce the law of conservation of mass. • The teacher can ask students to site other examples where the law of conservation of mass can be seen. • Discuss the question given in the Round table section of the textbook.	Scientific skills and Literacy skills, communication, critical thinking	Discuss the questions in Quick Check 2.
Period 5	Discuss Exercise: Objective questions and Subjective questions				
Period 6	Discuss Exercise: Exemplar problems, Draw and learn, Look-Observe-Interpret, Value add, Subject Bridge, Investigate and Field visit				

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Theme 2 Physical and Chemical Changes

Period	Materials required	Questions to be raised	Important topics and activities to be covered	Integrated life skills	Assessment
Period 1		• Explain and give examples for the following types of changes: a. Natural and Manmade changes b. Periodic and non-periodic changes c. Desirable and undesirable changes d. Reversible and Irreversible changes e. Slow and fast changes f. Exothermic and endothermic changes	• The teacher can divide the class into 6 groups. Each group can be given one of the following topics, the groups can be given 15 minutes to discuss the changes given to the group, along with coming up with at least three examples for each types of change. The groups are as follows: a. Natural and Manmade changes b. Periodic and non-periodic changes c. Desirable and undesirable change d. Reversible and Irreversible changes e. Slow and fast changes f. Exothermic and endothermic changes • The teacher can ask the students to present their findings to the class.	Character building, collaboration, communication	Can discuss Quick Check 1 and Draw and Learn.

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Period 2	Material required for activity 1 as given in the text book, Iodine crystals and apparatus for sublimation	• What is a Physical Change? • State the characteristic of a physical change? • Give examples of physical changes. • What is sublimation? • What is evaporation?	• Teacher can discuss the meaning of the term Physical change. • Teacher can conduct the Activity 1 as given in the textbook, while performing the activity the teacher can discuss the characteristics of a physical change. Also discuss how evaporation is also an example of a physical change. • The teacher can also conduct the sublimation of iodine crystals to discuss how sublimation is also an example of a physical change and the characteristics of physical changes are discussed.	Critical thinking, scientific skills and literacy	Can discuss Look-Observe-Interpret.
Period 3	Milk, lime juice, match box, paper	• What is a chemical change? • State the characteristic of a chemical change. • Give examples of a chemical change. • Distinguish between a physical and a chemical change.	• The teacher can discuss the meaning of the term Chemical change. • The teacher can conduct the following demonstration: take 10 ml milk in a beaker, add a few drops of lemon juice, ask the students to make a note of the observation. While conducting the demonstration the teacher can discuss the characteristics of a chemical change.	Scientific skills and literacy, communication and critical thinking	Can discuss Quick Check 2.

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			• The teacher can also conduct another demonstration – take a piece of paper and burn it to demonstrate the characteristics of a chemical change. • Discuss the various other examples of chemical changes. • Using think pair share strategy the teacher can ask the students to list the distinguishing points between physical and chemical changes.		
Period 4	• Discuss Exercise: Objective and Subjective questions				
Period 5	• Discuss Exercise: Exemplar Problems, Draw and Learn, Look-Observe-Interpret, Value add, Subject Bridge, Investigate and Field visit				

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Theme 3 Elements, Compounds and Mixtures

Period	Materials required	Questions to be raised	Important topics and activities to be covered	Integrated life skills	Assessment
Period 1	Pluck cards with element names on it	• What is an element? • What are elements classified as? • What is the chemical symbol of the given element?	• Discuss the meaning of the term elements. • Discuss the various examples of elements using the image of the modern periodic table. • Divide the class into groups, each group should be given pluck cards with names of elements written on them. Ask the students to arrange the elements in four groups-metals, non-metals, metalloids and noble gases. Give the students 5 minutes to do so and then ask the students to share their results with the class. • Discuss the information given in wonderment and extra ordinary minds of the text book. • Using the information given in Table 3.1 discuss the chemical symbols of some common elements Ask the students to create a quiz or a jigsaw puzzle using the same.	Communication, Collaboration	Ask the students to solve the quiz/jigsaw puzzle created on symbols of elements by their friends.

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Period 2	Models of oxygen hydrogen and water, beaker, water, CuSO4, mud, milk, stirrer	• What is a compound? • State the properties of a compound? • What is a mixture? • Distinguish between: a. Heterogeneous and homogeneous mixture b. Suspension and emulsion	• Discuss the meaning of the term compound. • Using the model of oxygen atoms, hydrogen atoms and water molecule discuss the formation of water as a molecule of a compound. Discuss the properties of compounds and how they differ from that of the elements. • Discuss the meaning of the term mixtures. • Conduct the following demonstration: in a beaker fill 100ml of water add a few crystals of $CuSO_4$. Stir the solution for the crystals to dissolve, ask the students to make a note of the observation, in another beaker add 100 ml and a spoon of mud stir the mixture and ask the students to observe the change. Use this demonstration to explain the meaning of homogeneous and heterogeneous mixtures with citing other examples. • Use the mixture of mud in water to further explain suspension as a type of heterogeneous mixture.	Scientific skills and literacy, communication	Can Discuss Quick Check 1.

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			• Use an example of milk to explain emulsion. • Discuss the Get it right section.		
Period 3	Pieces of chalk, sieve, wheat flour, pieces of paper and tissue	• Why is it important to separate the components of a mixture? • Explain the following methods of separation: a. Handpicking b. Sieving c. Winnowing	• Discuss the need to separate the components of a mixture. • Discuss the basis on which mixtures are separated. • Conduct the following demonstration to understand the separation technique of handpicking: Ask a student volunteer to separate the pieces of chalk based on their colour, then ask another volunteer to separate the pieces of chalk based on size. Use this to explain the principle of separation of handpicking and cite examples of this method in use in daily life. • Demonstration 2: ask a student to sieve a small amount of wheat flour, ask the students to make a note of the observation and deduce the principle of separation. Cite examples of using this method(sieving).	Scientific skills and literacy, critical thinking	Use the 3-2-1 strategy 3-things I learnt today. 2-examples of mixtures that can be separated using the methods studied today. 1-question I still have on this topic.

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			• Demonstration 3: Ask a student volunteer to hold small round balls of paper in his/her hand along with small open thin pieces of tissue. Using the winnowing action ask the student to drop the pieces of paper and tissue on the floor from a height. Make a note of the observation and deduce the principle of separation.		
Period 4	Iron fillings, sand, magnet, common salt, stirrer, water, iodine, sublimation setup	Explain the following methods of separation: a. Magnetic separation b. Solvent extraction c. Sublimation	• Demonstration 1: take a mixture of ion fillings and sand in a crucible. Ask a student volunteer to use a magnet to separate the iron fillings from the mixture. Discuss the method of magnetic separation and principle of separation. • Demonstration 2: take a mixture of common salt and sand in a beaker, ask a student volunteer to add 50 ml of water in the beaker, stir the mixture, discuss how solvent extraction can be used a method of separation. Discuss how one can separate the components.	Scientific skills and literacy, communication and critical thinking	Discuss Quick check 2 questions.

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			Use decantation to separate the salt solution from the sand, use evaporation to show the salt separated from the solution. • Use the set for sublimation to separate a mixture of iodine from sand, discuss the principle of separation.		
Period 5	Material required as per activity 1 in the text book	Explain the following methods of separation: a. Sedimentation – decantation b. Filtration c. Evaporation and d. Condensation	• Use think pair share strategy to recall the methods of separation studied in the previous lectures. • Conduct the activity 1 as given in the textbook, while conducting the activity allow the liquid to stand still for some time, use the process of sedimentation and decantation to separate the initially settled sand. • Explain the term supernatant liquid. This activity can be used to explain the process of filtration, evaporation and condensation. • Cite examples of these methods used in our daily life.	Scientific skills and literacy, communication and critical thinking	Discuss Look-Observe-Interpret.

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Period 6	Set up for distillation, centrifuge and sample of milk	• Explain the following methods of separation: a. Distillation, b. Froth floatation, c. Centrifugation	• Demonstration 1: Set up the apparatus to show the distillation of water. • Discuss the different components and state their function. • Deduce the principle of separation. • Show the students a video on froth floatation to separate sulphide ores. Discuss the principle of separation. • Show the students the centrifuge machine and use a sample of milk in the centrifuge to separate its components, discuss the principle of separation and use of this method in our daily life. • Discuss the Science in Action.	Scientific skills, communication	Discuss Draw and Learn.
Period 7	Oil, water, separating funnel, set up for chromatography	• Explain the following methods of separation: a. Separating funnel b. Fractional distillation c. Chromatography • Name different methods that can be used to separate the given mixture.	• Demonstration 1: Take a sample of an oil and water mixture and pour it in a separating funnel, separate the components, discuss the principle of separation and use of this method in our daily life. • Show the set up required for fractional distillation, explain the use of the fractionating column and deduce	Collaboration and communication	Ask the students to create a mind map for the list of methods done in class for the day.

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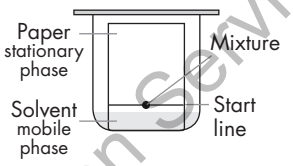
			the principle of separation, if the setup is not available then show the video on the fractional distillation. • Demonstration: Take a filter paper, draw the base line with pencil, place a drop of ink on the base line and place the filter paper in a beaker with a small amount of water, as shown in the figure below:  • Allow the mixture to stand for some time, the components of the ink canseparate an form a chromatogram. • Discuss the principle of separation and the use of this method in our daily life. • Use the Round table question to discuss the combination of methods of separation for a given mixture.		
Period 8	Discuss Exercise: Objective and Subjective questions				
Period 9	Discuss Exercise: Exemplar, Draw and Learn, Value Add, Look-Observe-Interpret, Subject bridge, Investigate and Field visit				

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Theme 4 Atomic Structure

Period	Materials required	Questions to be raised	Important topics and activities to be covered	Integrated life skills	Assessment
Period 1		• What was the atomic theory proposed by Maharishi Kanada? • Discuss the Atomic theory proposed by Democritus. • State the postulates of Dalton's atomic theory.	• Start the lesson using the K-W-L chart: What I already Know, What I Want to learn and what I Learnt at the end of the lecture. • Discuss the atomic theory proposed by Maharishi Kanada. • Discuss how Democritus coined the term 'atomos'. • Using pictographic representation discuss the postulates of Dalton's atomic theory and create a mind map based on the same.	Communication	Can ask the students to discuss what they learnt during the lecture using the K-W-L chart.
Period 2		• Describe the experiment used to discover the a. Electrons b. Protons c. Nucleus • State the Atomic model as proposed by Thomson.	• Use think pair share strategy, to discuss the different sub atomic particles present in the atom. • Discuss the discovery of the electron, use an image/video for the same. • Discuss the discovery of the proton using a pictographic representation. • Discuss the Atomic model proposed by Thomson.	Critical thinking	Can discuss Look-Observe-Interpret.

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			• Discuss Rutherford's Discovery of the nucleus. • Can provide the said video or images to the students prior to the lecture, use the flip classroom method to discuss questions to the discovery of the electrons, protons and nucleus.		
Period 3		• Describe the atomic model as proposed by Rutherford. • How was the neutron discovered? • State the postulates of Bohr's atomic model. • Discuss the postulates of the modern atomic model. • Distinguish between a proton, neutron and an electron.	• Start with the discussion of the points mentioned in Remember and Get it right sections. • Discuss the Atomic model as proposed by Rutherford. • Discuss the discovery of the neutron. • Discuss the postulates of Bohr's atomic model. Discuss information mentioned in Extraordinary minds. • Using table 4.1 discuss the modern atomic model. Use pictographic representations for the same.	Communication and character building	Using the fish bone method, ask the students to create a pictographic representation of the evolution of the atomic model.
Period 4	• The material required to conduct activity 1	• What is an atomic number? • Define atomic mass number. • Calculate the atomic number and mass number.	• Using a model of Oxygen atom, ask the students to count the number of electrons, protons and neutrons in the atom.	Collaboration and critical thinking	Can discuss Quick check 2 and 3.

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		Make an atomic model for each of the first 20 elements of the periodic table.	• Use this to explain the meaning of the terms atomic number and Atomic mass number, introduce the students to formulae involved in the calculation of atomic number and atomic mass number. • Discuss the questions in the round table. • Using the information present in table 4.2 conduct the activity 1. The teacher can divide the class into groups and give the groups different atoms to create. The models can be put on display in the class.		
Period 5	• NA	• What is atomic mass? • Distinguish between atomic mass and atomic mass number. • Define electronic configuration. • Write the electronic configuration of the first 20 elements of the periodic table.	• Discuss the meaning of the term atomic mass. • Discuss the difference between atomic mass and atomic mass number. • Discuss the meaning of the term electronic configuration and using the template of table 4.4 ask the students to create a similar table for the first 20 elements of the periodic table.	Critical thinking and communication	Discuss Exemplar questions 1 and 2.
Period 6	Models of the isotopes of hydrogen	• What is an isotope? • Define the term valency.	• Discuss the meaning of the term Isotopes, using models of the three isotopes of hydrogen. Discuss the difference in the subatomic particles.	Critical thinking	Ask the students to create a table with the valency for the first

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		• How is the valency of an element related to its electronic configuration? • Write the valency of some metals and non-metals.	• Discuss the meaning of the term valency, relate the term valency to the electronic configuration of the first 20 elements. • Discuss how metals have a positive valency while nonmetals have a negative, refer to the equations as mentioned in the textbook.		20 elements of the periodic table.
Period 7	Quiz/puzzle on electronic configuration and valency and radicals	• What is a radical? • State the valency and charge of some common radicals.	• Discuss the meaning of the term Radical. Give examples of monoatomic and polyatomic radicals. • Using the data given in table 4.6 create a jigsaw puzzle or a quiz for the students to solve. Ask the students to solve the quiz or puzzle in pairs. • Create a similar puzzle or quiz using the data mentioned in table 4.4 ask the students to practice and solve the same.	Critical thinking and communication	Can discuss the answers of the quiz solved
Period 8	Discuss Exercise: Objective and Subjective questions				
Period 9	Discuss Exercise: Exemplar problems, Draw and learn, Look-Observe Interpret, Value add, Subject Bridge, Investigate and Field visit				

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Theme 5 Language of Chemistry

Period	Materials required	Questions to be raised	Important topics and activities to be covered	Integrated life skills	Assessment
Period 1	Puzzles/flash cards/quiz on symbols	• What is a symbol? • What information can you gather from the symbol of an element? • Identify the element from its symbol.	• Discuss the meaning of the term symbol of an element. • Discuss the significance of a symbol of an element. • Using the symbols given in table 5.1, 5.2 and 5.3 create flash cards, puzzles or quiz for the students to solve. • Ask the students to identify some of the elements using their symbols from the periodic table.	Communication	Ask the students to write the symbols of some common elements.
Period 2	Quiz/puzzle on valency	• Define valency. • What is meant by combining capacity? • What are valence electrons? • When do atoms show variable valency? • Explain monovalent, divalent, trivalent and tetravalent atoms.	• Discuss the meaning of the term valency. • Explain the concept of combining capacity of an element with regards to Hydrogen. • Explain the concept of valence electrons. • Discuss the concept of valency with respect to valence electrons. • Discuss the concept of monovalent, divalent, trivalent and tetravalent atoms with examples. • Discuss the concept of variable valency. • Using the data in table 5.4 and 5.5 create a quiz/puzzle for the students to solve.	Critical thinking	Solve the quiz on valency.

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Period 3		• Define an ion. • Differentiate between cation and anion. • What is a radical? • Write the symbols for the given ions and radicals.	• Discuss the meaning of the term ion. Show examples of different ions. • Explain the terms cation and anion with different examples. • Explain the meaning of the term radical. • Using the information given in table 5.6 and 5.7 ask the students to work in groups and create a quiz/puzzles/ tables to identify the ion with their symbol. • Discuss the information given in the wonderment section.	Communication	Ask the students to solve the quiz/ puzzle created by the other groups.
Period 4		• What is a chemical formula? • State the steps involved in writing a chemical formula. • Write the chemical formula of some common compounds.	• Discuss the meaning of the term chemical formula. • Outline the steps involved in the writing of a chemical formula. • Practice the writing of the chemical formula of some common compounds, such as water, sodium chloride, potassium sulphide, potassium sulphate, carbon dioxide, aluminum nitride.	Critical thinking, Scientific literacy	Can discuss quick check 1.
Period 5		• What is a chemical reaction? • How can you represent the change taking place using a chemical equation?	• Discuss the properties of a chemical change and the meaning of the term chemical reaction. • Using pictographic representation for a chemical reaction between carbon and oxygen to form carbon dioxide explain the meaning of the term reactant and product.	Critical thinking and communication	Ask the students to share their learning with the class.

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		• State and explain the law of conservation of mass.	• Write the word equation of the reaction and then following by the chemical equation. • Using the same example explain the law of conservation of mass. • Repeat the above steps for the chemical reaction of hydrogen reacting with oxygen to form water. Ask student volunteers to help with identifying the reactant, product, writing the word equation and the chemical equation. • Discuss the data given in extra ordinary minds.		
Period 6	• NA	• What are the steps involved in writing a balanced chemical equation? • What is a co-efficient? • Write balanced chemical equations for the given reactions.	• Discuss the steps followed while writing a chemical equation. • Discuss the steps followed while writing a balanced chemical equation. • Explain the meaning of the term co-efficient. • Solve Example 1 and 2 as an entire class.	Scientific literacy	Can solve quick check 2 a and b.
Period 7		• Write balanced chemical equations for the given reactions. • State the significance of a chemical equation.	• Recapitulate the concept done in the previous class. • Solve Example 3 and 4 from the text book as an entire class.	Scientific literacy	Can solve Quick check 2 (remaining questions).

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			• Discuss the significance of writing a chemical equation practice all balanced chemical equations given in the textbook under the section – limitations of a chemical equation.		
Period 8	Material required for activity 1	• State the various limitation of a chemical equation.	• Perform activity 1 using student volunteers. Discuss and write the chemical equation for the reaction Discuss how the nature of the reactant is responsible for the rate of the reaction. • Discuss the other limitations of a chemical equation with regards to physical state, temperature, light electricity, pressure, catalyst, reversibility and energy change. • Discuss the points in Remember, get it right and science in action.	Critical thinking	Ask the students to create a mind map for the concept done.
Period 9	Discuss Exercise: Objective and Subjective questions				
Period 10	Discuss Exercise: Exemplar problems, Draw and learn, Value add, Subject Bridge, Look-Observe-Interpret, Investigate and Field visit				

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Theme 6 Chemical Reactions

Period	Materials required	Questions to be raised	Important topics and activities to be covered	Integrated life skills	Assessment
Period 1	Material listed for activity 1	• What is a chemical reaction? • Identify the reactant and the product of the given equation. • List the conditions required for a chemical reaction to take place. • Define combination reactions. Give examples for the same. • Write balanced chemical equations for the chemical reactions.	• Using Think pair strategy ask the students to list down their understanding of the term chemical reaction and then share it with the class. • Conduct Activity 1, ask the students to note down the observations. Ask the students to first identify the reactants and the products formed. Then, ask the students to write the word equation for the reaction followed by the balanced chemical equation. • Using the results from the above demonstration also deduce the conditions necessary for a chemical reaction to take place. • Deduce the general reaction for a combination reaction and discuss why they are also called synthesis reaction. • Practice the writing of all equations given under combination reaction in the textbook.	Scientific skills, collaboration	Discuss Subjective Questions 1 and 3c.

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Period 2	Lead nitrate crystals, test tube, Bunsen burner	• What is a decomposition reaction? • Define: Thermal decomposition and Electrolytic decomposition. • Write balanced chemical equations for the given chemical reactions.	• Demonstration: take a few crystals of lead nitrate in a dry test tube, gently heat the test tube, ask the students to make a note of the observation. The products formed as lead oxide, nitrogen dioxide and oxygen gas. Ask the students to write the word equation followed by a balanced chemical equation. • Introduce the general equation for a decomposition reaction. • Explain the meaning of thermal decomposition. • Show a video for the electrolytic decomposition for acidified water. • Explain the meaning of electrolytic decomposition. • Practice all the equations given in the textbook under the topics done in class.	Scientific skills and literacy and communication	Discuss subjective questions 2 and 3a.
Period 3	Silver nitrate crystals, test tube	• Define photochemical reaction. • What is an oxide? • Write balanced chemical equations for the given reactions.	• Discuss information given in extra ordinary minds. • Discuss question given in round table section. • Demonstration: keep a few crystals of silver nitrate exposed to the sunlight, a	Communication and Scientific skills	Discuss Subjective Question 3b.

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			reddish-brown gas is given out, ask the students to make a note of the observation, write the word equation and the balanced chemical equation for the reaction. • Explain the meaning of photochemical decomposition. • Discuss the meaning of the term oxide. • Practice all the balanced chemical equations given in the textbook for the topics done in the class. • Discuss science in action.		
Period 4	Straw, test tube with water, blue litmus paper, calcium oxide, test tube with water, blue litmus paper	• Explain a) acidic oxides b) basic oxide and c) amphoteric oxides. • Write balanced chemical equations for the given reactions.	• Demonstration 1: blow some air into a test tube of water. (This will take some time) test the water with a blue litmus paper. Make a note of the observations. Use this demonstration to introduce acidic oxides, practice all the balanced chemical equations given in the text book. • Demonstration 2: Add a few crystals of calcium oxide in water, test the solution with a red litmus paper make a note of the observations.	Scientific skills and literacy	Discuss subjective questions 4 and 7 and quick check 1.

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			Use this demonstration to introduce basic oxides, practice all the balanced chemical equations given in the text book. • Discuss the meaning of amphoteric oxides. practice all the balanced chemical equations given in the text book.		
Period 5	Zinc granule, dil HCl, burning splinter, copper sulphate solution, dil NaOH solution	• Define displacement reaction. • Define double decomposition. • Define precipitation reaction. • What is a precipitate? • Write balanced chemical equations for the given chemical reactions.	• Discuss the data given in wonderment. • Demonstration 1: place a small piece of zinc in dil. HCl, make a note of the observations, test the gas using a burning splinter. Write the word equation followed by the balanced chemical equation for the reaction. • Explain displacement reaction and the importance of the reactivity series as given in table 4.1. • Explain the meaning of the term double decomposition reactions. • Demonstration 2: take one test tube containing a few drops of copper sulphate solution and add a few drops of NaOH in the solution. Observe the colour changes, introduce the term precipitate.	Scientific skills and communication	Discuss subjective question 9.

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			• Explain double decomposition reaction. • Explain precipitation reactions, practice balanced chemical equations given in the text book under this topic.		
Period 6	NAOH solution, test tubes, HCl solution, phenolphthalein indicators, Material required for activity 2 as given in the text book	• What are neutralisation reactions? • Distinguish between endothermic and exothermic reactions. • Write balanced chemical equations for the given reactions.	• Perform the following demonstration: Take 5 ml of NaOH in a test tube, add a few drops of phenolphthalein, make a note of the change in colour of the solution. To this add a few drops of HCl, till the pink colour of the solution fades away. Write the word reaction for the reaction followed by the balanced chemical equation. • Use the demonstration to explain the concept of neutralisation reactions. Practice the chemical equations given in the textbook under this topic. • Perform activity 2 to explain and discuss endothermic and exothermic reactions.	Scientific skills and literacy	Discuss subjective questions 5 and 8.
Period 7		• Define oxidation reaction. • Define reduction reaction.	• Explain the meaning of oxidation reactions. • Explain the meaning of reduction reactions. • Explain the data given in remember section of the text book.	Scientific literacy and communication	Discuss subjective question 6.

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		• Identify the oxidising agent and reducing agent. • Identify the oxidised product and the reduced product. • Write balanced chemical equations for the given reactions.	• Practice all the equations given in the text book under this topic, while doing so identify the oxidising agent, reducing agent, oxidised product and reduced product.		
Period 8	Discuss Exercise: Objective and Subjective questions				
Period 9	Discuss Exercise: Exemplar problems, Draw and learn, Look-Observe-Interpret, Value Add, Subject Bridge, Investigate and Field visit				

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Theme 7 Hydrogen

Period	Materials required	Questions to be raised	Important topics and activities to be covered	Integrated life skills	Assessment
Period 1	Test tubes, beaker, water, dil HCl, zinc, sodium, calcium, copper pieces	• When was hydrogen discovered and by whom? • How does hydrogen occur in nature? • Draw the atomic structure of hydrogen. • Describe the importance of the position of hydrogen in the metal reactivity series.	• Use think pair share strategy, show the students an image of the periodic table, ask the pairs to find the position of hydrogen, identify the atomic number and mass number for hydrogen also list the number of protons, electrons and neutrons. The pair will draw an atom for hydrogen. • Discuss the discovery of hydrogen gas and Extra ordinary minds. • Discuss the occurrence of hydrogen gas and Wonderment. • Demonstration: a. Take a granule of zinc in a test tube, add a few drops of dil HCl acid, make a note of the observations. b. In a beaker take 50 ml of water and add a small piece of sodium/ calcium in it, make a note of the observation.	Scientific skills and literacy, collaboration and communication	Can discuss exemplar problems 2 and 3.

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			c. Repeat steps in a) and b) using copper instead of zinc and sodium/ calcium. Make a note of the observation. • Relate the above demonstration to the position of hydrogen in metal reactivity series, discuss the importance of this position and the reason why hydrogen is placed in the series.		
Period 2	• Ca piece, beaker, water, phenolphthalein	• Describe how hydrogen can be produced from water by a) reacting metals with water and b) electrolysis of water. • Write balanced chemical equations for the reactions.	• Show the students the image of the metal reactivity series, ask them to identify the most reactive metal and the least reactive metal. • Demonstration: Add a small piece of Ca in a beaker containing water and a few drops of phenolphthalein. Make a note of the observations. • Write the general equation when metals like Na, K and Ca react with cold water, test the gas released for pop sound test.	Scientific skills, communication	Can discuss subjective questions 1a and 1b.

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			• Show the video when Mg reacts with hot video and when Zn reacts with stem, discuss the general equation and practice all the equations in this section. • Discuss how the product change with change in reactivity of the metals. Also discuss how the temperature of water will also have to change as per reactivity of the metal. • Show the video of electrolysis of acidified water for the production of hydrogen. Discuss the reason for the water to be acidified, practice the balanced chemical equation.		
Period 3	Material required for activity 1 as given in the text book	• Describe with a balanced chemical equation for the preparation of hydrogen from acid and alkalis. • Describe the laboratory preparation of hydrogen.	• Discuss the preparation of hydrogen gas by reacting metals with acids and alkalis. Write the balanced chemical equations for these reactions. • Perform activity 1 as given in the text book.	Scientific skills and collaboration	Can discuss quick check.

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			• Discuss the importance of the use of anhydrous calcium chloride or phosphorous pentoxide in the process of drying the gas. • Explain the method used to collect the dry gas. • Explain the meaning of downward displacement of air and the reason for not using this method of collection. • Write the balanced chemical equation.		
Period 4	Material required for activity 2 and 3 as given in the text book	• Discuss the physical properties of hydrogen. • What is adsorption? • Describe an experiment to show that hydrogen is combustible but not a supporter of combustion.	• Perform activity 2 as given in the text book to discuss the physical properties of hydrogen gas. • Discuss the physical properties of hydrogen. • Discuss the round table question and the data mentioned in the wonderment section. • Discuss the meaning of occlusion/ adsorption. • Perform activity 3 as mentioned in the text book. This will help discuss the chemical property of combustion of hydrogen Write the balanced chemical equation for the reaction.	Scientific skills and critical thinking	Can discuss exemplar question 1.

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Period 5	Material required for activity 4 as mentioned in the text book.	• Write balanced chemical equation when hydrogen gas reacts with: metals, nonmetals, metallic oxides. • Describe the action of hydrogen gas on moist litmus paper.	• Discuss the data mentioned in Get it right section. • Discuss the reaction of hydrogen gas with metals, write the balanced chemical equations. • Perform activity 4 as mentioned in the text book. Discuss the reaction of hydrogen with non-metals, write the balanced chemical equation for the reaction. • Discuss all reactions of hydrogen with nonmetals. • Discuss the action of hydrogen on moist litmus paper. • Discuss the action of hydrogen gas on metallic oxides.	Scientific literacy and communication skills	Discuss subjective question 9.
Period 6	Material required for activity 5 as given in the text book	• Define: oxidation reaction, reduction reaction, redox reaction. • Define oxidising agent and reducing agent. • Describe an experiment to show that hydrogen is a reducing agent.	• Discuss the meaning of an oxidation reaction, reduction reaction, reducing agent and oxidising agent. (Since this topic was done in the previous chapter the teacher can choose to do this as a think pair share activity/jigsaw puzzle activity). • Discuss the meaning of a redox reaction.	Scientific skills and literacy	Can discuss quick check 2.

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			• Perform activity 5 as given in the textbook, make a note of the observations, write the balanced chemical equation for the reaction, identify the oxidising agent and reducing agent, identify the oxidation and reduction part of the reaction. • Discuss how hydrogen is a reducing agent.		
Period 7		• State the test to identify hydrogen. • List the uses for Hydrogen gas.	• Using think pair share ask the students to write the steps involved to identify if the given gas is hydrogen gas. • Ask the students to create a concept map of all the using of hydrogen in groups. They can do this by either recalling the information gained in class or by using the text book information. Encourage the students to create a comic strip/doodle for the same.	Communication and collaboration	Can discuss subjective question 11 and the concept map/comic strip/doodle created by the student.
Period 8	Discuss Exercise: Objective and Subjective questions				
Period 9	Discuss Exercise: Exemplar problems, Draw and learn, Look-Observe-Interpret, Value Add, Subject Bridge, Investigate and Field visit				

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Theme 8 Water

Period	Materials required	Questions to be raised	Important topics and activities to be covered	Integrated life skills	Assessment
Period 1	Material required for activity 1 as mentioned in the text book	• Describe the nature and structure of water. • State the melting point, freezing point and boiling point of water. • Describe how the change in pressure can change the boiling point or freezing point of water. • Why is pure water considered to be neutral? • Write the balanced chemical equation for the electrolysis of water.	• Can start by asking the students the following riddle: Wash me and I will not be clean, I fall yet I'm never hurt, you look for me to beat the heat only because I can run without any feet. Who am I? Expected answer is Water. • Discuss the importance and occurrence of water, the three states of water. • Discuss the properties of water such as its nature, structure, pH of pure water, freezing point, melting point. • Explain by demonstration the meaning of the term regelation. • Perform Activity 1 to find the boiling point of water. • Discuss the reaction during the electrolysis of acidified water.	Critical thinking	Can discuss the draw and learn question.
Period 2		• Write balanced chemical equations of the reaction of water with:	• Discuss Get it right and Wonderment.	Scientific literacy	Can discuss the questions in quick check 1.

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		a. Metals b. Nonmetals c. Netallic oxides d. Nonmetallic oxides	• Discuss the reactions of water with metals, nonmetals, metallic oxides and nonmetallic oxides. • Practice all the balanced chemical equations given in this section. • Discuss the meaning of acidic solutions and alkalis and their effect in litmus paper.		
Period 3	• Test tubes, water, copper sulphate, ammonium chloride, Iron (II) sulphate • Material required for activity 2 as given in the text book	• Define the term solvent. • Explain why water is a universal solvent. • List the various uses for water being a universal solvent.	• Demonstration: Take three test tubes with 5 ml water in each, to the first test tube add a few crystals of copper sulphate, to the second add a few crystal of ammonium chloride and to the third add a few crystals of Iron (II) sulphate. Make a note of the observation. Using this demonstration discuss how water is a universal solvent and the meaning of the term solvent. • Discuss wonderment. • Discuss the usefulness of water being a universal solvent. • Perform activity 2 as given in the text book, to identify that gases are also soluble in water.	Communication and scientific skills	Can discuss subjective question 3.

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Period 4	Materials required for activity 3 as given in the text book	• Define solute, solvent, and mixtures. • Define homogeneous and heterogeneous mixtures. • Compare the properties of a colloid, suspension and a solution with examples. • Explain solubility. • Explain saturated solution and super saturated solution.	• Recall the meaning of the term solvent, mixtures, homogeneous and heterogeneous mixtures. • Perform activity 3 as given in the text book. • Use the demonstration of the above activity to explain the concepts of solutions, suspensions and colloids. Use the example of the colloid to explain tyndall effect. • Discuss the meaning of the terms, saturated solution, solubility and super saturated solution. If time permits demonstrate the formation of a saturated copper sulphate solution. The colour gradation will aid in the understanding the concept.	Scientific skills and critical thinking	Can discuss quick check.
Period 5		• What is crystallisation? • Define water of crystallisation. • Distinguish between hydrous and anhydrous salts. • Define hygroscopic substances. • State the uses of some hygroscopic substances.	• Show a video on the process of crystallisation, recall the concept of saturated solutions. • Discuss the meaning of the term water of crystallisation. Use a model of copper sulphate to explain the concept. • Describe hydrated salts, anhydrous salts. Refer to table 8.2 for more examples.	Critical thinking and communication	Can discuss quick check.

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			• Discuss the meaning of the term hygroscopic. • Discuss the use of some hygroscopic substances like silica gels. • Discuss the question in round table section.		
Period 6	Material required for activity 3 as given in the text book	• Compare hard water and soft water. • What is the difference between permanent hard water and temporary hard water? • State the disadvantages of using hard water. • State the different ways to remove hardness of water. • Write balanced chemical equations for the given reactions.	• Distinguish between hard water and soft water. • Discuss the types of hardness of water. • Discuss the disadvantages of hard water. • Perform activity 3 as given in the text book to discuss the various method to remove hardness of water. • Write all the balanced chemical equations for the removal of hardness of water.	Scientific skills and critical thinking	Can discuss quick check 3.
Period 7	Discuss Exercise: Objective and Subjective questions				
Period 8	Discuss Exercise: Exemplar problems, Draw and Learn, Look-Observe-Interpret, Value Add, Subject Bridge, Investigation and Field visit				

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Theme 9 Carbon and Its Compounds

Period	Materials required	Questions to be raised	Important topics and activities to be covered	Integrated life skills	Assessment
Period 1	Materials required for activity 1 as given in the text book	• State the symbol of carbon and its atomic number and mass number. • Discuss the meaning of the term catenation. • Why is carbon and important and unique element? • Compare organic and inorganic compounds.	• Start the lecture with performing activity 1 as given in the text book. • Discuss the symbol, atomic number, mass number of carbon. • Discuss the occurrence of carbon in various compounds used in our daily life. • Draw the atom of carbon and discuss the meaning of the term catenation. • Discuss the difference between organic and inorganic compounds.	Communication and scientific skills	Can discuss subjective questions 1 and 2.
Period 2	Models of atoms	• What is allotropy? • Discuss the structure of diamond. • State the general properties of diamond. • List the uses of diamond.	• Using models or ice-cream sticks create a model of 3-4 atoms, then rearrange the same atoms to form a different shape. Relate this to the concept of allotropy. Explain the concept of allotropes in carbon. • Discuss the wonderment and remember data. • Divide the class into groups use the jigsaw strategy to discuss the structure of diamond, general properties of diamond and the use the of diamond. 20-25 mins.	Communication and collaboration	Can discuss Quick check 1.

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			• Ask the groups to present the information gathered.		
Period 3		• How is graphite produced from sand? • Describe the structure of graphite. • Discuss the general properties and uses of graphite.	• Discuss the production of graphite from sand. • Using image 9.4 discuss the structure of graphite. • Discuss the general properties of graphite. • Discuss the data in science in action. • Discuss the uses of graphite. • Ask the students to create the concept map for the topic done.	Critical thinking	Can discuss quick check 2.
Period 4		• State the properties of fullerene. • List the uses of fullerene. • Distinguish between diamond, graphite and fullerene.	• Use an image to discuss the structure of C60 fullerene. • Discuss the general properties and uses of fullerene. • Use the compare and contrast template to discuss the similarities and difference between graphite, diamond and fullerene.	Communication	Discuss subjective questions 17 and 20.
Period 5	Material required to perform activity 2 as given in the text book	• How is coal formed in nature? • Discuss the properties and uses of different types of coal. • Describe an experiment to study the destructive distillation of coal.	• Discuss the formation of coal, explain the process of carbonisation. • Discuss the types of coal. • Discuss the uses of different types of coal.	Communication and scientific skills	Can discuss quick check 3.

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		• State the product formed and their uses when coal undergoes destructive distillation.	• Perform activity 2 to discuss the destructive distillation of coal. • Discuss the details of the products obtained on the destructive distillation of coal and their uses.		
Period 6		• State the properties and uses of: a. Animal charcoal b. Wood charcoal and c. Sugar charcoal	• Discuss the general properties of charcoal and its production. • Discuss the properties and production of wood charcoal, animal charcoal and sugar charcoal. • State the uses of each of the three types of charcoal. • Discuss the meaning of the term activated charcoal. • Create a mind map for the concept done in class.	Communication	Discuss subjective question 12.
Period 7	Material required for activity 3 as given in the text book	• What is gas carbon? How is it produced? • State the uses of gas carbon. • State the properties and uses of lamp black.	• Discuss the production of gas carbon and its uses. • Perform activity 3 as given in the text book, make a note of the observation. • Discuss the production of lamp black or soot. • Discuss the uses of lamp black.	Communication	Can discuss quick check 4.
Period 8		• How was carbon dioxide discovered? • Discuss the occurrence of carbon dioxide.	• Discuss the discovery of Carbon dioxide. • Discuss the occurrence of carbon dioxide. • Discuss the preparation of carbon dioxide by burning carbon compounds.	Scientific literacy	Ask the students to do the 3-2-1 strategy 3- things they learnt today

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		• Describe the preparation of carbon dioxide by: a. Burning carbon compounds. b. Heating metallic carbonates and bi carbonates. c. Reacting dilute acids with metallic carbonates and bicarbonates.	• Discuss the preparation of carbon dioxide by heating metallic carbonates and bi carbonates. • Discuss the preparation of carbon dioxide by reacting dilute acids with metallic carbonates and bicarbonates. • Write the balanced chemical equations for all the reactions mentioned above.		2- interesting facts about carbon dioxide 1- question they still have on carbon dioxide
Period 9	Material required for activity 4 and 5 as given in the text book	• Describe the laboratory preparation of carbon dioxide. • State the test to identify carbon dioxide gas. • Write the balanced chemical equation for the reactions discussed.	• Perform activity 4 as given in the text book. Use the activity to discuss the laboratory preparation of carbon dioxide. Discuss the method of collection for the dry gas. • Discuss the other methods for preparation for carbon dioxide, write the balanced chemical equations for the preparation. • Perform activity 5 as given in the text book and discuss the tests for carbon dioxide gas. • Can also demonstrate that carbon dioxide turns lime water milky.	Critical thinking and scientific skills	Discuss subjective question 13.

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Period 10		• Describe the physical and chemical properties of carbon dioxide. • Write balanced chemical equations for the reactions discussed.	• Discuss the physical properties of carbon dioxide. • Discuss the chemical properties of carbon dioxide which include: its reaction with moist litmus paper, combustion, reaction with water, reaction with basic oxides, alkali, lime water. • Practice writing the balanced chemical equations for all the chemical properties discussed in class.	Communication	Create a mind map for the physical and chemical properties discussed in class.
Period 11	Material required to perform activity 6 as given in the text book	• State the uses of carbon dioxide. • Describe the structure and working of a soda acid fire extinguisher. • Describe the working of a foam type fire extinguisher and Liquid carbon dioxide fire extinguisher.	• Discuss the uses of carbon dioxide. • Discuss the working of a soda acid fire extinguisher with its balanced chemical equation. • Discuss the working of a foam type fire extinguisher and Liquid carbon dioxide fire extinguisher. • Perform activity 6 to make a fire extinguisher and discuss its basic functionality.	Communication and critical thinking	Discuss the question given in the round table section.
Period 12		a. What is greenhouse effect? b. What is global warming? c. What causes global warming?	• Divide the class into groups and ask the students to create a poster/presentation/ comic strip to cover the following topic: a. What is greenhouse effect? b. What is global warming?	Collaboration and communication	Discuss the subjective question 19.

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		d. What are the effects of global warming? e. What can we do to reduce global warming?	c. What causes global warming? d. What are the effects of global warming? e. What can we do to reduce global warming? • Ask the students to present their work to the class.		
Period 13		• How is carbon monoxide formed? • State the physical properties of carbon monoxide.	• Discuss the occurrence of carbon monoxide. • Discuss the formation of carbon monoxide with the balanced chemical equations for the reactions. • Discuss the physical properties of carbon monoxide. • Create a concept map for the topic done.	Critical thinking	Discuss subjective question 15.
Period 14		• Why is CO considered as a reducing agent? • State the effects and treatment of carbon monoxide poisoning.	• Discuss carbon monoxide as a reducing agent with the balanced chemical equations. • Discuss why carbon monoxide is called a silent killer. • Discuss the situations in which carbon monoxide poisoning can take place, the effects and treatment of carbon monoxide poisoning. • Create a mind map for the topic done in class.	Critical thinking and communication	Discuss subjective question 8.
Period 15	Discuss Exercise: Objective and Subjective questions				
Period 16	Discuss Exercise: Exemplar problems, Draw and Learn, Look-Observe-Interpret, Value add, Subject bridge, Investigate and Field visit				

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Worksheets

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Worksheet 1

DATE: _____ NAME: _____ CLASS: _____

A. Fill in the blanks.

1. _____ exists in all three states of matter.
2. _____ and _____ have definite volumes.
3. The heat energy supplied to the particles of matter increases their _____.
4. Particles of matter possess _____ energy.
5. _____ is the fourth state of matter.

B. Define the following:

1. Matter

   _____

   _____

2. Interparticle space

   _____

   _____

3. Diffusion

   _____

   _____

C. State which of the three states of matter have:

1. No definite shape _____
2. A definite shape _____
3. High density _____
4. No free surfaces _____
5. Particles that diffuse easily _____

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D. Answer the following questions.

1. In which three states of matter the movement of atoms is about their own position? Give a reason for the same.

2. State the main postulates of kinetic theory with reference to: interparticle space, interparticle attraction, the energy possessed by particle of matter.

3. Why do some particles of matter move faster, while other particles move slowly?

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Worksheet 2

DATE: _____ NAME: _____ CLASS: _____

A. State whether the following are true or false.

1. Gases have the least interparticle distance. _____
2. The kinetic energy of the gas particles decreases on cooling. _____
3. Mass is neither created nor destroyed in chemical reactions. _____
4. When pressure is applied, the interparticle space increases. _____
5. The change of a solid into gaseous state is called melting. _____

B. Give reasons for the following:

1. On heating a sublime substance, the molecules break free and escape from the surface of the solid directly into vapour.

   _____

   _____

   _____

2. Particles of matter move more rapidly on the application of heat.

   _____

   _____

   _____

C. Give one word for the following:

1. The change of state from liquid to gas at a fixed temperature. _____
2. The temperature at which the change from solid to liquid takes place. _____
3. Burning of a substance in air. _____
4. The temperature at which a substance changes from liquid to gaseous state. _____
5. They have slightly weaker interparticle attraction in comparison to solids. _____

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D. Answer the following questions.

1. How does change in temperature changes the state of solids?

2. Explain the inter conversion of matter due to change in pressure.

3. State the 'law of conservation of mass'. Describe a simple experiment to show that the law of conservation of mass is valid for a chemical change.

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Worksheet 1

DATE: _____ NAME: _____ CLASS: _____

A. Fill in the blanks.

1. The changes that occur due to human activities are called _____ changes.
2. _____ changes are beneficial to humans as well as other living beings on the Earth.
3. A change in which heat is liberated is called _____ change.
4. A change in which heat is absorbed is called _____ change.
5. Beating of the heart is an example of _____ change.

B. Choose the correct answer.

1. Which of the following is not a reversible change?
   a. evaporation b. drying of clothes
   c. digestion of food d. stretching of rubber band
2. The changes that occur at an instant in a very short span of time are called _____ changes.
   a. fast b. periodic
   c. non-periodic d. natural
3. Which of the following is a desirable change?
   a. souring of milk b. floods
   c. deforestation d. curdling of milk
4. Rusting of iron is an example of _____ change.
   a. slow b. fast
   c. reversible d. desirable
5. Which of the following is an example of endothermic change?
   a. burning of fuel b. melting of ice
   c. mixing of acid in water d. none of these

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C. State whether the following are true or false.

1. Burning of candle is an irreversible change. _____
2. Bursting of crackers is a fast change. _____
3. Baking of dough into bread is a reversible change. _____
4. The changes that do not occur at regular interval of time are called periodic changes. _____
5. Formation of petrol is a slow change. _____

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Worksheet 2

DATE: _____ NAME: _____ CLASS: _____

A. Fill in the blanks.

1. A physical change is usually _____ and _____ in nature.
2. _____ is a process by which a substance changes from its liquid state to its gaseous state.
3. In rusting, iron reacts with oxygen to form _____.
4. In a _____ change, one or more new substances are formed.
5. _____ developed vaccines for rabies and anthrax.

B. Give reasons for the following:

1. Change in state of matter is a physical change.

   _____

   _____

2. Rusting of iron is a chemical change but, magnetisation of iron is a physical change.

   _____

   _____

3. Curdling of milk is a chemical change.

   _____

   _____

C. Classify the following as physical and chemical changes.

1. Boiling of milk _____
2. Rotting of eggs _____
3. Vapourisation of water into water vapour _____
4. Respiration _____
5. Breaking of glass _____

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6. Glowing of an electric bulb _____
7. Change of seasons _____
8. Burning of wood _____
9. Photosynthesis _____
10. Sublimation _____

D. Answer the following questions.

1. Compare the energy changes involved in a physical and a chemical change.

_____
_____
_____
_____
_____

2. Explain any two reversible and irreversible physical changes.

_____
_____
_____
_____
_____

3. What are chemical changes? State any three of its characteristics.

_____
_____
_____
_____
_____

4. 'Fermentation is an irreversible chemical change'. Explain.

_____
_____
_____
_____
_____

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Worksheet 1

DATE: _____ NAME: _____ CLASS: _____

A. Fill in the blanks.

1. Elements can exist either as _____ or _____.
2. _____ was the first person to use symbols for representing elements.
3. When carbon and oxygen combine in the ratio of 1:1, _____ is formed.
4. An _____ is a mixture of two or more immiscible liquids.
5. Impurities from rice or pulses can be separated by _____ method.

B. Give two examples for each of the following:

1. Noble gases _____, _____
2. Compounds _____, _____
3. Metalloids _____, _____
4. Non-metals _____, _____
5. Suspension _____, _____
6. Alloys _____, _____

C. Define the following:

1. Compound

_____

_____

2. Mixtures

_____

_____

3. Winnowing

_____

_____

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D. Name the method of separation of each of the following mixtures.

1. Stones from sand _____
2. Steel and aluminium ball bearings _____
3. Husk from rice _____
4. Rotten tomatoes from fresh tomatoes _____
5. Camphor from sodium chloride _____
6. Sand from salt _____

E. Answer the following questions.

1. In the compound water, the elements are combined in a fixed ratio. Explain.

_____
_____
_____
_____
_____

2. Differentiate between homogeneous and heterogeneous mixtures. Give examples for each.

_____
_____
_____
_____
_____

3. Explain why zinc is considered an element, while zinc sulphide is a compound.

_____
_____
_____
_____
_____

4. Describe the separation process by solvent extraction method.

_____
_____
_____
_____
_____

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Worksheet 2

DATE: _____ NAME: _____ CLASS: _____

A. Choose the correct answer.

1. Which of the following technique is used to purify dirty water?
   a. Centrifugation b. Evaporation
   c. Sedimentation d. Decantation
2. Which of the following process separates colour pigments from flowers?
   a. Froth floatation b. Evaporation
   c. Decantation d. Chromatography
3. Which of the following is obtained from fractional distillation?
   a. distilled water b. crude oil
   c. tap water d. common salt
4. Which of the following is left as a residue in salt, sand and water mixture?
   a. sand b. water
   c. salt d. none of these
5. A separating funnel is used to separate the components of _____.
   a. soluble solid–liquid mixture b. immiscible liquids
   c. miscible liquids d. insoluble solid–liquid mixture

B. State whether the following are true or false.

1. Chalk in water can be separated by filtration. _____
2. Distillation involves both boiling and condensation. _____
3. Separation of sugar from tea can be done with filtration. _____
4. Fractional distillation is used to separate miscible liquids with same boiling point. _____
5. Separation of amino acids in a mixture is done through centrifugation. _____

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C. Unscramble the following words:

1. IATMIESDNETNO _____
2. NHCIUGNR _____
3. MPIITERSIU _____
4. MTURXIE _____

D. Answer the following questions.

1. Give an example of condensation that you see in nature.

_____
_____
_____
_____
_____

2. Explain the process of filtration.

_____
_____
_____
_____
_____

3. Name and describe the method used to separate cream from milk.

_____
_____
_____
_____
_____

4. How is ore purified using the method of froth floatation?

_____
_____
_____
_____
_____

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E. Draw and label the diagram showing the process of distillation.

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Theme 4 Atomic Structure

Worksheet 1

DATE: _____ NAME: _____ CLASS: _____

A. Fill in the blanks.

1. An atom is defined as the basic unit of an _____ that participate in chemical reactions.
2. _____ rays are formed of charged particles.
3. _____ discovered electrons through his experiment with discharge tube.
4. Anode rays were made of positively charged particles called _____.
5. A proton is _____ times heavier than an electron.

B. Match the following:

1. Plum pudding model	a. Rutherford
2. Orbits or energy shells	b. William Crookes
3. Alpha scattering experiment	c. Thomson
4. Neutron	d. Neil Bohr's
5. Cathode rays	e. James Chadwick

C. Define the following:

1. Nucleus

_____

_____

2. Atomic Number

_____

_____

3. Neutrons

_____

_____

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D. Answer the following questions.

1. Describe the Thomson's atomic model.

2. What are the major conclusions of Rutherford's Alpha scattering experiment?

3. What are the major postulates of modern atomic model?

4. What is atomic number and mass number? Write the atomic notation of an element.

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Theme 4

Atomic Structure

Worksheet 2

DATE: _____ NAME: _____ CLASS: _____

A. Choose the correct answer.

1. The atom of this element has 0 neutrons in its nucleus.
   a. Oxygen b. Nitrogen
   c. Hydrogen d. Helium
2. The maximum number of electrons present in shell is determined by _____.
   a. $2n^2$ b. $3n^3$
   c. $2n^3$ d. $3n^2$
3. Combining capacity of an element is known as _____.
   a. atomicity b. valency
   c. atomic number d. atomic mass
4. Which of the following is a radical?
   a. N_2 b. H_2
   c. 2O d. N^{3-}
5. Atoms of same element having same atomic number but different mass number are called _____.
   a. molecules b. isotopes
   c. allotropes d. radicals

B. State whether the following are true or false.

1. Atomic number of Hydrogen is equal to its mass number. _____
2. The numerical values of atomic mass and mass number are practically the same. _____
3. Isotopes have same number of neutrons but different number of protons. _____
4. Noble gases are stable due to their valency. _____
5. Radicals have no charge on them. _____

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C. Write the atomic number and electronic configuration of following elements.

	Atomic Number	Electronic Configuration
1. Oxygen	_____	_____
2. Potassium	_____	_____
3. Neon	_____	_____
4. Chlorine	_____	_____
5. Sodium	_____	_____
6. Magnesium	_____	_____

D. Answer the following questions.

1. How do we calculate the atomic mass?

_____

_____

_____

_____

_____

_____

2. What are isotopes? Name the three isotopes of Hydrogen.

_____

_____

_____

_____

_____

_____

3. What is valency? Why noble gases are stable?

_____

_____

_____

_____

_____

_____

4. What are radicals?

_____

_____

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E. **Complete the following table.**

Name of Element	Symbol	Atomic Number	Mass Number	No. of Protons	No. of Electrons	No. of Neutrons
Lithium			7		3	
Carbon		6				6
Nitrogen			14	7		
Aluminium		13			13	
Silicon			28			14

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Theme 5 Language of Chemistry

Worksheet 1

DATE: _____ NAME: _____ CLASS: _____

A. Fill in the blanks.

1. A symbol represents a definite _____ of an element.
2. The chemical symbol of Chromium is _____.
3. The outermost shell of an atom is known as the _____ shell.
4. If an atom has 7 valence electrons, then its valency is _____.
5. When a group of atoms gain electrons, they develop a _____ charge and is known as a/an _____.
6. In the chemical reaction of hydrogen and oxygen, _____ is the product.

B. Match the following:

1. Divalent	a. radical containing nitrogen and hydrogen
2. Ammonium	b. valency of noble gases
3. Nitric oxide	c. elements having valency of two
4. Zero	d. ion of iron
5. Ferrous	e. chemical name for nitrogen monoxide

C. Define the following:

1. Ions

_____

_____

2. Radicals

_____

_____

3. Chemical reaction

_____

_____

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D. Give the symbols and valencies of the following radicals:

Elements	Symbol	Valency
a. Hydroxide		
b. Chloride		
c. Carbonate		
d. Ammonium		
e. Nitrate		

E. Write the molecular formulae for the following compounds and name the elements present.

1. Common salt

_____

2. Sulphuric acid

_____

3. Nitric acid

_____

4. Aluminium nitride

_____

5. Potassium sulphate

_____

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Worksheet 2

DATE: _____ NAME: _____ CLASS: _____

A. Choose the correct answer.

1. Which of the following is the chemical formula of lead sulphate?
   a. Pb_2SO_4 b. $Pb(SO_4)_2$
   c. $PbSO_4$ d. $Pb_2(SO_4)_3$
2. Which information is not conveyed by a balanced chemical equation?
   a. Physical states of reactants and products
   b. Symbols and formulae of all the substances involved in the reaction
   c. Number of atoms of the reactants and products formed
   d. Whether a particular reaction is actually feasible or not
3. In which of the following reactions, heat energy will be evolved?
   a. electrolysis of water b. dissolution of NH_4Cl in water
   c. burning of LPG d. decomposition of silver bromide
4. What is the ratio of hydrogen and oxygen gases liberated during electrolysis of water?
   a. 1:1 b. 2:1
   c. 4:1 d. 1:2
5. Which of the following is used as a catalyst in the preparation of oxygen from potassium chlorate?
   a. MnO_2 b. P_2SO_4
   c. MnO d. V_2O_5

B. State whether the following are true or false.

1. The number of atoms of each element is conserved in any chemical reaction. _____
2. The symbols of the products in a chemical equation is written on the left- hand side. _____
3. Hydrogen combines with chlorine at a very high temperature to form hydrogen chloride. _____

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4. For an endothermic reaction, the absorption is indicated by adding heat on the product side. _____

C. Balance the following chemical equations.

1. $Fe + O_2 \rightarrow Fe_2O_3$

_____

2. $C_2H_4 + O_2 \rightarrow CO_2 + H_2O$

_____

3. $H_2SiCl_2 + H_2O \rightarrow H_8Si_4O_4 + HCl$

_____

4. $Na + NaNO_3 \rightarrow Na_2O + N_2$

_____

5. $C + S_8 \rightarrow CS_2$

_____

6. $N_2 + H_2 \rightarrow NH_3$

_____

7. $CH_4 + O_2 \rightarrow CO_2 + H_2O$

_____

8. $NH_3 + O_2 \rightarrow N_2 + H_2O$

_____

D. Answer the following questions.

1. What is a chemical equation? Write the steps of writing a chemical equation.

_____

_____

_____

_____

_____

_____

2. State what is a balanced equation with reference to the law of conservation of matter with a relevant example.

_____

_____

_____

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3. How do the following conditions limit the chemical reactions?

   i. Light

   ii. Pressure

   iii. Catalyst

4. What do you mean by reversible chemical reaction?

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Theme 6 Chemical Reactions

Worksheet 1

DATE: _____ NAME: _____ CLASS: _____

A. Fill in the blanks.

1. Substances formed at the end of the chemical reaction are called _____.
2. Decomposition of silver salts in the presence of sunlight is an example of _____ decomposition.
3. _____ is formed during direct combination reaction of calcium oxide and water.
4. Basic oxides form _____ when they react with water.
5. The digestion of food in human body is an example of _____ reaction.

B. Name the following:

1. The type of reaction when a compound is prepared from its elements. _____
2. A substance which changes the rate of chemical reaction without undergoing a chemical change. _____
3. A binary chemical compound in which the anion is oxygen. _____
4. These oxides can behave both as an acid as well as a base. _____
5. An acidic oxide that forms sulphuric acid when reacts with water. _____

C. State whether the following are true or false.

1. A complete chemical equation represents the reactants, products and their physical states. _____
2. A magnesium ribbon burns with a dazzling flame in air and changes into a white substance. _____
3. The reaction between nitrogen and hydrogen to give ammonia is a decomposition reaction. _____
4. Non-metals react with oxygen to form basic oxides. _____
5. Positive catalyst increases the rate of a chemical reaction. _____

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D. Complete the following reactions and name the type of reactions.

1. $NH_3 + HCl \rightarrow$ _____

   _____

2. _____ $\rightarrow PbO + CO_2$

   _____

3. $Cu(OH)_2 \rightarrow$ _____ $+ H_2O$

   _____

4. _____ $\rightarrow 2Na + Cl_2$

   _____

5. $2AgNO_3 \rightarrow 2Ag +$ _____ $+ O_2$

   _____

6. $Al_2O_3 + 3H_2SO_4 \rightarrow$ _____ $+ 3H_2O$

   _____

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Worksheet 2

DATE: _____ NAME: _____ CLASS: _____

A. Choose the correct answer.

1. Which of the following is the least reactive metal?
   a. copper b. silver
   c. platinum d. hydrogen
2. Which of the following reactions take place when dilute hydrochloric acid is added to zinc granules?
   a. the surface of the metal becomes shining
   b. the reaction mixture turns milky
   c. odour of a pungent smelling gas is recorded
   d. a colourless and odourless gas is evolved
3. The process of reduction involves _____.
   a. addition of oxygen b. addition of hydrogen
   c. removal of oxygen d. removal of hydrogen
4. Which of the following is an endothermic process?
   a. sublimation of dry ice b. dilution of sulphuric acid
   c. respiration in human beings d. condensation of water vapour

B. State whether the following are true or false.

1. Oxidation is the loss of electrons from a substance. _____
2. Rusting is a double decomposition reaction. _____
3. Displacement Reactions are represented by AB + CD → AD + CB _____
4. Heat is released when an acid is mixed to a base. _____
5. Silver nitrate reacts with common salt to form sodium nitrate and silver chloride. _____

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C. Define the following:

1. Double decomposition reaction

_____

_____

2. Neutralization reactions

_____

_____

3. Displacement reaction

_____

_____

D. Classify the following reactions as displacement, reduction, precipitation and neutralization. Also, balance the equations.

1. $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$

_____

2. $AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$

_____

3. $CuSO_4 + H_2S \rightarrow CuS + H_2SO_4$

_____

4. $NaOH + HCl \rightarrow NaCl + H_2O$

_____

5. $KOH + H_2SO_4 \rightarrow K_2SO_4 + H_2O$

_____

6. $CuO + H_2 \rightarrow Cu + H_2O$

_____

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Theme 7 Hydrogen

Worksheet 1

DATE: _____ NAME: _____ CLASS: _____

A. Fill in the blanks.

1. _____ discovered hydrogen in 1766.
2. In combined state, it is majorly found as _____.
3. Hydrogen occurs in space as _____ from which stars are born.
4. Like metals, Hydrogen behaves as an _____ element.
5. Hydrogen can be prepared from water, _____ and _____.
6. _____ is the decomposition of compound by passage of electricity.

B. Complete the following equations:

1. $2K + _____ \longrightarrow _____ + H_2\uparrow$
2. $_____ + _____ \longrightarrow 2NaOH + H_2\uparrow$
3. $Mg + 2H_2O \xrightarrow{slow} _____ + _____$
4. Metal + Water (Steam) $\longrightarrow$ _____ + _____

C. Explain how hydrogen is produced from the following along with equation:

1. Electrolysis

_____

_____

_____

2. Acids

_____

_____

_____

3. Alkalis

_____

_____

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D. Answer the following questions.

1. What is displacement reaction? Name three metals that displaces hydrogen by reacting with cold water at room temperature.

2. What is metal reactivity series? Name three less reactive metals than hydrogen.

3. Explain with diagram the laboratory method to extract Hydrogen.

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Theme 7 Hydrogen

Worksheet 2

DATE: _____ NAME: _____ CLASS: _____

A. Choose the correct answer.

1. Which of the following is not a property of hydrogen?
   a. colourless b. odourless
   c. soluble in water d. tasteless
2. Which information is correct about hydrogen?
   a. Hydrogen is a combustible gas b. Hydrogen is supporter of combustion
   c. On burning hydrogen forms cold water d. All of the above
3. The trapping of gas or liquid within the cavities in a solid or on its surface.
   a. electrolysis b. dissolution
   c. occlusion d. absorption
4. As per the reaction to litmus paper, choose the correct property of hydrogen.
   a. acidic b. neither acidic nor basic
   c. basic d. both acidic and basic
5. Which compound is formed through Haber-Bosch process?
   a. H_2O b. H_2SO_4
   c. HCl d. NH_3

B. State whether the following are true or false.

1. Hydrogen burns in air with a red flame. _____
2. The reaction between Hydrogen and Oxygen is exothermic. _____
3. On heating at 300°C, Hydrogen combines with active metals to form hydrides. _____
4. Hydrogen is a bad reducing agent. _____
5. The oxy-hydrogen flame is used for welding and cutting metals. _____

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C. Write the equation for following reactions with Hydrogen.

1. Sodium at 300°C

_____

2. Chlorine under diffused sunlight

_____

3. Haber – Bosch process

_____

4. Heated copper oxide

_____

5. Redox reaction with Lead

_____

6. Molten sulphur

_____

D. Answer the following questions.

1. Write five physical properties of Hydrogen.

_____
_____
_____
_____
_____
_____

2. Write five chemical properties of Hydrogen.

_____
_____
_____
_____
_____
_____

3. What are redox reactions?

_____
_____
_____

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4. Write five uses of Hydrogen.

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Theme 8 Water

Worksheet 1

DATE: _____ NAME: _____ CLASS: _____

A. Fill in the blanks.

1. Tomato contains about _____ of water.
2. The pH of pure water is _____ that means that pure water is chemically _____.
3. Water decomposes to form _____ and _____ gases, when an electric current is passed through it.
4. Chlorine gas dissolves in water and produces _____.
5. Carbon dioxide dissolves in water to form _____.

B. Match the following:

1. Boiling point of water	a. 0°C
2. Freezing point of water	b. acidic solutions
3. Triple point of water	c. liberation of hydrogen
4. Reaction with metal	d. 0.01°C
5. Reaction with non-metallic oxides	e. 100°C

C. Write the balanced equation for the following reactions.

1. Action of steam on Iron.

   _____

2. Action of cold water on sodium metal.

   _____

3. Dissolution of carbon dioxide in water.

   _____

4. Action of boiling water on magnesium.

   _____

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5. Dissolution of calcium oxide in water.

_____

D. Answer the following questions.

1. Water is a transparent liquid but it appears to be bluish-green in colour. Explain.

_____

_____

_____

_____

_____

_____

2. What do you mean by regelation?

_____

_____

_____

_____

_____

_____

3. Describe a simple experiment to determine the boiling point of water.

_____

_____

_____

_____

_____

_____

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Theme 8 Water

Worksheet 2

DATE: _____ NAME: _____ CLASS: _____

A. Choose the correct answer.

1. Which of the following solute can be separated by filtration?
   a. salt
   b. mayonnaise
   c. milk of magnesia
   d. gelatin
2. Which of the following is an anhydrous salt?
   a. Na_2CO_3
   b. $MgSO_4.7H_2O$
   c. $FeSO_4.7H_2O$
   d. all of these
3. Which of the following methods can remove both temporary and permanent hardness?
   a. boiling
   b. distillation
   c. washing soda
   d. ion-exchange
4. Which of the following is not true for solutions?
   a. In sugar solution, the sugar cannot be separated by filtration.
   b. When a beam of light is passed through solute, it gets scattered.
   c. The size of the particles is too small to be visible.
   d. Solubility changes with change in temperature.
5. Which of the following causes permanent hard water?
   a. sulphate salts of calcium
   b. chlorides
   c. sulphate salts of magnesium
   d. all of these

B. Match the following:

1. Green vitriol	a. permanent hardness
2. Paint	b. hygroscopic
3. Magnesium chloride	c. temporary hardness
4. Magnesium bicarbonate	d. heptahydrate
5. Calcium oxide	e. colloidal

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C. Give balanced equations for the following conversions.

1. Calcium sulphate in permanent hard water to calcium carbonate using sodium carbonate.

_____

2. Magnesium bicarbonate in temporary hard water to magnesium carbonate by boiling.

_____

3. Magnesium sulphate in permanent hard water to calcium carbonate using sodium carbonate.

_____

D. Answer the following questions.

1. Give reason why water is called as universal solvent.

_____

_____

_____

_____

_____

_____

2. Describe the process of crystallisation with the help of an example.

_____

_____

_____

_____

_____

_____

3. State how a supersaturated solution differs from a saturated solution.

_____

_____

_____

_____

_____

_____

4. Why are packets of silica gel kept in new items?

_____

_____

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5. What is the difference between hard water and soft water? State any two methods of removing hardness of water.

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Theme 9 Carbon and Its Compounds

Worksheet 1

DATE: _____ NAME: _____ CLASS: _____

A. Fill in the blanks.

1. _____ and _____ are synthetic compounds containing carbon.
2. Inorganic carbon compounds are obtained from _____.
3. Diamond has a/an _____ shape and its density is _____.
4. On heating strongly at 700°C, graphite burns to form _____.
5. The first step of coal formation begins with _____.
6. _____ charcoal is the purest among the amorphous forms of carbon.

B. Name the following:

1. A crystalline allotrope of carbon built from a hexagonal unit. _____
2. An allotrope of carbon used for the manufacture of coke. _____
3. An amorphous allotrope of carbon which floats on water. _____
4. Type of coal used as a fuel in steam engines and furnaces. _____
5. A crystalline form of carbon used for treatment of AIDS. _____

C. Choose the correct answer.

1. The crystal of _____ is opaque to light and is a good conductor of heat.
   a. diamond b. graphite
   c. fullerene d. charcoal
2. In a combined state, carbon occurs as _____.
   a. coal b. diamond
   c. graphite d. petroleum
3. Which of the following is an inorganic carbon compound?
   a. acids b. carbon monoxide
   c. glucose d. hydrocarbons

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4. Which of the following products produces water gas when steam is passed through it?
   a. coke
   b. coal tar
   c. liquor ammonia
   d. coal gas
5. Which of the following is not true for fullerene?
   a. They are bad conductors of electricity.
   b. They are neither very hard nor very soft.
   c. They have specific gravities in between 2.8 to 3.1.
   d. They are used as catalysts.

D. Give reasons for the following:

1. Diamond and graphite are allotropic modifications of carbon.

_____

_____

2. Graphite is used to make the black lead of pencils.

_____

_____

3. Coal is called fossil fuel.

_____

_____

E. Answer the following questions.

1. Compare the structure of the crystal of diamond and graphite. Also state why diamond is the hardest substance and graphite one of the softest.

_____

_____

_____

_____

_____

2. What is carbonisation? Describe the steps of coal formation.

_____

_____

_____

_____

_____

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3. State two uses of each of the following:

a. Diamond

_____

_____

b. Coal

_____

_____

c. Wood charcoal

_____

_____

d. Soot

_____

_____

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Carbon and Its Compounds

Worksheet 2

DATE: _____ NAME: _____ CLASS: _____

A. Fill in the blanks.

1. Carbon dioxide can be prepared in laboratory by the action of a dilute acid on _____.
2. Carbon dioxide gas is _____ in nature, it turns blue litmus paper _____.
3. _____ is solid white snow-like carbon dioxide.
4. _____ burns in the presence of carbon dioxide and forms black specks of carbon.
5. _____ fire extinguisher can be used in oil fires.

B. State whether the following are true or false.

1. Carbon dioxide evolves during fermentation of sugar to manufacture ethyl alcohol. _____
2. Carbon dioxide is lighter than air and has a sour taste. _____
3. Basic oxides react with carbon dioxide to produce non-metal carbonates. _____
4. Due to air pollution, the amount of carbon dioxide in the atmosphere is increasing. _____
5. Carbon monoxide is formed due to complete combustion of carbon. _____

C. Give a balanced equation for the following conversions:

1. Calcium bicarbonate to calcium nitrate using a dilute acid.

   _____

2. Lime water to calcium bicarbonate.

   _____

3. The acid reacts with sodium bicarbonate to form carbon dioxide and water.

   _____

4. Carbon monoxide reaction with Iron oxide.

   _____

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5. Carbon dioxide to carbon.

_____

6. Carbon monoxide as reducing agent to carbon dioxide

_____

D. Give reasons for the following:

1. Carbon dioxide turns lime water milky.

_____

_____

2. Soda-acid fire extinguisher is not useful in fires caused by oil.

_____

_____

3. Carbon monoxide and not carbon dioxide is highly poisonous gas.

_____

_____

E. Answer the following questions.

1. State three methods of how carbon dioxide is added to the atmosphere.

_____

_____

_____

_____

_____

_____

2. Explain the working of liquid carbon dioxide fire extinguisher.

_____

_____

_____

_____

_____

_____

3. Define global warming. State its harmful effects.

_____

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4. Write any two incidences that can cause carbon monoxide poisoning. Also states its treatment.

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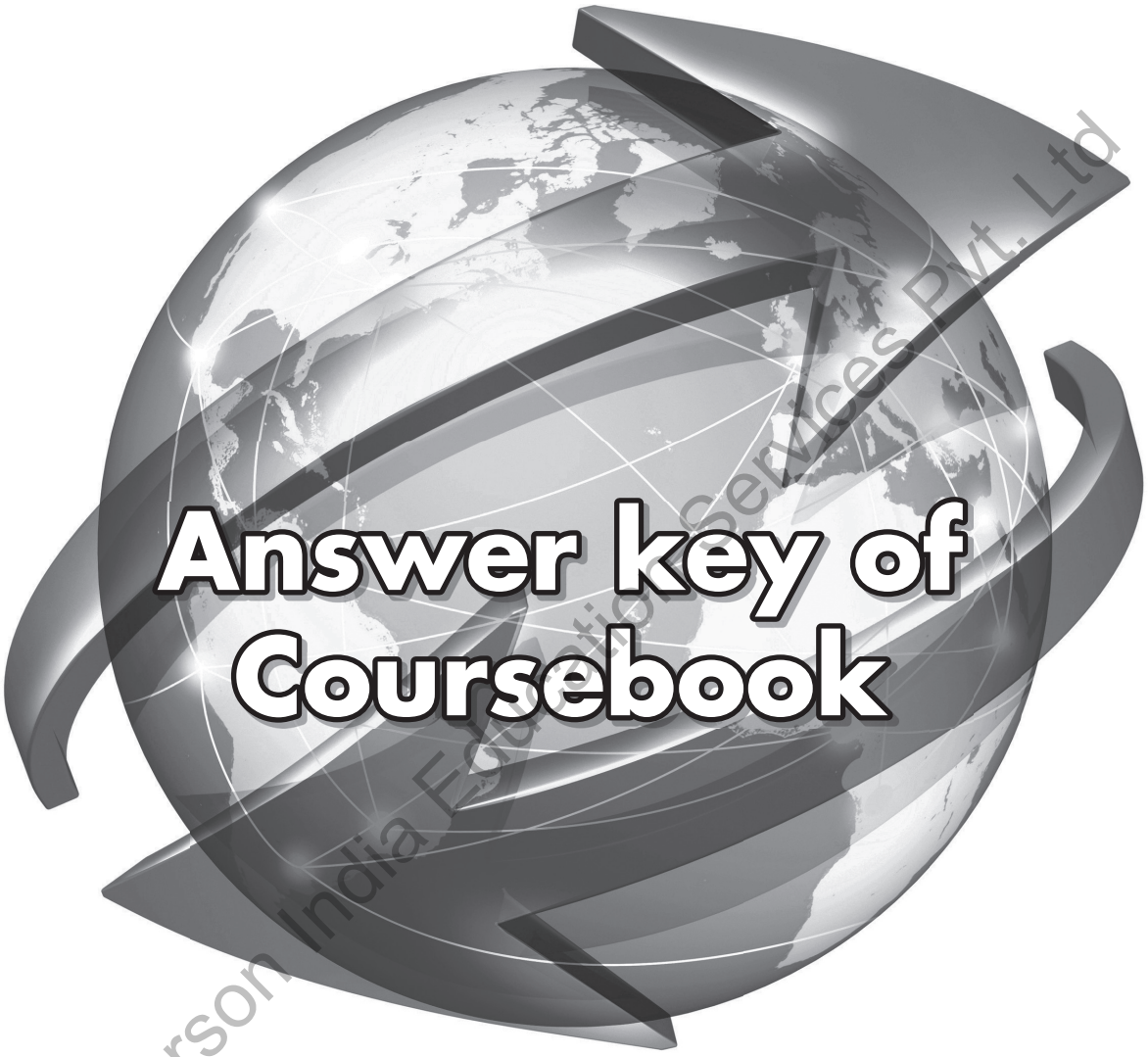

Answer key of Coursebook

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Theme 1 Matter

Quick check

1. a. definite
   b. entire
   c. continuous
   d. vibrates
   e. solid

Quick check

2. a. True
   b. False
   c. False
   d. True

Exercise

Objective Questions

A. 1. Gas
   2. Solid
   3. Solid
   4. Solid
   5. Gas

B. 1. Mass, volume
   2. Shape
   3. Small
   4. Antoine Lavoisier
   5. Directly

C. 1. True
   2. True
   3. False
   4. True
   5. False

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Subjective Questions

1. Anything which occupies space (volume) and has mass and can be perceived by our senses is called matter. Matter exists in three states—solid, liquid and gas.

   Solid – Copper and silver.

   Liquid – Water and oils.

   Gas – Ammonia and hydrogen.

2. The particles of matter have empty space between them. It is for this reason that the particles of sugar get easily distributed in the empty space present in between the particles of milk. When we mix sugar with milk the particles of sugar get into the empty space between those of the milk.

3. The ability of a gas to spread and occupy the whole available space, irrespective of other gases present in its surroundings, is called diffusion. The smell of hot food or perfume spreads by the process of diffusion. Diffusion is possible due to the presence of empty space between the particles of matter and continuous random motion exhibited by these particles.

4. The particles of matter are continuously moving in all directions. These particles possess kinetic energy due to their motion. This energy of motion is directly proportional to temperature. With an increase in temperature, the particles gain more kinetic energy and move faster. The actual average speed of the particles depends on their mass as well as the temperature – heavier particles move more slowly than lighter ones at the same temperature.

5.

Properties	Solid	Liquid	Gas
On the basis of kinetic theory – Intermolecular space	In solids, the space between the particles is very less.	In liquids, the space between the particles is slightly more as compared to solids but still very less. The particles of liquid can slip and slide over each other.	In gases, the particles are much farther apart from one another as compared to solids and liquids. They have a very disorderly arrangement of particles compared to solids and liquids.
On the basis of kinetic theory – Force of attraction	The force of attraction between the particles is strong. Thus, particles in a solid are closely packed.	The force of attraction between the particles is strong enough to hold the particles together but not strong enough to hold the particles in a fixed position. Thus, particles in a liquid are not as closely packed as in solids.	The force of attraction between the particles is negligible; hence, particles of a gas move freely in all directions. Gases can thus mix or diffuse into other gases.

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On the basis of kinetic theory – Movement	Solid particles vibrate only about their mean position.	Liquid particles are free to move around in the liquid only. They can slip and slide over each other.	Gaseous particles move with high speed in all directions and can exert pressure on the walls of the container walls of the container.

6. The particle nature of matter is explained through kinetic theory of matter. This theory states that matter is made up of continuously moving tiny particles (atom or molecules). The postulates of kinetic theory of matter are as given here:
   - Matter is made up of a large number of tiny invisible particles (atom or molecules).
   - Particles of all kinds of matter have empty spaces between them. This empty or vacant space between particles of matter is called interparticle space. The interparticle space is maximum in gases and minimum in solids.
   - Particles of matter are always in state of continuous motion. They possess energy of motion called kinetic energy.
   - The kinetic energy of particles increases with increase in temperature.
   - Particles of matter attract each other.
   - There is a force of attraction between particles constituting the matter. The strength of this force varies from one kind of matter to another. The interparticle attraction decreases from solid to liquid and liquid to gas.
   - The particles collide with each other and with the walls of the container.
   - The force exerted by the particles on the walls of the container creates pressure.
7. The law of conservation of mass states that mass in an isolated system is neither created nor destroyed by chemical reactions or physical transformations. According to the law of conservation of mass, the total mass of the products in a chemical reaction must equal to the total mass of the reactants. Suppose in a reaction, reactant A combines with reactant B to form products C and D. Then mathematically, this law can be represented in the following way:

   $$mA + mB = mC + mD$$

   where mA, mB, mC and mD are the masses of A, B, C and D, respectively.
8. A. Melting point – The change of a solid into its liquid state is called melting. The temperature at which the change from solid to liquid takes place at atmospheric pressure is called melting point.

   B. Boiling point – The temperature at which a substance changes from liquid to gaseous state at atmospheric pressure is called the boiling point.
9. The postulates of kinetic theory of matter are as given here:
   - Matter is made up of a large number of tiny invisible particles (atom or molecules).
   - Particles of all kinds of matter have empty spaces between them. This empty or vacant space between particles of matter is called interparticle space. The interparticle space is maximum in gases and minimum in solids.

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- Particles of matter are always in state of continuous motion. They possess energy of motion called kinetic energy.
- The motion of particles increases with increase in temperature.
- Particles of matter attract each other.
- There is a force of attraction between particles constituting the matter. The strength of this force varies from one kind of matter to another. The interparticle attraction decreases from solid to liquid and liquid to gas.
- The particles collide with each other and with the walls of the container.
- The force exerted by the particles on the walls of the container creates pressure.

10. Interchangeability of the state of matter is dependent on pressure and temperature. The states of matter are interchangeable i.e. a substance can be changed from its solid state to its liquid state and vice-versa. This is also applicable to solids as well as gases.

    When a solid is heated, the kinetic energy increases and the particles vibrate faster about their mean position. At a particular temperature the particles gain enough energy to overcome the interparticle forces of attraction and change into the liquid state.

    On heating a liquid, the kinetic energy increases further and at a particular temperature the particles break away from one another and get converted to the vapour state.

    On the other hand upon cooling the kinetic energy of the gas particles decreases and hence the gases get converted into liquids and further to the respective solids.

    On application of pressure the interparticle space decreases and the particles move closer to one another. This in turn results in the increase of interparticle forces of attraction and the gas condenses to its liquid state. On further increase of pressure the molecules come so close that the liquid gets solidified.

11. Refer to activity 2

Exemplar problem

Since in chalk the particles forces between the chalk particles are not so strong hence they can be easily broken while the inter-particle force between the particles of iron is strong as there are strong metallic bonds between them. Hence they cannot be easily broken down.

Draw and Learn

Refer to fig. 1.1

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Theme 2 Physical and Chemical Change

Quick check

1. a. True
   b. False
   c. False
   d. False
   e. False

Quick check

2. a. Physical
   b. Physical
   c. Chemical
   d. Chemical
   e. Chemical

Exercise

Objective Questions

A. 1. c
   2. c
   3. b
   4. a
   5. b

B. 1. Physical
   2. Periodic
   3. Chemical
   4. Physical
   5. Liquid

C. 1. Boiling of water is a physical change. All others are chemical changes [In the coursebook correct spelling of chapati and use the word cooking instead of baking]
   2. Rainfall is a non periodic change. All others are periodic changes.
   3. Melting of ice is an endothermic reaction. All others are exothermic reaction.

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4. Tsunami is an undesirable change. All others are desirable changes.
5. Lightning is a fast change. All others are slow changes.

D. 1. False
2. True
3. False
4. False
5. False

E. 1. c
2. a
3. d
4. e
5. b

Subjective Questions

1. Melting of ice is a physical change because it involves change only in the physical state of water, from ice in the solid state to water in the liquid state. Moreover, no new chemical substance is formed in the process and this change is reversible. Water can be converted back into ice simply by freezing.
2. Fermentation is the chemical breakdown of a substance by bacteria, yeast or other microorganisms, typically involving the release of carbon dioxide and heat. The fermentation of dosa batter, idli and bread dough are irreversible processes and hence a chemical change.
3. A physical change is usually temporary and reversible in nature. For example, wax melts on heating. This molten wax solidifies again on cooling. However, some physical changes such as tearing of paper, breaking of glass and cutting of vegetables and fruits are irreversible.
4. Changes that are beneficial to humans as well as other living beings on the Earth are called desirable changes. Example: Ripening of fruits and vegetables, germination of seeds etc.
5. The changes that occur at regular intervals of time are called periodic changes. Examples: change of seasons, changing of day and night etc.
6. Changes that can be easily reversed by removing the cause of the change are called reversible changes. Examples: Melting of ice, evaporation of water, drying of clothes etc. Changes that cannot be easily reversed are called irreversible changes. Examples: Burning of paper, tearing of paper, germination of seeds etc.
7. A change in which heat is liberated is called exothermic change. Rusting of iron, burning of candle, fuel and fireworks, mixing of acid in water are examples of exothermic changes.
8. A physical change has the following characteristics:
   - During a physical change, no new substances are formed.
   - A physical change is usually temporary and reversible in nature. For example, wax melts on heating. This molten wax solidifies again on cooling. However, some physical changes such as tearing of paper, breaking of crockery are irreversible.

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- In a physical change, the chemical properties of a substance do not change.
- In a physical change, the physical properties such as colour, odour, shape and size of a substance may undergo a change.

9. Chemical changes are changes in which the chemical composition of a substance alters, resulting in the formation of a new substance. In a chemical change, the atoms of the parent substance(s) rearrange themselves to form new substance(s). [Can mention reactant instead of parent substance]

   A chemical change has the following characteristics:

   - In a chemical change, one or more new substances are formed. For example, curdling of milk results in the formation of a new substance, curd.
   - The composition and properties of the new substance(s) formed during a chemical change are different from those of the parent substance(s). For example, curd has completely different properties from milk.
   - Chemical changes are usually permanent and irreversible in nature.
   - A chemical change is accompanied by a transfer of energy, usually in the form of heat. Heat may be absorbed or evolved in a chemical change

10. Curdling is intentional and desirable in making cheese and curd. When curdling occurs naturally in milk, if it is left open to air for a few days in a warm environment then it becomes an undesirable change.
11. Sublimation is a process by which a substance directly changes from its solid state to its gaseous state without changing into liquid state. It is simply a change of state which is reversible and hence a physical change. Examples include- sublimation of naphthalene balls, camphor, ammonium chloride, iodine crystals etc.
12. In an irreversible physical change, the original form cannot be restored. Burning is an example of an irreversible change. When you burn wood you get ash and smoke. You cannot change the ash and smoke back to wood again. Breaking of glass is another physical irreversible change.

Exemplar problem

A change can't be both physical and chemical, but physical and chemical changes can occur simultaneously. This is what's happening with the burning of wood. When wood is burnt the moisture present in it turns to vapour, it is a physical change while it burns and generate CO_2 is a chemical change. Another example is digestion, chewing of food is a physical change while in the actual digestion process this chewed food is acted upon by enzymes and chemically broken.

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Theme 3 Elements, Compounds and Mixtures

Quick check

1. Classify the following as elements or compounds or mixtures

Elements	Compound	Mixture
Gold	Water	Honey
Calcium	Salt	Lemonade
Carbon	Limestone	Milk
Oxygen	Carbon dioxide	Cement
Graphite		

Quick check

2. Name the method of separation in each one
   a. Separation of rotten potatoes from a sack of potatoes – Hand Picking
   b. Separation of pebble from sand – Sieving
   c. Iron nail from a mixture of iron and sand – Magnetic separation
   d. Camphor from a mixture of sodium chloride and camphor – Sublimation
   e. Separation of table salt from saw dust – Solvent Extraction

Exercise

Objective questions

A. Choose the following answers

1. b
2. c
3. d
4. a
5. b

B. Fill the Blanks

1. Elements, Compounds
2. Froth Flotation

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3. Suspension & Emulsion
4. Winnowing

C. State whether the following are true or false.

1. False
2. False
3. False
4. False
5. True

Subjective Questions

1. An emulsion is a mixture of two or more immiscible liquids. They are of two types—oil in water (milk) and water in oil (butter).
2. An alloy is homogenous mixture of two or more metals. In certain alloys non-metals are also added. Steel and bronze are examples of alloy.
3. The fractions obtained by fractional distillation are petroleum gas, petrol, diesel, kerosene, lubricating oil, paraffin wax and asphalt.
4. Depending on the distribution of the components in the mixture, they are of two types—homogeneous mixtures and heterogeneous mixtures. In homogeneous mixtures, the composition is uniform and the properties are same throughout, whereas in heterogeneous mixtures, the composition is non-uniform and properties vary throughout the mixture. Air and alloys are homogeneous mixture of several gases. Alloys such as steel are also homogeneous mixtures. Soil, vegetable soup and muddy water are examples of heterogeneous mixtures.
5. a. separating funnel
   b. Magnetic separation
   c. Chromatography
   d. Seiving
6. Noble gases are inert elements and do not react with any other substance. For example, helium, neon, argon etc.
7.

Evaporation	Distillation
The method of changing liquid into gas by adding heat to the liquid so that the molecules on the surface will quickly transform into a gas.	Distillation is a method of producing liquid vapour or steam. This is done by heating the liquid to acquire gas and then, for various reasons, condensing the obtained gas into the appropriate liquid form.
A slow and gradual process	Quick and rapid
Occurs at the surface	Doesn't only occur at the surface

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Not a separation technique	A separation technique
No formation of liquid bubbles at the boiling point	Formation of liquid bubbles at the boiling point
Liquid vaporization below the boiling point	Liquid vaporization at the boiling point

8. A suspension is a heterogeneous mixture that contains solid particles that are sufficiently large for sedimentation and can be visible through naked eye or a magnifying glass. The components of a suspension can be separated by filtration. The solute particles in a suspension do not get dissolved and are suspended throughout the solvent. For example, sand in water, chalk in water, dust particles in air, saw dust in water.

9. Iodine changes directly from solid to gaseous state on heating. Iodine can be separated from the mixture by sublimation. The gaseous form of Iodine can be cooled easily to get a pure solid. The remaining components of the mixture are salt and sand.

   Salt is soluble in water and sand is insoluble in water and can be separated by the process of filtration. The insoluble sand remains in the filter paper while the filtrate contains the dissolved salt.

10. A separating funnel is used to separate the components of a mixture consisting of two or more immiscible liquids. The principle used in this method is dependent on the difference in the densities of the liquids to be separated. A mixture of oil and water can be separated by this method. The mixture is taken in the separating funnel and allowed to stand for some time. The heavier oil settles down and the lighter water forms the upper layer. Now, the stopcock is opened to allow the oil to come out which is collected in a container. Next, the water is collected in another container and ultimately, the two liquids are separated.

11. Froth flotation is used to purify *ore* from the impurities present in it. The principle used in this process is the preferential wetting of the ore by the oil and the impurities by water. The ores which are lighter like the sulphides of lead and zinc are purified by this method. The impure ore is mixed with water in a huge tank and pine oil and ethyl xanthate are added. When compressed air is bubbled through this mixture from the bottom of the tank, a huge mass of froth is formed. This froth consists of the lighter ores and the impurities which are wet by water settle down in the tank. The froth is skimmed off and the impurities are removed.

12. Distillation is the process of separating a solid dissolved in a liquid. It involves both evaporation and condensation. The solid–liquid mixture is heated in a flask. The vapours of the liquid that rise up are made to pass through a condenser that has cold water running around it. The cold conditions condense the vapour into liquid that is collected in a separate container. In this way, both the solid and the liquid are separated.

13. Chromatography is the process of separation of a mixture by passing it through a solvent in which the components move at different rates. The principle of this technique is based on the difference of rates of adsorption of the components on the surface of the adsorbent. The components move to different heights on the adsorbent and hence the components are separated. The different types of chromatography are paper chromatography, thin layer chromatography, column chromatography and gas–liquid chromatography. he ore.

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Exemplar problem

Adsorption is the process by which ions, atoms or molecules adhere to the surface of a solid material. It differs from absorption which is when a fluid penetrates the entire volume of a material. In adsorption, the molecules are held loosely on the surface of the adsorbent and can be easily removed.

Draw and Learn

Refer to fig. 3.10

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Theme 4 Atomic Structure

Quick Check

1. State whether the following are True or False
   a. True
   b. False
   c. True
   d. False
   e. True

Quick Check

2. Mass number = 31 and atomic number 15 - given
   no. of proton = atomic number = 15.
   No. of neutrons = Mass number - no. of proton = 31 – 15 = 16
   No. of electrons = 15
3. $^{12}_{6}C$
   Mass number = 12
   atomic number = no. of proton = 6
   No. of electrons = no. of proton = 6
   No. of neutrons = Mass number – no. of proton = 12 – 6 = 6

Exercise

Objective questions

A. 1. c
   2. c
   3. d
   4. d
   5. b

B. 1. J.J. Thomson
   2. Nucleus
   3. Nucleons
   4. Planetary
   5. Orbits or energy shells

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C. 1. True
2. True
3. True
4. True
5. True
6. True
7. False
8. False

D. 1. b
2. c
3. e
4. a
5. d

Subjective Questions

1. The important postulates of Dalton's atomic theory are as follows:
   - Matter is made up of extremely small particles called atoms.
   - All the atoms present in an element are identical in all respects such as mass and size but they differ from atoms of other elements.
   - Atoms are indivisible and is the smallest part of matter that takes part in a chemical reaction.
2. Plum pudding model could explain the electrical neutral behavior of an atom. However, this model was not accepted as it failed to explain the results of Rutherford's scattering experiment.
3. Protons and electrons have opposite electrical charges.

Subatomic particle	Relative mass	Relative charge
Proton	1	+ 1
Neutron	1	0
Electron	1/1837	–1

4. The total number of protons present in the nucleus of an atom is called its atomic number. It is equal to the number of electrons present in a neutral atom. It is represented by 'Z'. For example, atomic number of oxygen is 8 and nitrogen is 7.

   Atomic number (Z) = Number of protons (p)

   The total number of protons and neutrons present in the nucleus of an atom is called its mass number or atomic mass. It is represented by 'A'.

   Mass number (A) = Number of protons (p) + Number of neutrons (n)

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5. The discovery made by J. J. Thomson suggested that atoms consist of negatively charged particles called electrons but atoms are electrically neutral. In 1886, A German scientist, Eugen Goldstein conducted an experiment with the same discharge tube, but with a perforated (slit) cathode. He observed a glow behind the cathode. He found that these rays emanated from the anode and moved behind the cathode. These rays were referred to as anode or canal rays. Anode rays were made of positively charged particles. Later in 1919, Ernest Rutherford named the positively charged particles as protons.

6. In 1911, Rutherford, Marsden and Geiger discovered the dense atomic nucleus by bombarding a thin gold sheet with the alpha particles emitted by radium. Rutherford and his students then counted the number of sparks produced by these alpha particles on a zinc sulphate screen. From this observation, they concluded that almost all the atomic matter was concentrated in a tiny volume situated at the atom center, the atomic nucleus. The following observations were made by Rutherford as a result of the above experiment:

   - Most of the alpha particles passed through the foil, without any deflection
   - A small number of the alpha particles were deflected from their original path. A few of the alpha particles were deflected by 90° or even wider angles.
   - A few alpha particles bounce back. That is, they were deflected through almost 180°.

   On the basis of his observations, Rutherford made the following conclusions:

   - As most of the alpha particles pass through the gold foil undeflected, an atom consists of predominantly empty space.
   - The deflection of a small number of alpha particles suggests that the positive charge in an atom is not uniformly distributed. It is concentrated in a small core, which he called nucleus.
   - The fact that only a few alpha particles bounced back suggests that the heavy positively charged nucleus occupies a very small fraction of the total volume of the atom.

7. According to Rutherford's atomic model:

   - An atom consists of an extremely small, heavy, positively charged core called nucleus, situated at its centre. The entire mass of the atom is concentrated in the nucleus.
   - The negatively charged electrons surround the nucleus of an atom. They revolve around the nucleus in circular orbits, just as the planets revolve around the Sun.
   - Rutherford's model of the atom resembled the solar system and hence was referred to as the planetary model of atom. However, this model could not explain the stability of the atom.

8. The important postulates of Bohr's atomic model are:

   - The electrons revolve around the nucleus in circular paths called orbits or energy shells.
   - The orbits or energy shells are associated with definite energy levels. Starting from the innermost energy shell, these shells are represented by numbers 1, 2, 3, 4 and so on or symbols K, L, M, N and so on.
   - Different orbits possess different energies.
   - The energy of an orbit increases as it moves away from the nucleus.
   - The energy difference between one orbit and another orbit is constant.

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9. Studies conducted by renowned scientists J. J. Thomson, Ernest Rutherford, Niels Bohr, E. Goldstein and James Chadwick revealed the complex structure of the atom. This led to the development of the modern atomic model. The main postulates of modern atomic model are as follows:
   - An atom consists of three sub-atomic particles—electron, proton and neutron.
   - An atom is divided into two parts—nucleus and the empty space that surrounds the nucleus called extra-nuclear region.
   - The nucleus is the central dense core of the atom consisting of neutrons and protons. They are collectively called nucleons. The total mass of an atom is concentrated in the nucleus considering electrons have negligible mass. The nucleus of an atom is positively charged due to the presence of positively charged protons.
   - In extra-nuclear region, electrons revolve around the nucleus in circular fixed paths called orbits. The orbits are fixed imaginary paths associated with a fixed amount of energy.
   - An atom is electrically neutral. The total number of protons present is equal to the total number of electrons, thus balancing the total charge of the atom.

Exemplar problem

1. By looking at the periodic table, you will see that Fluorine has 9 protons and 10 neutrons. Meanwhile,10 neutrons and 9 protons (= electrons) will give mass number 19 so it's mass number would be 19. Hence, the atom would be Fluorine.

   Mass number (A) = Number of protons (p) + Number of neutrons (n)

   = 9 + 10 = 19

2. Number of protons (p) = Number of electrons = 19

   Number of neutrons (n) = Mass number (A) – Number of protons (p)

   = 39 – 19

   = 20

Draw and Learn

Refer to fig. 4.8

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Theme 5 Language of Chemistry

Quick check

1. a. Sodium phosphate – Na_3PO_4
   b. Ammonium carbonate – $(NH_4)_2CO_3$
   c. Magnesium sulphate – $MgSO_4$
   d. Aluminium nitrate – $Al(NO_3)_3$
   e. Ferrous chloride – Fe Cl_2

Quick check

2. a. $2FeCl_2 + Cl_2 \rightarrow 2FeCl_3$
   b. $BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + 2HCl$
   c. $2Mg + O_2 \rightarrow 2MgO$
   d. $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$
   e. $4Fe + 3O_2 \rightarrow 2Fe2O_3$

Exercise

Objective questions

A. 1. c
   2. c
   3. b
   4. d
   5. b

B. 1. Destroyed
   2. Atoms, molecules
   3. Equal
   4. Potassium chlorate
   5. $CaCO_3$

C. Balanced chemical equation for the following reactions:
   1. $2H_2O \rightarrow 2H_2\uparrow + O_2\uparrow$
   2. $2KClO_3 \rightarrow 2KCl + 3O_2\uparrow$
   3. $H_2O + CO_2 \rightarrow H_2CO_3$

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4. $C + O_2 \rightarrow CO_2$
5. $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$

D. 1. Ferric phosphate – $FePO_4$
2. Plumbic chloride – $PbCl_2$
3. Calcium nitrate – $Ca(NO_3)_2$
4. Aluminium iodide – $Al\ I_3$
5. Ammonium sulphide – Al_2S_3

Subjective Questions

1. In a chemical reaction, the given substances react with one another to form one or more new substances.

   In this process, the composition and properties of the original substance(s) change, resulting in the formation of new substance(s). Therefore, a chemical reaction leads to a chemical change. For example, carbon reacts with oxygen at low concentrations to form carbon monoxide

2. The law of conservation of mass in a chemical reaction states that matter can neither be created nor destroyed. It can only be transformed from one form to another. It implies that the total mass of the substances that react or undergo change must be equal to the total mass of the substances obtained after the chemical change. This is possible only if each element has equal number of atoms on both sides of the equation.

3. Photosynthesis is a photochemical reaction. Light provides energy for the synthesis of glucose from carbon dioxide and water during photosynthesis.

4. The capacity of the elements to show different valencies in different compounds is called variable valency. Variable valency is shown by elements like Iron, mercury, and copper. Transition elements show variable valency. For example: in some cases, iron shows a valency of 2 like ferrous sulphate ($FeSO_4$), and in some, it shows valency of 3 like ferric chloride ($FeCl_3$).

5. A symbol is the short form that represents an atom of a specific element or the abbreviation used for the name of an element.

   Significance of a Symbol

   - A symbol represents a specific element. 'O' denotes the element oxygen.
   - A symbol represents an atom of an element. 'O' represents an atom of oxygen.
   - A symbol represents a definite mass of an element. 'O' represents 16 grams of oxygen.

6. Steps to balance a chemical equation

   - Count the number of atoms of each element on the two sides.
   - Take any one unbalanced element and make changes in its coefficients to make the number of atoms of the element on the two sides equal.
   - Take another element and balance it, as done in step 2.
   - After balancing the last element, once again check to make sure that all elements have been balanced.

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7. Chemical reaction is just a rearrangement of atoms. Atoms are neither created nor destroyed during chemical reaction. Chemical equations must be balanced to **satisfy the law of conservation of mass**, that states that mass cannot be produced or destroyed in a closed system.

8. Some conditions that limit chemical reactions are –

   1. Temperature – Temperature is one of the most important factors for a chemical reaction to take place. Some reactions take place only at high temperature. The reaction between nitrogen and hydrogen to form ammonia takes place only at high temperature.

   $$N_2 + 3H_2 \rightarrow 2NH_3$$

   2. Close contact – For a chemical reaction to take place the reactants should be brought in close contact i.e., they should be mixed.

   Sodium + Water → Sodium hydroxide + hydrogen

   $$2\ Na + 2H_2O \rightarrow 2NaOH + H_2$$

   3. Solution form – Some substances react with each other only when they are mixed in the solution form, e.g.,

   Silver nitrate + Sodium chloride → Silver nitrate + Sodium nitrate

   $$NaCl + AgNO_3 \rightarrow AgCl + NaNO_3$$

   4. Heat-Some reactants need to be heated to undergo a chemical change, e.g.,

   Potassium chlorate $\xrightarrow{heat}$ Potassium chloride + Oxygen

   $$KClO_3 \rightarrow KCl + O_2$$

   5. Potassium dichromate – $K_2Cr_2O_7$

   Potassium chloride – KCl

   Ammonium bisulphate – $(NH_4)HSO_4$

   Ammonium phosphate – $(NH_4)_3PO_4$

   Stannic sulphate – $SnSO_4$

   Ferric hydroxide – $Fe(OH)_3$

Exemplar problem

The general balanced reaction for Photosynthesis is

$$\underset{\text{(Carbon dioxide)}}{6CO_2} + \underset{\text{(Water)}}{6H_2O} \rightarrow \underset{\text{(Glucose)}}{C_6H_{12}O_6} + \underset{\text{(Oxygen)}}{6O_2}$$

The general balanced reaction for respiration is

$$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$$

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Theme 6 Chemical Reactions

Quick check

1. a. Reactants
   b. Thermal
   c. Lead monoxide, carbon dioxide
   d. Combination reaction
   e. Photochemical

Exercise

Objective Questions

A. 1. b
   2. c
   3. a
   4. b

B. 1. Product
   2. Decomposition
   3. Silver, chlorine
   4. More
   5. Neutralization

C. 1. False
   2. True
   3. False
   4. False
   5. True

Subjective Questions

1. The conditions necessary for a chemical reaction to take place are as follows:
   - There must be one or more substances to take part in a chemical reaction.
   - There must be release or absorption of energy during a chemical reaction.
   - There must be formation of one or more new substances.

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2. Examples of decomposition reactions are -

   a. Upon heating, magnesium oxide breaks down into magnesium and oxygen.

   $$2HgO \rightarrow 2Hg + O_2$$

   b. Cupric hydroxide upon heating decomposes to form copper oxide and water.

   $$Cu(OH)_2 \rightarrow CuO + H_2O$$

3. **Electrolytic decomposition** – A decomposition reaction which is brought about by electricity is called electrolytic decomposition.

   Examples: When an electric current is passed through acidulated water, it decomposes to give hydrogen and oxygen.

   $$2H_2O \rightarrow 2H_2 + O_2$$

   Photochemical decomposition – A decomposition reaction which is brought about by light is called photochemical decomposition.

   Silver chloride decomposes to silver and chlorine in the presence of light.

   $$2AgCl \rightarrow 2Ag + Cl_2$$

   Synthesis reaction – It is a reaction in which two or more substances combine chemically to form a new product.

   Sulphur burns in oxygen to form sulphur dioxide.

   $$S + O_2 \rightarrow SO_2$$

4. Amphoteric oxides can behave both as an acid as well as a base. When these oxides react with a base, they undergo neutralization reaction to form salt and water, thereby reacting as a base. Similarly, these oxides react with an acid to produce salt and water, thereby behaving as an acid. Examples: zinc oxide (ZnO), lead monoxide (PbO) and aluminium oxide (Al_2O_3).

Endothermic Reaction	Exothermic Reaction
A reaction in which the system absorbs energy from its surrounding in the form of heat.	A reaction that releases energy from the system in the form of heat.
The energy is absorbed from the surrounding into the reaction	The energy is released from the system to its environment.
Energy is absorbed in the form of heat	Energy is released as heat, electricity, light or sound.
Melting ice, evaporation, cooking, gas molecules, photosynthesis are a few examples	Rusting iron, explosions, nuclear fission are a few examples.

5. Reactions in which hydrogen gets added or oxygen is removed are called reduction reactions. Moreover, addition of electrons is also known as reduction.

   Example 1 – $H2 + Cl_2 \rightarrow 2HCl$

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In the above example, hydrogen is getting added to chlorine and hence chlorine is getting reduced.

Example 2 – $CuO + H_2 \rightarrow Cu + H_2O$

Here, oxygen is getting removed from copper oxide and hence copper oxide is getting reduced.

6. Oxides can be classified into four types: acidic oxides, basic oxides, amphoteric oxides, neutral oxides. [remove italic]

   i) Acidic oxide: Non-metals react with oxygen to form non-metallic oxides or acidic oxides. Acidic oxides form acids when they react with water. They are also called acid anhydrides as they produce acid in presence of water. Examples: carbon dioxide (CO_2), sulphur dioxide (SO_2), phosphorus pentoxide (P_2O_5) etc.

   ii) Basic oxide: Metals react with oxygen to form metallic oxides or basic oxides. Basic oxides form abases or alkalis when they react with water.

   Examples: sodium oxide (Na_2O), calcium oxide (CaO), magnesium oxide (MgO) etc.

   iii) Amphoteric oxides can behave both as an acid as well as a base. When these oxides react with a base, they undergo neutralization reaction to form salt and water, thereby reacting as a base. Similarly, these oxides react with an acid to produce salt and water, thereby behaving as an acid. Examples: zinc oxide (ZnO), lead monoxide (PbO) and aluminium oxide (Al_2O_3)

   iv) Neutral oxides are oxides which are neither acidic nor basic. In other words, oxides which neither react with acids nor with bases are called neutral oxides. Some of the examples of neutral oxides are a nitrous oxide (N_2O), nitric oxide (NO), carbon monoxide (CO).

7. The reactions in which an acid reacts with a base to form salt and water only are called neutralization reactions.

$$\text{Acid} + \text{Base} \rightarrow \text{Salt} + \text{Water}$$

Sulphuric acid reacts with potassium hydroxide to form potassium sulphate and water.

$$\underset{\text{Sulphuric acid}}{H_2SO_4} + \underset{\text{Potassium hydroxide}}{KOH} \rightarrow \underset{\text{Potassium sulphate}}{K_2SO_4} + \underset{\text{Water}}{H_2O}$$

8.

Displacement reaction	Decomposition reaction
In a displacement reaction a more reactive element displaces a less reactive element from its compound.	In a decomposition reaction a substance is broken down into two or more new substances.
It can be represented as: $AB + C \rightarrow AC + B$ Here, 'C' is the more reactive element which displaces the less reactive element 'B' from its compound.	It can be represented as: $AB \rightarrow A + B$

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Zinc is placed above hydrogen in the metal reactivity series. When dilute hydrochloric acid is added to zinc granules, hydrogen gas is evolved. Zinc combines with chlorine to form zinc chloride, displacing hydrogen. $Zn + 2HCl \rightarrow ZnCl_2 + H_2$	Calcium carbonate, on heating, decomposes to calcium oxide and carbon dioxide. $CaCO_3 \rightarrow CaO + CO_2$

9. A reaction in which two or more elements or compounds combine with one another to form a new compound is called a combination reaction. It is the reverse of decomposition. This reaction is usually accompanied by liberation of heat. It can be represented as:

   Examples:

   $$A + B \rightarrow AB$$

   - Hydrogen combines with oxygen to produce water.

     $$2H_2 + O_2 \rightarrow 2H_2O$$

   - Carbon reacts with oxygen to produce carbon dioxide.

     $$C + O_2 \rightarrow CO_2$$

   Thus, we see that oxides are produced on heating an element in oxygen.

10. a. $2KClO_3 \rightarrow 2KCl + 3O_2$
    b. $NH_3 + HCl \rightarrow NH_4Cl$
    c. $Zn + 2HCl \rightarrow ZnCl_2 + H_2$
    d. $BaCl_2 + ZnSO_4 \rightarrow ZnCl_2 + BaSO_4$
    e. $H_2SO_4 + 2KOH \rightarrow K_2SO_4 + 2H_2O$

Exemplar problem

pH papers are paper infused, or saturated, with pH indicators or more frequently, a mixture of indicators. They are used to test for alkaline or acidity of a solution or substance such as soil. pH papers are usually sold as strips. PH paper is used to determine if a solution is acidic, basic or neutral. This is determined by dipping part of the paper into a solution of interest and watching the color change. The packages that pH paper comes in often include a color-coded scale indicating the pH that something has when the paper turns a certain color.

pH meter is an electric device used to measure hydrogen-ion activity (acidity or alkalinity) in solution. Fundamentally, a pH meter consists of a voltmeter attached to a pH-responsive electrode and a reference (unvarying) electrode.

The use of the pH scale is one practical way of quantitatively determining how acidic something is. If the pH of a solution is less than 7, it is acidic. If the pH is 7, the solution is neutral and if the pH is greater than 7,the solution is basic.

pH of following items:

Lemon juice – about 2

Orange juice – 3.3 to 4.2

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Cold drink – 3.7 – 5.7

Water – 7

Dish washing soap – 8.7 – 9.3

Bathing soap – 9 – 10

Shampoo – 3.5 – 9.0

Toilet cleaning liquid – 1 – 3

Draw and Learn

Refer to fig. 6.1

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Theme 7 Hydrogen

Quick check

1. a. Henry Cavendish
   b. Antoine Lavoisier
   c. Magnesium
   d. Electrolysis

Quick check

2. a. $2Na + H_2 \rightarrow 2NaH$
   b. $H_2 + I_2 \rightarrow 2HI$
   c. $CuO + H_2 \rightarrow Cu + H_2O$
   d. $H_2 + S \rightarrow H_2S$
   e. $Zn + 2NaOH + 2H_2O \rightarrow Na_2ZnO_2 + H_2$

Exercise

Objective Questions

A. 1. a
   2. b
   3. b
   4. c

B. 1. Nebulae
   2. Potassium
   3. Electrolysis
   4. lose
   5. Copper

C. 1. False
   2. True
   3. True
   4. False
   5. True

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6. False
7. True
8. True

D. 1. $2Na + H_2O \rightarrow 2NaOH + H_2$
2. $Mg + 2HCl \rightarrow MgCl_2 + H_2$
3. $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$
4. $2Al + 2NaOH + 2H_2O \rightarrow 2NaAlO_2 + 3H_2$
5. $3Fe + 4H_2O \leftrightarrow Fe_3O_4 + 4H_2$

Subjective Questions

1. a. **Displacement reaction –** A reaction in which the more reactive element displaces the less reactive element from a compound is called displacement reaction.

For example**:** magnesium displaces copper from copper sulphate.

$$Mg\ (s) + CuSO_4 \rightarrow MgSO_4\ (aq) + Cu\ (s)$$

b. **Electrolysis –** Electrolysis is the decomposition of a compound by the passage of electricity. When electricity is passed through water using platinum electrodes, hydrogen gas is liberated at the cathode (negative electrode) while oxygen gas is liberated at the anode (positive electrode).

$$2H_2O \rightarrow 2H_2 + O_2$$

c. **Oxidation –** Oxidation reactions involve addition of oxygen or any other electronegative substance and removal of hydrogen or any electropositive substance from any of the substances participating in the reaction.

The reaction between copper oxide and hydrogen is a redox reaction. In this reaction, copper oxide is reduced to copper and hydrogen oxidises into water. It can be represented as:

$$CuO + H_2 \rightarrow Cu + H_2O$$

d. **Reduction –** Reduction reactions involve addition of hydrogen or any other electropositive substance and removal of oxygen or any electronegative substance from any of the substances participating in the reaction.

Reduction of lead oxide by hydrogen:

$$PbO + H_2 \rightarrow Pb + H_2O$$

2. a. Hydrogenation is a process by which unsaturated compounds present in vegetable oils are converted to saturated solid vegetable fats (e.g., vanaspati ghee). It is done in the presence of a metal catalyst such as finely powdered nickel, platinum or palladium at 200°C and 5 atmospheric pressure.

b. When compressed hydrogen is used in a fuel cell, its only byproducts are **electricity, clean water and heat**, meaning that hydrogen-powered vehicles and equipment release zero pollutants or greenhouse gases into the air.

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c. Hydrogen is a good reducing agent. It reduces oxides of metals such as copper, lead and iron into their respective metals.

d. Hydrogen burns in oxygen producing a very high temperature. The oxy-hydrogen flame is used for welding and cutting metals as it has a temperature of about 2800°C.

e. Hydrogen is an essential element for life. It is present in water and in almost all the molecules in living things. Hydrogen is a very useful element. It is used to make ammonia for fertilizers, refining metals, and methanol for making artificial material like plastics.

3. The metal reactivity series is a list that arranges the metals in decreasing order of their reactivity. The metal reactivity series has been prepared with respect to hydrogen. The displacement of hydrogen from water, acids and alkalis is based on the position of the metal in the reactivity series of metals. From the activity series, we can infer the following:

- Metals that are at the top of the series are very reactive, they displace hydrogen from cold water and dilute acids easily, and sometimes very vigorously.
- Metals that are lower in the series but above hydrogen, displace hydrogen from water and dilute acids less vigorously.
- Metals below hydrogen in the metal reactivity series usually do not displace hydrogen from water or dilute acids.

4. a. Manganese (Mn) and magnesium (Mg) react with very dil. HNO_3 to evolve H_2 gas.

b. Aluminium (Al) and magnesium (Mg) will displace hydrogen from dilute acids.

c. Mercury (Hg) and silver (Ag) will not displace hydrogen from dilute acids.

d. Sodium (Na) and Potassium (K) give hydrogen with cold water. e. Iron and zinc

5. Hydrogen cannot be prepared by using conc. HNO_3 because HNO_3 decomposes into [O] (nascent oxygen). This oxygen reacts with hydrogen to form water.

$$HNO_3 \rightarrow NO + H_2O + [O]$$

$$[O] + H_2 \rightarrow H_2O$$

6. Sodiun is oxidised by water to sodium hydroxide.

$$2Na + 2H_2O \rightarrow H_2 + 2NaOH$$

7. **Refer to acivity 1**

8. Physical properties of hydrogen

- Hydrogen is a colourless, odourless and tasteless gas.
- Hydrogen gas is almost insoluble in water. 1000 mL of water can dissolve only 20 mL gas.
- Liquefaction of hydrogen gas is not easy. It can be liquefied under high pressure and by cooling it below –240°C.
- It is the lightest of all elements. It is also lighter than air.
- Certain metals such as gold, platinum and palladium readily take up large volumes of hydrogen at red-hot conditions. This is called occlusion or adsorption. Occlusion is the trapping of gas or liquid within the cavities in a solid or on its surface.

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9. Chemical properties of hydrogen

A. Combustion

- Hydrogen is a combustible gas. It burns in air with a blue flame and forms steam, which condenses to form water.
- Hydrogen burns in air with a 'pop' sound due to impurities present in it. However, it is a non-supporter of combustion.

B. Reaction with Metals

- Hydrogen gas combines with active metals such as sodium and potassium to form hydrides when heated at a temperature of about 300°C.

  $2Na + H_2 \rightarrow 2NaH$

C. Reaction with Non Metals

Hydrogen gas combines with nonmetals to form compounds under different conditions.

- It forms halides with chlorine, bromine and iodine.

  $H2 + Cl_2 \rightarrow 2HCl$

- Hydrogen combines with nitrogen to form ammonia.

  $N2 + 3H_2 \rightarrow 2NH_3$

D. Action on litmus solution

It is neutral to litmus solution, that is, neither acidic nor basic.

E. Reaction with metallic oxides

When hydrogen gas is passed over heated metal oxides such as copper oxide, lead oxide or tin oxide, it reacts with them to form the respective metal and water.

$PbO + H_2 \rightarrow Pb + H_2O$

10. Redox reactions are the reactions in which the oxidation and reduction reactions always occur simultaneously. The substance getting reduced in a chemical reaction is known as the oxidizing agent, while a substance that is getting oxidised is known as the reducing agent.

Examples of redox reaction: -

- $Na_2CO_3 \rightarrow Na_2O + CO_2$ – Decomposition reaction
- $CuSO_4 + Zn \rightarrow Cu + ZnSO_4$ – Metal displacement reaction
- $4Fe + 3O_2 \rightarrow 2Fe_2O_3$ – Combination reaction

11. The following are the uses of hydrogen:

- Hydrogen, being extremely light, was earlier used to fill balloons used in meteorology.
- The oxy-hydrogen flame is used for welding and cutting metals as it has a temperature of about 2800°C.
- It is used in the manufacturing of ammonia by Haber's process.
- It is used in the extraction of metals such as tungsten, copper, lead and tin from their oxides.

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- Liquid hydrogen is used as a rocket fuel. It is used along with liquid oxygen, which serves as the supporter of combustion.
- It is used in the hydrogenation of oils. Hydrogenation is a process by which vegetable oils which contain unsaturated compounds are converted to saturated solid vegetable fats (e.g., vanaspati ghee).
- Hydrogen is seen as the alternative for petrol in automobiles. This could be a solution to prevent pollution and to reduce our dependence on fossil fuels, which are limited.

12. Climate change is a serious issue becoming increasingly evident to much of the population. Rising CO_2 levels have directly contributed to the global warming phenomenon. Presently, there is an increasing need of a pollution free fuel to arrest the situation of global warming . An alternative fuel must be technically feasible, economically viable, easily convert to another energy form when combusted, be safe to use, and be potentially harmless to the environment. Hydrogen is the most abundant element on earth. Hydrogen is an energy carrier that can be used in internal combustion engines or fuel cells producing virtually no greenhouse gas emissions when combusted with oxygen. The only significant emission is water vapour. Hydrogen production and storage is currently undergoing extensive research. A solar-hydrogen system can provide the means of a totally emissions-free method of producing hydrogen.

Exemplar problem

1. Even though hydrogen is lighter than air it is not collected by downward displacement of air because of these reasons:
   a. Hydrogen gets oxidised when it is exposed to oxygen which makes it burn with a pale blue flame and the residue is water. This means that it mixes with oxygen.
   b. Downward displacement of air requires a gas that does not mix with air and is lighter than air. Hydrogen is lighter than air but mixes with air.It is collected over water because it is insoluble in water.
2. No, because calcium lies above hydrogen in metal reactivity series so calcium is more reactive than hydrogen so hydrogen cannot displace calcium from calcium oxide.
3. Metal M should be placed lower in series but above hydrogen.

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Theme 8 Water

Quick check

1. a. Neutral
   b. Melting point
   c. Boiling point
   d. Hydrogen, oxygen
   e. Metallic hydroxides

Quick check

2. a. Suspension – The mixtures in which particles are big enough that they can be seen with naked eyes are called suspension. The suspended particles of a suspension can be separated by filtration. Since, the solute particles are much larger than the pores of filter paper and cannot pass through. Some common examples of suspensions are milk of magnesia, finger paints, muddy water etc.
   b. Crystallisation – Crystallisation is a process in which pure solid is separated in the form of its crystals from a solution. For example, an impure sample of copper sulphate can be purified by the method of crystallisation. An impure sample of salt is dissolved in a small quantity of hot water to form a saturated solution. On cooling the saturated solution, the salt which is less soluble, crystallises out first leaving behind more soluble component in solution. The principle involved in crystallisation is that the less soluble substance crystallises out first on cooling the solution.
3. a. False
   b. True
   c. False
   d. True
   e. True

Exercise

Objective Questions

D. 1. d
   2. c
   3. d
   4. b
   5. b

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E. 1. Three fourth
   2. Water vapours
   3. Oxides, hydroxides
   4. Regelation
   5. Temporary

F. 1. False
   2. True
   3. False
   4. True
   5. True

Subjective Questions

1. Water occurs in three states—solid, liquid and gas. Water in the solid state, is present in the form of ice in glaciers and polar regions. In seas, oceans, rivers, lakes, wells and streams, water is present in the liquid state. In its gaseous state, water is present in the atmosphere in the form of water vapour.
2. Regelation is the phenomenon of melting under pressure and freezing again when the pressure is reduced. Thus when two pieces of ice are pressed together they form a single lump, regelation takes place. When the two ice cubes are pressed together, the melting point of ice is lowered, so they melt to form a thin layer of water (between them). On releasing the pressure, the water formed freezes because the decrease in pressure raises the freezing point. Hence the two cubes stick together.
3. Water is called the "universal solvent" because it is capable of dissolving more substances than any other liquid. This is important to every living thing on earth. It means that wherever water goes, either through the air, the ground, or through our bodies, it takes along valuable chemicals, minerals, and nutrients. It is water's chemical composition and physical attributes that make it such an excellent solvent. Water molecules have a polar arrangement of oxygen and hydrogen atoms—one side (hydrogen) has a positive electrical charge and the other side (oxygen) had a negative charge. This allows the water molecule to become attracted to many other different types of molecules. Water can become so heavily attracted to a different compound, like salt (NaCl), that it can disrupt the attractive forces that hold the sodium and chloride in the salt compound together and, thus, dissolve it.
3. a. Suspension – The mixtures in which particles are big enough that they can be seen with naked eyes are called suspension. The suspended particles of a suspension can be separated by filtration. Since, the solute particles are much larger than the pores of filter paper and cannot pass through. Some common examples of suspensions are milk of magnesia, finger paints, muddy water etc.

   b. Colloids – The mixture in which the size of the solute particles is small but big enough to scatter the beam of light is called colloids. The colloidal particles in colloidal solution in activity cannot be separated from water by filtration. This is because the size of colloidal particles is small and they can pass through the pores of the filter paper. Some common examples of colloids are whipped cream, mayonnaise, milk, butter, gelatin and jelly.

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c. Solution – In solutions, the size of the particles is too small to be visible. The particles of true solutions cannot be separated from water by filtration. This indicates that particles of true solution are extremely small. In a true solution, such as sugar solution, the dissolved particles of sugar are extremely small and easily pass through pores of filter paper. Some common examples are Salt solution and sugar solution.

5.

Hard Water	Soft Water
It is rich in minerals	Contains very few elements
Soap is not so effective	Soap is easily effective
No foam and lather from soaps	Bubbly lather from soaps
Leaves spots on the washed dishes after they are dried	Does not leave any spots on dishes after they are dried
Contains minerals like magnesium and calcium	Contains sodium ion
Example: Groundwater like deep wells	Example: Rainwater
Hair and skin become dry	Hair and skin become soft

6. **PROPERTIES OF WATER**

a. **Nature and Structure** – Pure water is a colourless, odourless and tasteless compound. Water is chemically made up of two atoms of hydrogen and one atom of oxygen. It has the molecular formula H_2O. The pure water is chemically neutral so pH is 7.

b. **Freezing Point** – Water freezes at 0°C and forms ice. Therefore, we say that the freezing point of water is 0°C. The freezing point of water decreases with increase in pressure. Ice melts at 0°C.

c. **Boiling Point** – The boiling point of water is 100°C at atmospheric pressure (1 atmosphere). At this temperature, water starts boiling and changes to steam. The boiling point of water increases with the increase in pressure.

d. **Neutral Behaviour** – Water (pure) does not change the colour of red or blue litmus. This shows that water is neutral, that is, neither acidic nor basic.

e. **Electrolysis of Water** – Water decomposes to form hydrogen and oxygen gases, when an electric current is passed through it.

f. **Reaction with metals** – Metals such as sodium, calcium, magnesium, aluminium and zinc react with water to form oxides and hydroxides. This reaction involves liberation of hydrogen gas.

$$2Na + 2H_2O \rightarrow 2NaOH + H_2$$

g. **Reaction of Water with Metallic oxides** – Metallic oxides dissolve in water to form metallic hydroxides, for example, sodium oxide dissolves in water to form sodium hydroxide.

$$NaO + H_2O \rightarrow 2NaOH$$

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h. **Reaction of Water with non metallic oxides** – Non-metallic oxides such as carbon dioxide and sulphur dioxide dissolve in water to form acidic solutions.

$CO2 + H_2O \rightarrow H_2CO_3$

7. Some examples to show water is an universal solvent are -
   - In our body water mixes with the blood and transports nutrients to different parts of our body. In plants, water acts as a medium to transport nutrients from the soil to the different parts of the plants. Therefore, we can say that this is possible due to this property of water.
   - Water can dissolve many solid substances such as salt and sugar, which helps to prepare the solutions of these substances in water.
   - Water has dissolved minerals that are needed for the growth of teeth and bones in human beings.
   - Water contains dissolved oxygen and carbon dioxide in it, which helps aquatic animals and plants to survive. Aquatic animals breathe in the dissolved oxygen in water for respiration and aquatic plants use the dissolved carbon dioxide in water for the process of photosynthesis.
8. Refer to activity 3.
9. For certain salts, a fixed amount of water is necessary to obtain their crystals from their aqueous solution. This water is called water of crystallisation. It helps in the formation of crystals of the salt and gives shapes to their crystals. In crystals, salt and water are combined in a definite ratio.
10. Methods to remove permanent hardness –
    - **By adding washing soda** – Washing soda is used to remove permanent hardness of water. Adding washing soda (sodium carbonate) converts chlorides and sulphates into insoluble carbonates. These insoluble carbonates are removed by filtration.

$$\underset{\text{Calcium sulphate}}{CaSO_4} + \underset{\text{Sodium carbonate}}{Na_2CO_3} \rightarrow \underset{\text{Calcium carbonate}}{CaCO_3} + \underset{\text{Sodium sulphate}}{Na_2SO_4}$$

$$\underset{\text{Magnesium sulphate}}{MgSO_4} + \underset{\text{Sodium carbonate}}{Na_2CO_3} \rightarrow \underset{\text{Magnesium carbonate}}{MgCO_3} + \underset{\text{Sodium sulphate}}{Na_2SO_4}$$

    - **Distillation** – Temporary and permanent hardness, both, can be removed by the method of distillation. The water obtained after distillation is called distilled water. It is the purest form of water.

Exemplar problem

1. Compared to land, water takes longer to heat and cool. Thus, oceans heat up and cool down slower than the land around them. Cool sea breeze keeps the coastal areas cooler in summer and warmer in winter than places far away from the sea.
2. Water isn't inherently blue; our eyes and brains *interpret* water as being blue because water molecules absorb reds, greens, oranges, and yellows—thus leaving only shorter-wavelength blues and violets unabsorbed to reflect back for our eyes to see. This effect is intensified with the ocean, because there's such a high concentration of water molecules reflecting blue wavelengths back at us.

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Theme 9 Carbon and Its Compounds

Quick check

1. a. Carbon
   b. Allotropes
   c. Diamond
   d. Graphite
   e. Glass, rocks

Quick check

2.

Diamond	Graphite
It is the hardest substance known	It is black-grey crystalline solid and soft to touch
It is bad conductor of electricity	It is good conductor of electricity
It has huge three dimensional octahedral network structure.	It has two dimensional sheet like structure.
It a has very high melting point.	It has low melting point.

Quick check

3. a. Carbonisation
   b. Anthracite
   c. Destructive distillation
   d. Coke
   e. Coal tar

Quick check

4. a. **Activated Charcoal** is used as a catalyst. It separates mixture of noble gases.
   b. **Bone charcoal** is used as decolourising agent in manufacturing sugar, honey etc.
   c. **Gas carbon** is used to prepare electrodes.
   d. **Lamp black** is used for making printer ink, carbon paper and shoe polishes.

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Exercise

Objective Questions

A. 1. c
2. b
3. a
4. c
5. a

B. 1. Octahedral
2. Weak
3. Peat, lignite
4. Upward
5. Sodium bicarbonate solution, sulphuric acid

C. 1. False
2. True
3. False
4. False
5. False

Subjective Questions

1. Here are some compounds of carbon we use in our everyday life
   - Fuels such as petrol, diesel, LPG and kerosene.
   - Fibres such as cotton, silk, wool, nylon and rayon.
   - Many medicines are compounds containing carbon.
   - Paints and varnishes.
   - The nutrients present in our food such as proteins, fats, carbohydrates and vitamins are carbon compounds.

2.

Organic carbon compounds	Inorganic carbon compounds
Hydrocarbons like methane, propane etc.	Carbon dioxide
Sugar like glucose and sucrose	Carbonates like sodium carbonate, calcium carbonate etc.

3. The property of an element to exist in more than one form in the same physical state is called allotropy. These different forms of an element in the same physical state are called allotropes of that element. They have different chemical and physical properties.

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4. Two uses of graphite are given below:
   - Graphite is used for making electrodes that are used in electric furnaces and cells.
   - It is used to make crucibles to heat metals, as it is a good conductor of heat and has a high melting point.

   Two uses of carbon are given below:
   - Diamond is a precious stone. Due to its brilliance and sparkling effect, it is used as a gem in jewellery.
   - Due to its hardness, diamond is used to cut glass and drill hard rocks.
5. The products obtained after the destructive distillation of coal are coke, coal tar, coal gas and liquor ammonia.
   - Coke is used as reducing agent in metallurgy
   - Coal tar: It is a highly viscous brown or black liquid used in preparing medicines, dyes and cosmetics.
   - Coal gas: It is used as an industrial and household fuel.
6. Refer to activity 3
7. Carbon monoxide gas can be prepared in laboratory by heating formic acid or oxalic acid with conc. H_2SO_4.
8. Carbon monoxide has been called 'the silent killer' because, being colourless, odourless, tasteless and non-irritating, it is very difficult for people to detect.
9.

Diamond	Graphite
It is the hardest substance known	It is black-grey crystalline solid and soft to touch
It is bad conductor of electricity	It is good conductor of electricity
It has huge three dimensional octahedral network structure.	It has two dimensional sheet like structure.
It a has very high melting point.	It has low melting point.

10. Coal is formed by the slow decomposition of fossils remains of dead and decayed forest vegetation buried deep inside the earth about 300 million years ago. In swampy areas, plants are submerged in water. Over millions of years, successive layers of sediments covered them. The buried plant matter, in the absence of oxygen, was subjected to high temperature and pressure. The extreme temperature and pressure caused the decayed plant matter to transform into coal. The carbon content of coal increases and the amount of impurities decrease with each successive stage. This process of formation of coal is known as carbonisation. Carbonisation results in a variety of coal. There are four different types of coal, classified on the basis of varying percentage of carbon in them. They are peat, lignite, bituminous and anthracite.

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Uses of coal

- Anthracite coal is used as a fuel in steam engines and furnaces. Peat and lignite are used as industrial fuels.
- Bituminous coal, which burns with a smoky flame, is used in the production of coal tar.
- Coal is used in the preparation of artificial or synthetic petrol, water gas, producer gas, coal gas, coke and liquor ammonia.

11. Animal charcoal (or Bone charcoal) is obtained by destructive distillation of bones. It Contains about 10-12% of amorphous carbon.

    Sugar Charcoal is obtained by heating sugar in the absence of air. Sugar charcoal is the purest form of amorphous carbon.

    Wood Charcoal is obtained when wood is heated strongly in a very limited supply of air,. This process is called destructive distillation of wood. The volatile products are allowed to escape. Charcoal is a black, porous and brittle solid. It is a good adsorbent.

12. Carbon monoxide enters the atmosphere by several ways like:
    - Carbon monoxide is formed as a result of photochemical reactions in the troposphere.
    - It is one of the products of volcanic eruption and is found in the earth's mantle, under pressure in the molten volcanic rock.
    - Natural or man-made fires such as forest and bush fires and burning of crop residues result in the formation of CO.
    - The incomplete combustion of fossil fuels in the internal combustion engines of automobiles, generators and other household appliances is a major source of carbon monoxide production.

13. Methods to reduce the entering of CO in atmosphere
    - Keep gas appliances properly adjusted.
    - Avoid incomplete burning of fossil fuels.
    - Afforestaion can cool atmosphere and reduce forest fires.
    - Crop residues should not be burnt.
    - Use proper fuel in kerosene space heaters.

    Effects of global warming:
    - Global warming causes melting of glaciers which leads to the rise in sea levels and will cause floods.
    - Global warming leads to irregular weather patterns and hence disturbance in the ecological balance.
    - Due to global warming there is an increase in the rate of evaporation which leads to drought in some areas.
    - Global warming may lead to extinction of many species of plants and animals.

14. Properties of fullerenes:
    - Fullerenes are neither very hard nor very soft.

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- It is soluble in organic solvents.
- They are bad conductors of electricity.
- Fullerenes have specific gravities in between 1.8 to 2.1.
- In nature, fullerenes are found in very small quantities in interstellar dust and soot.
- Carbon nanotubes are long tubes of strongly bonded carbon atoms and hence have high tensile strength. Carbon nanotubes are good conductors of electricity.

Uses of fullerene:

- Fullerenes are used as insulators.
- They are wonderful lubricants as the balls can roll between the surfaces.
- They are used as catalysts.
- Some fullerenes are used as superconductors.
- They find use as semiconductors in flat screen televisions and computers.
- Fullerenes are used for treatment of HIV/AIDS.

15. Wood charcoal on being heated at around 900°C in absence of air produces activated charcoal. It has more surface area and is a more effective adsorbent. Activated charcoal is used as a catalyst and in the separation of a mixture of noble gases.

Exemplar problem

1. a. The outermost shell of each carbon atom has four electrons. In diamond, these electrons are shared with four other carbon atoms to form very strong chemical bonds resulting in an extremely rigid tetrahedral crystal. It is this simple, tightly-bonded arrangement that makes diamond one of the hardest substances on Earth.

   b. While there are strong covalent bonds between carbon atoms in each layer, there are only weak forces between layers. This allows layers of carbon to slide over each other in graphite.

2. Burning of Angethi produces many harmful gases such as Carbon dioxide and Carbon monoxide etc.

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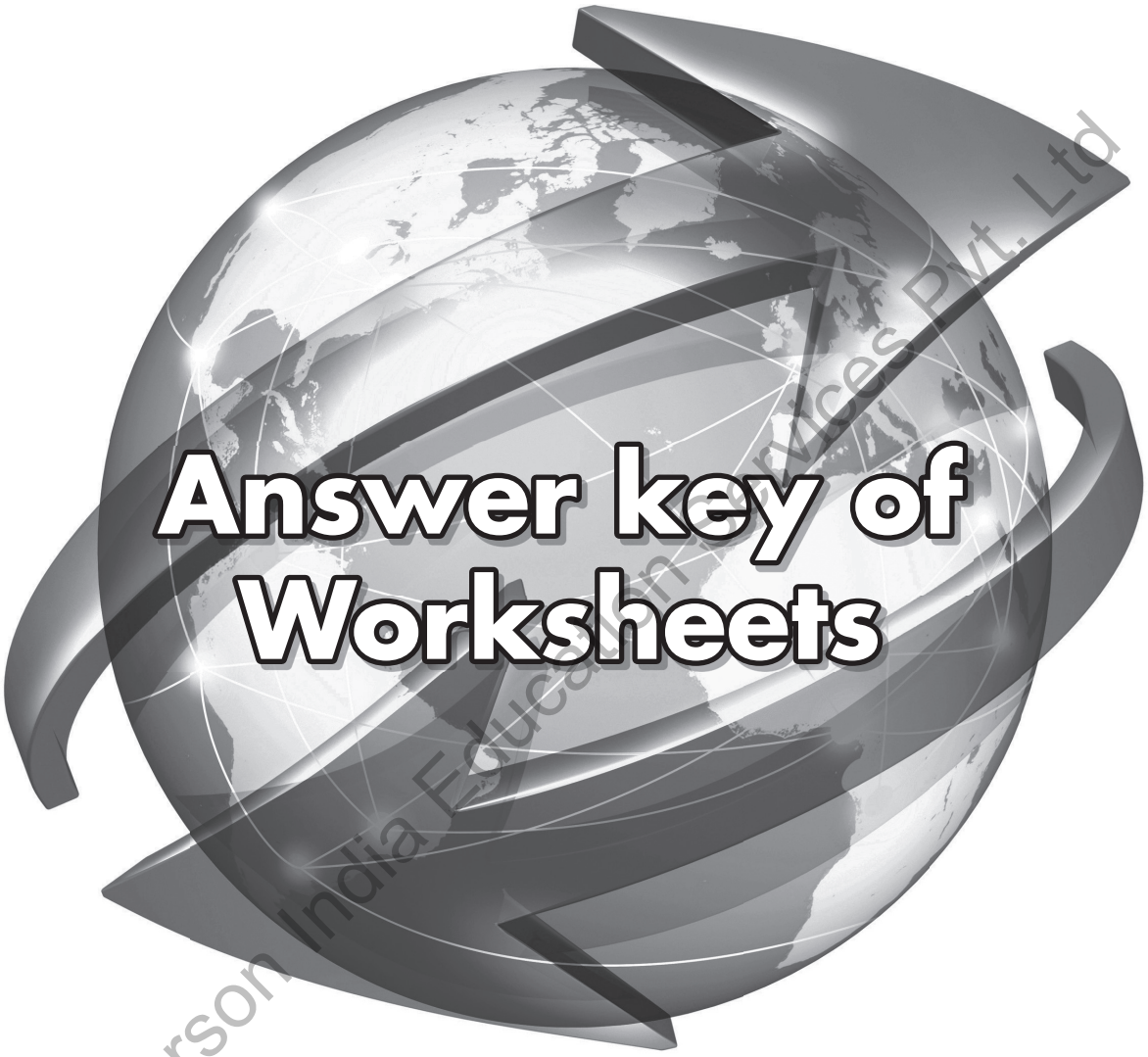

Answer key of Worksheets

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Theme 1 Matter

Worksheet 1

A. Fill in the blanks.

1. water
2. Solids, liquids
3. velocity
4. kinetic
5. Plasma

B. Define the following:

1. Anything which occupies space (volume) and has mass and can be perceived by our senses is called matter.
2. The empty or vacant space between particles of matter is called interparticle space.
3. The ability of a gas to spread and occupy the whole available space, irrespective of other gases present in its surroundings, is called diffusion.

C. State which of the three states of matter have:

i. gases and liquids

ii. solids

iii. solids

iv. gases

v. gases

D. Answer the following questions.

1. The particles in solids are very closely packed, the interparticle space between them is very less and the interparticle attraction is very strong. Hence, the movement of atoms in solid is about their own position.
2. The postulates of kinetic theory of matter are:
   i. Particles of all kinds of matter have empty spaces between them. This empty or vacant space between particles of matter is called interparticle space. The interparticle space is maximum in gases and minimum in solids.

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ii. There is a force of attraction between particles constituting the matter. The strength of this force varies from one kind of matter to another. The interparticle attraction decreases from solid to liquid and liquid to gas.

iii. Particles of matter are always in state of continuous motion. They possess energy of motion called kinetic energy.

3. On increasing the temperature, the speed of all types of particles increases. The phenomenon of motion of particles is common to all kinds of matter. The particles of matter are continuously moving in all directions. The kinetic energy is directly proportional to the temperature. As the temperature increases, the kinetic energy of the particle increases and the particle moves faster.

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Worksheet 2

A. State whether the following are true or false.

1. false
2. true
3. true
4. false
5. false

B. Give reasons for the following:

1. When heated, the attraction between particles of solid is overcome and they break free and escape the surface of the solid and turn into vapours.
2. When heat is applied to particles of matter, the kinetic energy possessed by the particles increases and so does the space, therefore they move more rapidly and freely.

C. Give one word for the following:

1. vaporisation
2. melting point
3. combustion
4. boiling point
5. liquids

D. Answer the following questions.

1. When a solid is heated, the kinetic energy increases and the particles vibrate faster about their mean position. At a particular temperature the particles gain enough energy to overcome the interparticle forces of attraction and change into the corresponding liquid state. The change of a solid into its liquid state is called melting.
2. On application of pressure the interparticle space decreases and the particles move closer to one another. This in turn results in the increase of interparticle forces of attraction and the gas condenses to its liquid state. On further increase of pressure, the molecules come so close that the liquid gets solidified.
3. The law of conservation of mass states that mass is neither created nor destroyed in chemical reactions.

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To show that the law of conservation of mass is valid for a chemical change:

Take a H-shaped tube and in its two limbs take the sodium sulphate solution and the barium chloride solution separately. Measure the mass of the shaped tube along with the two solutions with the help of a digital balance. Now mix the two solutions and allow them to react. The reaction taking place is:

$$Na_2SO_4 + BaCl_2 \rightarrow 2NaCl + BaSO_4$$

After some time measure the mass of the H-shaped tube with the products. You will find that there is no change in the mass, i.e., initial mass of the H-shaped tube with the reactants is the same as the final mass of the H-shaped tube with the products.

Conclusion: Total mass of chemicals present before a chemical reaction remains unaltered after a chemical reaction. Thus, in a chemical reaction mass is neither created nor destroyed.

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Physical and Chemical Changes

Worksheet 1

A. Fill in the blanks.

1. man-made
2. Desirable
3. exothermic
4. endothermic
5. periodic

B. Choose the correct answer.

1. c
2. a
3. d
4. a
5. b

C. State whether the following are true or false.

1. true
2. true
3. false
4. false
5. true

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Physical and Chemical Changes

Worksheet 2

A. Fill in the blanks.

1. temporary, reversible
2. Evaporation
3. iron oxide
4. chemical
5. Louis Pasteur

B. Give reasons for the following:

1. This is because only the physical condition and appearance changes but not the chemical properties.
2. Iron rust has a different composition from iron and has new properties, which cannot be reversed. Magnetization of iron is a temporary change, which does not change the composition of iron.
3. This is because; curdling of milk is an irreversible process as paneer cannot be changed back to milk. The final products are also different from the starting material and hence it is a chemical change.

C. Classify the following as physical and chemical changes.

1. physical
2. chemical
3. physical
4. chemical
5. physical
6. physical
7. physical
8. chemical
9. chemical
10. physical

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D. Answer the following questions.

1. Physical change: There is no addition or deduction of energy during physical change. A chemical change is accompanied by a transfer of energy, usually in the form of heat. Heat may be absorbed or evolved in a chemical change.
2. A physical change can be reversible and irreversible. For example, wax melts on heating. This molten wax solidifies again on cooling. Evaporation, as water vapour turns into water on cooling. Some irreversible physical changes are tearing of paper and cutting of vegetables.
3. Chemical changes are changes in which the chemical composition of a substance alters, resulting in the formation of a new substance.

   Characteristics of a chemical change:

   - In a chemical change, one or more new substances are formed.
   - The composition and properties of the new substance(s) formed during a chemical change are different from those of the parent substance(s).
   - Chemical changes are usually permanent and irreversible in nature. The original substance cannot be obtained back by simple physical methods.
4. Fermentation is the chemical breakdown of a substance by bacteria, yeast or other micro organisms, typically involving the release of carbon dioxide and heat. The fermentation of dosa batter, idli and bread dough are irreversible processes and hence a chemical change.

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Theme 3 Elements, Compounds and Mixtures

Worksheet 1

A. Fill in the blanks.

1. atoms, molecules
2. John Dalton
3. carbon monoxide
4. emulsion
5. handpicking

B. Give two examples for each of the following:

1. helium, neon
2. water, salt
3. silicon, germanium
4. sulphur, bromine
5. sand in water, chalk in water
6. steel, bronze

C. Define the following:

1. Compounds are substances that are made up of two or more kinds of atoms (elements) chemically combined in a fixed proportion.
2. Mixtures are substances made up of two or more pure substances (elements or compounds) physically mixed in any proportion.
3. Winnowing is the process by which the lighter constituents of a mixture can be separated from the heavier ones.

D. Name the method of separation of each of the following mixtures.

1. sieving
2. magnetism
3. winnowing
4. hand picking
5. sublimation
6. solvent extraction

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E. Answer the following questions.

1. A typical compound always contains the same elements in a fixed proportion. Water always contains hydrogen and oxygen in the ratio 2: 1, regardless of the state or source of water. The properties of a compound are different from the properties of its constituent elements. The properties of water are different from its constituent elements, hydrogen and oxygen. Hydrogen gas is inflammable and oxygen is requisite for combustion. However, water is, on the contrary, a liquid which is non- inflammable and is used as an extinguisher.
2. In homogeneous mixtures, the composition is uniform and the properties are same throughout, whereas in heterogeneous mixtures, the composition is non-uniform and properties vary throughout the mixture. Air is a homogeneous mixture of several gases. The perfume we use to smell is a homogeneous mixture of many chemicals. Alloys such as steel and bronze, which are mixtures of two or more metals, are also homogeneous mixtures. Soil, vegetable soup and muddy water are examples of heterogeneous mixtures.
3. Zinc cannot be broken down any further to substances which can exist independently, while zinc sulphide is made of two elements zinc and sulphur which can exist independently.
4. In solvent extraction process, one of the solid components is soluble in a liquid and the other is not. It depends upon the relative solubility of the components of the mixture. A mixture of common salt and sand can be separated by this method. The mixture of common salt and sand is taken in a beaker and water is added to it. The solution is stirred with a stirrer and it is observed that the common salt dissolves in water but the sand does not. Now, by decantation, the salt solution can be separated from the sand.

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Worksheet 2

A. Choose the correct answer.

1. c
2. d
3. b
4. a
5. b

B. State whether the following are true or false.

1. true
2. true
3. false
4. false
5. false

C. Unscramble the following words:

1. sedimentation
2. churning
3. impurities
4. mixture

D. Answer the following questions.

1. We have seen droplets of water falling from the clouds during the rain. This is because water vapour, on reaching the cooler region high up in the air, change back into water droplets. Such a change is called condensation. Many of these water droplets join together to form clouds. When the clouds become too heavy with a large number of droplets, the water falls down to the ground as rain.
2. Filtration is used for separating fine insoluble solid particles from the liquid. In this method, the mixture is allowed to pass through a filter. A filter paper is a device with fine pores. The insoluble particles are retained by the filter paper and is called the residue and the clear liquid called the filtrate passes through it.

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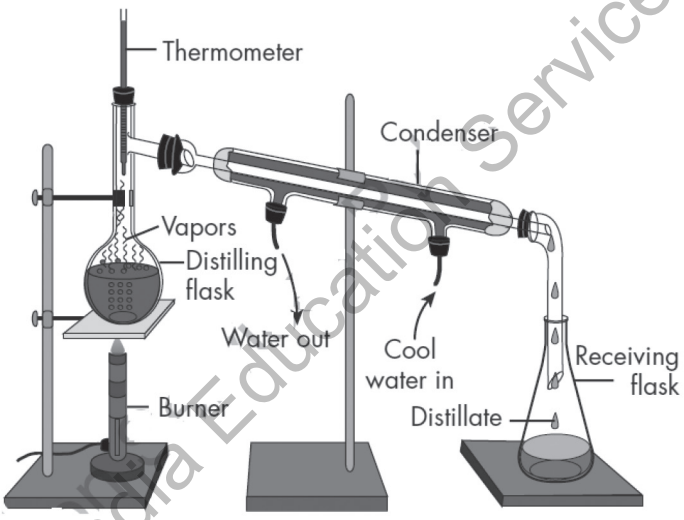
3. Centrifugation is a mechanical process in which finely suspended solid components present in a liquid are separated by spinning the mixture at a very high speed. This process is used to separate the components that are not easily separated by filtration due to the smaller size of the solute particles. The particles that settle down are called the sediments and the liquid above the sediment is called the supernatant liquid. This process is used in dairy farms for separation of cream from milk.
4. The principle used in froth floatation is the preferential wetting of the ore by the oil and the impurities by water. The ores which are lighter like the sulphides of lead and zinc are purified by this method. The impure ore is mixed with water in a huge tank and pine oil and ethyl xanthate are added. When compressed air is bubbled through this mixture from the bottom of the tank, a huge mass of froth is formed. This froth consists of the lighter ores and the impurities which are wet by water settle down in the tank. The froth is skimmed off and the impurities are removed from the ore.

E. Draw and label the diagram showing the process of distillation.



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Theme 4 Atomic Structure

Worksheet 1

A. Fill in the blanks.

1. element
2. cathode
3. J. J. Thomson
4. protons
5. 1837

B. Match the following:

1. c
2. d
3. a
4. e
5. b

C. Define the following:

1. The nucleus is the central dense core of the atom consisting of neutrons and protons. They are collectively called nucleons. The total mass of an atom is concentrated in the nucleus considering electrons have negligible mass. The nucleus of an atom is positively charged due to the presence of positively charged protons.
2. The total number of protons present in the nucleus of an atom is called its atomic number. It is equal to the number of electrons present in a neutral atom. It is represented by 'Z'. For example, atomic number of helium is 2, oxygen is 8 and nitrogen is 7.
3. Neutrons are the neutral particles in the nucleus that also accounts for the mass of the atom. The mass of a neutron (1.675×10^{-27} kg) is almost equal to that of a proton (1.672×10^{-27} kg). Neutrons carries no charge.

D. Answer the following questions.

1. To account for the arrangement of electrons and protons within the atom. In 1904, Thomson put forward a model of an atom known as the plum pudding model. According to this model, an atom consists of a positively charged sphere in which the negatively charged electrons are uniformly embedded, thus making the atom electrically neutral. As this structure resembled a

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pudding, it was called the plum pudding model. Thomson's model could explain the electrical neutral behaviour of an atom.

2. On the basis of his observations through Alpha scattering experiment, Rutherford made the following conclusions:
   a. As most of the alpha particles pass through the gold foil undeflected, an atom consists of predominantly empty space.
   b. The deflection of a small number of alpha particles suggests that the positive charge in an atom is not uniformly distributed. It is concentrated in a small core, which he called nucleus.
   c. The fact that only a few alpha particles bounced back suggests that the heavy positively charged nucleus occupies a very small fraction of the total volume of the atom.
3. The main postulates of modern atomic model are as follows:
   a. An atom consists of three sub-atomic particles—electron, proton and neutron.
   b. An atom is divided into two parts—nucleus and the empty space that surrounds the nucleus called extra-nuclear region.
   c. The nucleus is the central dense core of the atom consisting of neutrons and protons.They are collectively called nucleons. The total mass of an atom is concentrated in the nucleus considering electrons have negligible mass. The nucleus of an atom is positively charged due to the presence of positively charged protons.
   d. In extra-nuclear region, electrons revolve around the nucleus in circular fixed paths called orbits. The orbits are fixed imaginary paths associated with a fixed amount of energy.
   e. An atom is electrically neutral. The total number of protons present is equal to the total number of electrons, thus balancing the total charge of the atom.
4. The total number of protons present in the nucleus of an atom is called its atomic number. It is equal to the number of electrons present in a neutral atom. It is represented by 'Z'. For example, atomic number of helium is 2, oxygen is 8 and nitrogen is 7.

Atomic number (Z) = Number of protons (p)

The total number of protons and neutrons present in the nucleus of an atom is called its mass number or atomic mass. It is represented by 'A'.

Mass number (A) = Number of protons (p) + Number of neutrons (n)

In the atomic notation of an element, the mass number is often indicated as a superscript.Thus, the atomic notation of an element X is given by:

$$^{A}_{Z}X$$

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Worksheet 2

A. Choose the correct answer.

1. c
2. a
3. b
4. d
5. b

B. State whether the following are true or false.

1. true
2. true
3. false
4. true
5. false

C. Write the atomic number and electronic configuration of following elements:

	Atomic Number	Electronic Configuration
1.	8	2, 6
2.	19	2, 8, 8, 1
3.	10	2, 8
4.	17	2, 8, 7
5.	11	2, 8, 1
6.	12	2, 8, 2

D. Answer the following questions.

1. An atom is too small to be weighed, hence the mass of an atom of an element is calculated by comparing it with the mass of a standard atom. The standard atom chosen for this purpose is carbon-12. The mass of an atom of an element compared to $1/12^{th}$ of the mass of a carbon-12 atom is called its atomic mass. Its unit is atomic mass unit (amu) or unified atomic mass unit (u). For example, the atomic mass of oxygen is 16 u and that of hydrogen is 1 u.

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2. Isotopes are the atoms of the same element having the same atomic number but different mass number due to the difference in the number of neutrons. Isotopes have the same chemical properties but different physical properties. Hydrogen has three isotopes; protium ($^{1}H_{1}$), deuterium ($^{2}H_{1}$) and tritium ($^{3}H_{1}$).
3. Valency is the combining capacity of an element. In other words, valency of an element is the number of hydrogen atoms which combine with it. In hydrogen chloride, one atom of chlorine combines with one atom of hydrogen, thus the valency of chlorine is one. In water, one atom of oxygen combines with two atoms of hydrogen and hence the valency of oxygen is two. Similarly in ammonia (NH_3). and methane (CH_4) the valency of nitrogen and carbon are three and four respectively. Noble gases or inert gases have two (duplet) or eight (octet) electrons in their valence shell and hence they are stable.
4. Radicals are groups of atoms which behave as a single unit and bear a charge on them. They are usually two or more non-metals that collectively accept or donate electrons and becomes positively or negatively charged in the process.

E. Complete the following table.

Name of Element	Symbol	Atomic Number	Mass Number	No. of Protons	No. of Electrons	No. of Neutrons
Lithium	Li	3	7	3	3	4
Carbon	C	6	12	6	6	6
Nitrogen	N	7	14	7	7	7
Aluminium	Al	13	27	13	13	14
Silicon	Si	14	28	14	14	14

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Theme 5 Language of Chemistry

Worksheet 1

A. Fill in the blanks.

1. atomic mass
2. Cr
3. valence
4. 1
5. negative, anion
6. water

B. Match the following:

1. c
2. a
3. e
4. b
5. d

C. Define the following:

1. Ions are atoms or groups of atoms which are formed by the loss or gain of electrons.
2. A radical is an atom or groups of atoms of different elements (behaving as a single unit) having a positive or a negative charge.
3. A chemical reaction is the process by which the composition and properties of the original substance change, resulting in the formation of new substance.

D. Give the symbols and valencies of the following radicals:

Elements	Symbol	Valency
a. Hydroxide	OH^-	–1
b. Chloride	Cl^-	–1
c. Carbonate	CO_3^{2-}	–2
d. Ammonium	NH_4^+	1
e. Nitrate	NO_3^-	–1

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E. Write the molecular formulae for the following compounds and name the elements present.

1. NaCl Elements present are sodium and chlorine
2. H_2SO_4 Elements present are hydrogen, sulphur, oxygen
3. HNO_3 Elements present are hydrogen, nitrogen, oxygen
4. AlN Elements present are nitrogen, aluminium
5. K_2SO_4 Elements present are sulphur, oxygen, potassium

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Worksheet 2

A. Choose the correct answer.

1. c
2. d
3. c
4. b
5. a

B. State whether the following are true or false.

1. true
2. false
3. false
4. false

C. Balance the following chemical equations.

1. $4Fe + 3O_2 \rightarrow 2Fe_2O_3$
2. $C_2H_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$
3. $4H_2SiCl_2 + 4H_2O \rightarrow H_8Si_4O_4 + 8HCl$
4. $10Na + 2NaNO_3 \rightarrow 6Na_2O + N_2$
5. $4C + S_8 \rightarrow 4CS_2$
6. $N_2 + 3H_2 \rightarrow 2NH_3$
7. $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$
8. $4NH_3 + 3O_2 \rightarrow 2N_2 + 6H_2O$

D. Answer the following questions.

1. A chemical equation is a symbolic representation of a chemical reaction. In a chemical equation, symbols and formulae are used to represent the reactants and products. The following steps are followed while writing a chemical equation.
   i. Write the symbols or formulae of the reactants on the left-hand side, separated by the plus (+) sign.

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ii. Write the symbols or formulae of the products on the right-hand side, separated by the plus (+) sign.

iii. Separate the reactants and products with an arrow (→) symbol. The arrow indicates the direction of the reaction.

2. The law of conservation of mass in a chemical reaction states that matter can neither be created nor destroyed. It implies that the total mass of the substances that react or undergo change must be equal to the total mass of the substances obtained after the chemical change. This is possible only if each element has equal number of atoms on both sides of the equation. The equations consisting of equal number of atoms of each element on both the sides are called balanced equations. For example:

$$2Mg + O_2 \rightarrow 2MgO$$

3. Conditions that limit the chemical reactions:

   Light: Some chemical reactions require the presence of light energy. Changes that take place in the presence of light are called photochemical reactions. Photosynthesis in plants occurs only in the presence of sunlight. Similarly, hydrogen combines with chlorine in the presence of sunlight to form hydrogen chloride. Thus, the chemical equation should convey the information related to the requirement of light.

   Pressure: Certain reactions take place only under pressure. For example, ammonia is manufactured from nitrogen and hydrogen gases at a very high pressure of 200-900 atm. Thus, the data of this high amount of pressure needed is essential.

   - Catalyst: Some reactions are carried out in the presence of a catalyst that speeds up the reactions. A chemical substance, which alters the speed of a reaction without itself undergoing any permanent change is called a catalyst. The change in the rate of a chemical reaction due to the participation of a catalyst is called catalysis. Thus, if a catalyst is used in a reaction, then it should be mentioned.

4. Some chemical reactions proceed in both directions, that is, not only they move in the forward direction to produce the products but also move in the backward direction to produce the reactants back. These reactions are known as reversible chemical reactions. In such reactions, instead of using a single arrow, a double arrow should be used.

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Theme 6 Chemical Reactions

Worksheet 1

A. Fill in the blanks.

1. products
2. photochemical
3. calcium hydroxide
4. alkalis
5. decomposition

B. Name the following:

1. synthesis reaction
2. catalyst
3. oxides
4. amphoteric
5. sulphur trioxide

C. State whether the following are true or false.

1. true
2. true
3. false
4. false
5. false

D. Complete the following reactions and name the type of reactions.

1. NH_4Cl combination reaction
2. $PbCO_3$ decomposition reaction
3. CuO thermal decomposition
4. 2NaCl electrolytic decomposition
5. $2NO_2$ photochemical decomposition
6. $Al_2(SO_4)_3$ decomposition reactions to form oxides

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Worksheet 2

A. Choose the correct answer.

1. c
2. d
3. b
4. a

B. State whether the following are true or false.

1. true
2. false
3. false
4. true
5. true

C. Define the following:

1. Reactions in which two compounds in their aqueous solution react to form two new products by interchanging their radicals or ions are called double decomposition reaction.
2. The reactions in which an acid reacts with a base to form salt and water only are called neutralization reactions.
3. A reaction in which a more reactive element displaces a less reactive element from its compound is called a displacement reaction.

D. Classify the following reactions as displacement, reduction, precipitation and neutralization. Also, balance the equations.

1. Displacement reaction
2. Precipitation reaction
3. Precipitation reaction
4. Neutralisation reaction
5. $2KOH + H_2SO_4 \rightarrow K_2SO_4 + H_2O$ Neutralisation reaction
6. Reduction reaction

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Theme 7 Hydrogen

Worksheet 1

A. Fill in the blanks.

1. Henry Cavendish
2. water
3. nebulae
4. electropositive
5. acids, alkalis
6. Electrolysis

B. Complete the following equations.

1. $2K + 2H_2O \longrightarrow 2KOH + H_2\uparrow$
2. $2Na + 2H_2O \longrightarrow 2NaOH + H_2\uparrow$
3. $Mg + 2H_2O \xrightarrow{slow} Mg(OH)_2 + H_2\uparrow$
4. Metal + Water (Steam) $\longrightarrow$ Metallic Oxide + hydrogen gas

C. Explain how hydrogen is produced from the following along with equation.

1. Electrolysis of water is the cheapest method to obtain hydrogen gas on a large scale. Pure water does not conduct electricity. It is acidified by adding a few drops of sulphuric acid, which makes it a conductor. When electricity is passed through this water using platinum electrodes, hydrogen gas is liberated at the cathode (negative electrode) while oxygen gas is liberated at the anode (positive electrode).

$$2H_2O \rightarrow 2H_2 + O_2$$

2. Active metals displace hydrogen from dilute acids (HCl and H_2SO_4). Metals such as magnesium, zinc and iron react with dilute hydrochloric or sulphuric acid to form their respective salts and hydrogen gas.

$$Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2\uparrow$$

3. The reaction of metals such as aluminium, zinc, lead or tin with hot concentrated solutions of alkalis such as caustic soda (NaOH) or caustic potash (KOH) liberates hydrogen gas.

$$Zn + 2NaOH \rightarrow Na_2ZnO_2 + H_2\uparrow$$

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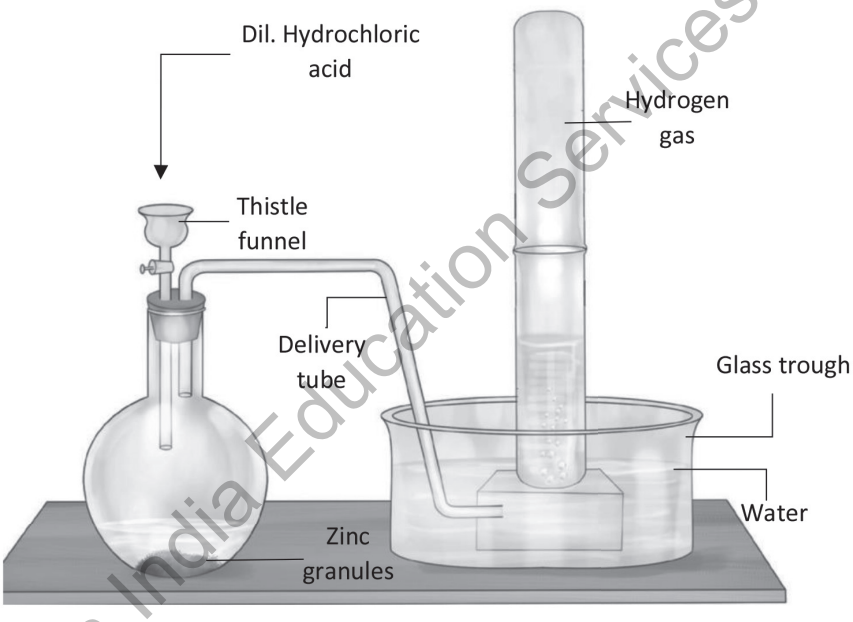
D. Answer the following questions.

1. A reaction in which the more reactive element displaces the less reactive element from a compound is called displacement reaction. Sodium, Calcium and Potassium are three metals that displaces Hydrogen by reacting with cold water at room temperature.
2. The metal reactivity series is a list that arranges the metals in decreasing order of their reactivity. Gold, Silver and Platinum are less reactive than Hydrogen.
3. Take some zinc granules in a flat-bottom flask. Close it with a two-holed rubber cork. Insert a thistle funnel through one hole and a delivery tube through the other. Insert the other end of the delivery tube into the beehive shelf kept in a trough of water. Fill the gas jar with water and invert it over the beehive shelf. Pour dilute hydrochloric acid into the flask through the thistle funnel. Also, add a small amount of copper sulphate solution. A reaction takes place between zinc and dilute hydrochloric acid and hydrogen gas is liberated. The gas can be collected by the downward displacement of water.



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Theme 7 Hydrogen

Worksheet 2

A. Choose the correct answer.

1. c
2. a
3. c
4. b
5. d

B. State whether the following are true or false.

1. false
2. true
3. true
4. false
5. true

C. Balance the following chemical equations.

1. $2Na + H_2 \rightarrow 2NaH$
2. $H_2\uparrow + Cl_2 \rightarrow 2HCl$
3. $3H_2 + N_2 \rightarrow 2NH_3$
4. $CuO + H_2 \rightarrow Cu + H_2O$
5. $PbO + H_2 \rightarrow Pb + H_2O$
6. $H_2 + S \rightarrow H_2S$

D. Answer the following questions.

1. i. Hydrogen is a colourless,odourless and tasteless gas.
   ii. Hydrogen gas is almost insoluble in water. 1000 mL of water can dissolve only 20 mL gas.
   iii. Liquefaction of hydrogen gas is not easy. It can be liquefied under high pressure and by cooling it below –240°C.
   iv. It is the lightest of all elements. It is also lighter than air.

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v. Certain metals such as gold, platinum and palladium readily take up large volumes of hydrogen at red-hot conditions.

2. i. Hydrogen is a combustible gas. It burns in air with a blue flame and forms steam, which condenses to form water.

   ii. Hydrogen gas combines with active metals such as sodium and potassium to form hydrides when heated at a temperature of about 300°C.

   iii. Hydrogen reacts with non-metals under different conditions like it forms halides with chlorine, bromine and iodine, ammonia with nitrogen etc.

   iv. It is neutral to litmus solution,that is neither acidic nor basic.

   v. When hydrogen gas is passed over heated metal oxides such as copper oxide, lead oxide or tin oxide, it reacts with them to form the respective metal and water.

3. Redox reactions involve transfer of electrons between atoms, ions or radicals taking part in a chemical reaction. In these reactions, oxidation and reduction reactions occur at the same time.

   Oxidation reactions involve addition of oxygen or any other electronegative substance and removal of hydrogen or any electropositive substance from any of the substances participating in the reaction.

   Reduction reactions involve addition of hydrogen or any other electropositive substance and removal of oxygen or any electronegative substance from any of the substances participating in the reaction.

   The substance that brings about oxidation by itself undergoing reduction is called an oxidising agent. It gains electrons during the reaction. The substance that brings about reduction by itself undergoing oxidation is called a reducing agent. It loses electrons during the reaction.

4. i. Hydrogen, being extremely light, was earlier used to fill balloons used in meteorology.

   ii. Hydrogen burns in oxygen producing a very high temperature. The oxy-hydrogen flame is used for welding and cutting metals as it has a temperature of about 2800°C.

   iii. It is used in the manufacturing of ammonia by Haber's process. The compound ammonia is required to manufacture fertilisers and nitric acid.

   iv. It is used in the extraction of metals such as tungsten, copper, lead and tin from their oxides.

   v. It is used in the manufacture of hydrogen chloride gas and hydrochloric acid.

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Theme 8 Water

Worksheet 1

A. Fill in the blanks.

1. 90%
2. 7, neutral
3. hydrogen, oxygen
4. hydrochloric acid
5. carbonic acid

B. Match the following:

1. e
2. a
3. d
4. c
5. b

C. Write the balanced equation for the following reactions.

1. $3Fe + 4H_20 \longrightarrow Fe_3O_4 + H_2$
2. $2Na + 2H_2O \longrightarrow 2NaOH + H_2$
3. $CO_2 + H_2O \longrightarrow H_2CO_3$
4. $Mg + 2H_20 \xrightarrow{fast} Mg\ (OH)_2 + H_2$
5. $CaO + H_2O \longrightarrow Ca(OH)_2$

D. Answer the following questions.

1. Water is a transparent liquid. However, water in the seas appears bluish- green in colour due to the reflection of light. The colour can also be due to the presence of green aquatic plants. Transparent water allows significant transmission of light, which helps marine plants to make their food by photosynthesis.
2. When pressure is applied on two ice cubes placed together, the melting point of ice or freezing point of water decreases, and the ice cubes start melting to form water. As soon as the pressure is removed, the water freezes back to form ice and the two ice cubes join. This phenomenon is called regelation.

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3. Aim: To determine the boiling point of water.

   Procedure: Take some water in a beaker. Place the beaker on a tripod stand, on wire gauze and dip a thermometer in it. Boil the water in the beaker using a Bunsen burner. Keep heating the water till it starts boiling and changing into steam. Note the temperature at which the water starts boiling.

   Observation: As the temperature reaches 100°C, water starts boiling. Once the water starts boiling, the temperature remains constant.

   Conclusion: The boiling point of pure water is 100°C

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Theme 8 Water

Worksheet 2

A. Choose the correct answer.

1. c
2. a
3. b
4. b
5. d

B. Match the following:

1. d
2. e
3. a
4. c
5. b

C. Give balanced equations for the following conversions.

1. $Na_2CO_3 + CaSO_4 \rightarrow CaCO_3 + Na_2SO_4$
2. $Mg(HCO_3)_2 \rightarrow MgCO_3 + H_2O + CO_2$
3. $MgSO_4 + Na_2CO_3 \rightarrow MgCO_3 + Na_2SO_4$

D. Answer the following questions.

1. A solvent is a substance in which another substance can dissolve. Water has a unique property to dissolve almost everything. It can dissolve solids such as salt and sugar; liquids such as honey and milk and gases such as oxygen and carbon dioxide in it. Water is, therefore, called as universal solvent.
2. Crystallisation is a process in which pure solid is separated in the form of its crystals from a solution. For example, an impure sample of copper sulphate can be purified by the method of crystallisation. An impure sample of salt is dissolved in a small quantity of hot water to form a saturated solution. On cooling the saturated solution, the salt which is less soluble, crystallises out first leaving behind more soluble component in solution. The principle involved in crystallisation is that the less soluble substance crystallises out first on cooling the solution.

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3. There is always a limit to the amount of the solute that can be dissolved in a given amount of solvent at a particular temperature. The solution becomes saturated with the solute at this upper limit and it is normally, not possible to dissolve any more solute in the solvent. Such a solution is called saturated solution. However, solubility changes with change in temperature and pressure. It is possible to prepare solutions where the amount of solute is more than that it can hold at that temperature. This kind of a solution is called supersaturated solution.
4. Silica gel is hygroscopic in nature that has tiny pores to adsorb and hold moisture. Packets of silica gel are commonly found in new bottles, leather products, medicines, electronic items and also in some food products. These packets absorb moisture from the atmosphere and prevent growth of mould and fungus, thus reducing spoilage.
5. Water contains a number of dissolved salts and minerals. When these salts are present in very small quantities in water, it is called soft water. In this water, soaps or detergents form lather easily. Sometimes, these minerals and salts are present in water in such a large quantity that soaps or detergents form a thick precipitate called scum instead of forming lather. This makes the removal of dirt difficult. Such water is called hard water.

   Methods of removing hardness of water:

   i. By adding washing soda: Washing soda is used to remove permanent hardness of water. Adding washing soda (sodium carbonate) converts chlorides and sulphates into insoluble carbonates. These insoluble carbonates are removed by filtration.

   ii. By ion-exchange method: Another method to remove the hardness of water is to pass it through a column of ion exchange resins where calcium and magnesium ions get replaced by sodium ions. This converts hard water into soft water.

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Theme 9 Carbon and Its Compounds

Worksheet 1

A. Fill in the blanks.

1. paints, varnishes
2. minerals
3. octahedral, 3.5 g/cm^3
4. carbon dioxide
5. peat
6. Sugar

B. Name the following:

1. graphite
2. coal
3. wood charcoal
4. anthracite
5. fullerenes

C. Choose the correct answer.

1. b
2. d
3. b
4. a
5. c

D. Give reasons for the following:

1. Diamond and graphite are carbon elements, their chemical properties are same i.e., they form CO_2 on burning but differ in physical state. Hence, they are allotropic modifications.
2. Graphite is used to make the black lead of pencils as it is soft, lustrous and leaves a black mark on paper.
3. Coal is formed by the slow decomposition of fossils remains of dead and decayed forest vegetation buried deep inside the earth about 300 million years ago. Therefore, coal is called fossil fuel.

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E. Answer the following questions.

1. Structure of diamond: It is formed when pure carbon present in the earth's mantle is subjected to high temperature and enormous pressure. A carbon atom has four valence electrons. Each carbon atom shares its valence electrons with four neighbouring carbon atoms in a tetrahedral manner. This is the basic unit, which is repeated throughout the crystal, forming a three-dimensional octahedral structure. The bonds between the carbon atoms in diamond are very strong and rigid. This structure makes diamond very hard.

   Structure of graphite: Graphite has a layered structure. It consists of sheets or layers of carbon atoms joined together by weak forces of attraction. The layers can, therefore, slip over the other layers. Therefore, graphite is a soft and slippery substance, and hence a good lubricant.

2. The buried plant matter, in the absence of oxygen, was subjected to high temperature and pressure. The extreme temperature and pressure caused the decayed plant matter to transform into coal. The carbon content of coal increases and the amount of impurities decrease with each successive stage. This process of formation of coal is known as carbonisation. The first step of coal formation begins with peat. It is light brown in colour and the youngest variety of coal. In the next step peat gets converted into brown coloured lignite. Lignite transforms to produce bituminous coal which is the most abundant variety of coal. Anthracite is the final stage of coal and is called hard coal.

3. Uses of the following:

   a. Diamond:

      i. Due to its brilliance and sparkling effect, it is used as a gem in jewellery.

      ii. Diamond is used to cut glass and drill hard rock.

   b. Coal:

      i. Anthracite coal is used as a fuel in steam engines and furnaces. Peat and lignite are used as industrial fuels.

      ii. Bituminous coal is used in the production of coal tar.

   c. Wood charcoal:

      i. It is mainly used as a domestic fuel.

      ii. It is also used as a reducing agent in metallurgy.

   d. Soot:

      i. It is used for making printer's ink, carbon paper and shoe polishes.

      ii. It is used to make kajal.

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Carbon and Its Compounds

Worksheet 2

A. Fill in the blanks.

1. calcium carbonate
2. acidic, red
3. Dry ice
4. Magnesium
5. Foam-type

B. State whether the following are true or false.

1. true
2. false
3. false
4. true
5. false

C. Give a balanced equation for the following conversions:

1. $Ca(HCO_3)_2 + 2HNO_3 \rightarrow Ca(NO_3)_2 + 2CO_2 + 2H_2O$
2. $Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$
3. $2NaHCO_3 + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O + CO_2$
4. $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$
5. $2Mg + CO_2 \rightarrow 2MgO + C$
6. $ZnO + CO \rightarrow Zn + CO_2$

D. Give reasons for the following:

1. Lime water turns milky when carbon dioxide is passed through it due to the formation of insoluble calcium carbonate.
2. Soda-acid fire extinguisher is not useful in fires caused by oil as the water being heavier than oil sinks down the oil which makes this method ineffective in controlling such fires.
3. Carbon monoxide is considered highly poisonous as it combines with haemoglobin in the blood of a human body. It decreases the oxygen carrying capacity of blood.

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E. Answer the following questions.

1. Carbon dioxide is added to the atmosphere by:
   a. Burning of carbon compounds like wood, petroleum. Etc.
   b. Death and decay of organic matter for million years.
   c. Exhaling carbon dioxide during respiration in living organisms.
2. In the liquid carbon dioxide extinguishers, a cylinder usually made up of steel is filled with carbon dioxide gas under extreme pressure. Due to this pressure, carbon dioxide is present in liquid form. When the fire extinguisher is used liquid carbon dioxide shoots out in the form of dry ice. Carbon dioxide displaces oxygen, thus removing the element supporting combustion. Also, the carbon dioxide that comes out of the extinguisher is very cold and cools the fuel as well.
3. Global warming is defined as the increase in the average temperature of the earth's atmosphere. The enhanced greenhouse effect is leading to a massive change in our environment.

   Effects of global warming:

   i. Global warming causes melting of glaciers which leads to the rise in sea levels and will cause floods.
   ii. Global warming leads to irregular weather patterns and hence disturbance in the ecological balance.
   iii. Due to global warming there is an increase in the rate of evaporation which leads to drought in some areas.
   iv. Global warming may lead to extinction of many species of plants and animals.
4. Incidences that result in carbon monoxide poisoning:
   - Carbon monoxide is often produced in homes when fires are lit, especially during winters in cold countries, where windows are shut and there is no free airflow. Sleeping in such rooms can result in carbon monoxide poisoning.
   - Engines of motor vehicles, other gasoline-powered tools, generators, heaters and cooking equipment also produce carbon monoxide. Using such equipment in an enclosed area where there is no airflow can cause serious carbon monoxide poisoning.

   Treatment for carbon monoxide poisoning:

   A patient suffering from carbon monoxide poisoning should be given a plentiful supply of oxygen. This can be done by:

   - bringing out the patient in open air.
   - giving artificial respiration using carbogen, which is a mixture of 95% oxygen and 5% carbon dioxide.

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