ICSE CHEMISTRY 6

CHAPTER 1. Introduction to Chemistry

TEST YOURSELF

A. 1. theory **2.** Mortar; pestle **3.** sodium chloride
4. chlorine/potassium permanganate **5.** magnesium **6.** magic
7. alchemists **8.** nutritional chemists **9.** Natural
10. Artificial/synthetic

B. 1.–(e) **2.**–(a) **3.**–(b) **4.**–(c) **5.**–(d)

C. 1.

Test tube	Boiling tube
A test tube is a thin glass tube with an open top and a rounded U-shaped bottom and is used to hold materials for small scale laboratory tests.	A boiling tube is a special type of test tube that is made specifically for boiling chemicals.

2.

Pipette	Burette
A pipette is a long and narrow glass tube which is used to measure and dispense a known volume of a liquid.	A burette has volumetric graduation on its full length and a stopcock at the bottom. It is used to dispense an accurate (known) amount of a liquid.

3.

Test-tube holder	Test-tube stand
A test-tube holder is a type of iron tongs, with a wooden handle. It is mainly used for holding a test tube when it is being heated.	A test-tube stand is a plastic or a wooden stand. It is used to place clean test tubes when they are not in use and also when some liquid chemicals are kept in them.

4.

Separating funnel	Thistle funnel
A separating funnel, made of glass, has a stopper at the top and a stopcock at the bottom. It is used to separate two liquids of different densities.	A thistle funnel is made of a long glass tube with a round-shaped section at the top. It is used to add liquid to an existing set-up of apparatuses.

5.

Natural fibres	Synthetic fibres
The fibres obtained from plants and animals are called natural fibres.	The fibres that are prepared by a number of processes using material of petroleum origin are called synthetic fibres.

D. 1. Chemistry is the branch of science concerned with the study of different kinds of substances, their nature and properties, and how they react or interact with each other.

2. A systematic manner in order to solve a problem is called scientific method. It involves the following steps:

- The first step is identifying a problem.
- The next step is the collection of data and information from various sources like scientific literature, journals and other available materials.
- Based on the information collected, a prediction is made which is called hypothesis.
- Many experiments are conducted to test the hypothesis.
- If the results of the experiments do not agree with the hypothesis, more and more experiments are conducted, or another hypothesis is formulated. When the results of the experiments agree with the hypothesis, the hypothesis becomes a theory.

3. (a) Chemistry plays a major role in improving the crop-yield. Different types of fertilisers, used by farmers to increase the crop-yield, are also gifts of chemistry.

Pesticides and insecticides, used to kill or control the pests and insects in fields and warehouses, are all products of chemistry.

(b) Chemistry is used in food industry to prepare new foodstuffs and also to maintain their purity. For example, vegetable oil on treating with hydrogen changes to margarine which is more like butter and can be spread easily. Preservatives used in foodstuffs are also chemicals. These are added to increase the shelf life of stored food.

4. While working in a chemistry laboratory, it is important to take safety precautions. These are as follows:

- Never work alone in the laboratory. It is always better to work under the guidance of an experienced instructor.
- Use safety goggles while working in the lab to prevent any chemical from entering your eyes.
- Wear a lab coat to protect your clothes from chemicals.
- You should know the location and use of the fire extinguisher.
- Never taste any chemicals.

5. (a) A tripod stand is used in laboratories to support various apparatuses like beakers, conical flasks, etc., when not in use or while heating.

(b) A wire gauze is used to spread out heat evenly to heat an object uniformly.

(c) Mortar and pestle are used to crush, grind and also to mix solid substances.

(d) A watch glass is used to evaporate liquids and to hold solids while weighing.

(e) A test tube is used to hold materials for small scale laboratory tests.

6. The substance that cannot be decomposed by the action of bacteria is called nonbiodegradable substance, e.g., conveyer belts, combs, toothbrushes, etc.

7. Disadvantages of natural fibres are as follows:

(a) Natural fibres are difficult to maintain.

(b) They cannot be drip dried.

(c) They get creased easily.

(d) They are more expensive.

(e) They are less elastic.

8. Two uses of nylon are as follows:

(a) Nylon is used in making toothbrushes.

(b) It is used in making fishing nets.

E. 1. False; The first step involved in scientific method is **identifying a problem.**

2. True

3. False; A chemical called **citric acid** is present in lemons and oranges.

4. False; **Hydrochloric acid** is present inside our stomach helps in the digestion of food.

5. False; A **tripod stand** is a three-legged equipment made of cast iron.

6. True

7. True

8. False; All magics **cannot** be explained on the basis of scientific reasons.

F. 1. Boiling tubes and conical flasks are made of borosilicate glass because these are used for heating or boiling some chemicals. Borosilicate glass is heat resistant.

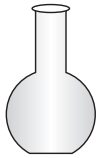
2. Liquids can be poured easily from a beaker as it has a thick lip at the top.

G. 1. (b) **2.** (c) **3.** (c) **4.** (c) **5.** (d) **6.** (b) **7.** (a) **8.** (b)

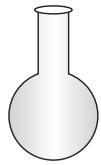
H. 1. 1. Glass rod 2. Funnel 3. Iron stand 4. Beaker

2. (a)

Conical flask

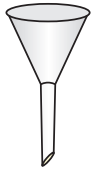


Flat-bottomed flask



Round-bottomed flask

(b)



Funnel

Thistle funnel

Separating funnel

THINK ZONE

- I would prefer to heat potassium permanganate in a boiling tube as it is made up of borosilicate glass which is heat resistant.
- Delivery tubes are made from glass tubes as glass tubes are hollow and can be bent by heating on a Bunsen burner. A glass rod is not hollow; it is a cylindrical rod and can be used for stirring liquids.
- This is because glass does not react with chemicals.

CHAPTER 2. Elements and Compounds

Check Point 1

1. Element **2.** Bromine **3.** Mercury **4.** Metalloid **5.** Protons
6. Energy shells

Check Point 2

1. kalium **2.** hydrogen; oxygen **3.** Ca; C
4. carbon; hydrogen; oxygen

Check Point 3

1. True **2.** False **3.** True **4.** True

TEST YOURSELF

A. 1. atoms **2.** element **3.** Sodium; calcium **4.** Mercury **5.** Neon; argon **6.** Au **7.** Water **8.** molecule **9.** Ozone **10.** Sodium; chlorine

B. 1. Atom: Everything around us is made up of tiny particles called atoms. In other way, we can define atoms as the tiny particles which cannot exist independently but take part in chemical reaction.

2. Element: An element is a pure substance made up of similar kinds of atoms and cannot be broken down into simpler substances.

3. Molecule: When atoms combine together, they form a molecule. In other way, we can define molecule as the smallest particle that exists independently and can take part in chemical reaction.

4. Metalloid: An element having common properties of metals and nonmetals is called metalloid, e.g., silicon, boron, etc.

5. Compound: Compounds are formed when two or more elements are combined chemically in a fixed ratio by mass.

C. 1.

Compound	Element
When two or more elements combine chemically in a fixed ratio by mass, they form a compound.	A pure substance that is made up of only one kind of atoms and cannot be broken down into simpler substances is called an element.

2.

Element	Atom
A pure substance that is made up of only one kind of atoms and that cannot be broken down into simpler substances is called an element.	Atom is the smallest particle of matter that cannot exist independently.

3.

Molecule of an element	Molecule of a compound
A molecule of an element is formed when similar kinds of atoms combine together.	A molecule of a compound is formed when two or more dissimilar atoms combine together.

D. 1. The substance which is made up of only one kind of atoms or molecules is called a pure substance, e.g., element and compound.

2. Pure substances are classified as elements and compounds on the basis of their uniform composition, definite properties, fixed MP and BP, etc.

3. The properties of a pure substance are as follows:

- A pure substance is made up of only one kind of atoms or molecules.

- A pure substance has a uniform composition and definite properties.
- A pure substance melts and boils at fixed temperatures, i.e., has fixed melting and boiling points.
- The components of a pure substance cannot be separated by simple physical methods.

4. The elements (nonmetals) which occur in gaseous state in air in traces are called noble gases, e.g., argon, helium, etc.

5. An atom is made up of three subatomic particles named electron, proton and neutron.

6. The fixed circular paths in which electrons move around the nucleus are called energy shells.

7. (a) **Monoatomic molecule:** Carbon (C) and helium (He)

(b) **Diatomic molecule:** Oxygen molecule (O_2) and hydrogen molecule (H_2)

(c) **Triatomic molecule:** Ozone molecule (O_3) and water (H_2O)

(d) **Tetraatomic molecule:** Phosphorus (P_4) and ammonia (NH_3)

8. The chemical formula of a compound represents the elements which make up the compound.

9. (a) Sodium (Na) and chlorine (Cl)

(b) Hydrogen (H), nitrogen (N) and oxygen (O)

(c) Nitrogen (N) and hydrogen (H)

(d) Calcium (Ca) and oxygen (O)

(e) Carbon (C), hydrogen (H) and oxygen (O)

10. On the basis of their arrangement, molecules are classified into five categories as given below:

(a) **Monoatomic molecule:** A molecule made up of only one atom is called monoatomic molecule, e.g., neon (Ne), argon (Ar), etc.

(b) **Diatomic molecule:** A molecule made up of two atoms is called diatomic molecule, e.g., H_2 and O_2.

(c) **Triatomic molecule;** A molecule made up of three atoms is called triatomic molecule, e.g., O_3 and CO_2.

(d) **Tetraatomic molecule:** A molecule made up of four atoms is called tetraatomic molecule, e.g., P_4 and H_2O_2.

(e) **Polyatomic molecule:** A molecule made up of many atoms is called a polyatomic molecule, e.g., S_8.

E. 1. False; A mixture is an **impure** substance.

2. False; Common salt is a **compound.**

3. True

4. True

5. False; H_2 represents **one molecule** of hydrogen.

F. 1. Iron; Iron is an element while others are compounds.

2. Nitrogen; Nitrogen is a nonmetal while others are metals.

3. Bromine; Bromine is a liquid nonmetal while others are gaseous nonmetals.

G. 1. As water is made up of two atoms of hydrogen and one atom of oxygen together, so, it is considered a compound.

2. As a molecule of oxygen is made up of two atoms of oxygen together, so, it is a diatomic molecule.

3. As aluminium is hard, ductile, malleable, nonbrittle, good conductor of heat and electricity, so, it is considered a metal.

H. 1. (c) **2.** (d) **3.** (a) **4.** (d) **5.** (c)

I. (a) Nucleus

(b) Protons and neutrons

(c) Electrons

THINK ZONE

- As copper metal is ductile and a good conductor of electricity, electric wires are made of copper metal.

CHAPTER 3. Mixtures

Check Point 1

1. Handpicking **2.** Threshing **3.** Winnowing

4. Magnetic separation **5.** Sieving

Check Point 2

1. evaporation **2.** tea strainer **3.** sedimentation

TEST YOURSELF

A. 1. homogeneous; heterogeneous **2.** heterogeneous

3. handpicking **4.** sediment **5.** sedimentation **6.** Evaporation

B. 1. Evaporation **2.** Centrifugation (or churning) **3.** Solute

4. Solvent **5.** Winnowing

C. 1. Sediment: A substance that settles at the bottom of a liquid is called sediment.

2. **Sedimentation:** The process of settling down of a solid at the bottom of a liquid is called sedimentation.
3. **Decantation:** The method of separating an insoluble solid component from a liquid or a mixture of two liquids which do not mix with each other is called decantation.
4. **Filtration:** The method of separating insoluble solid components from a liquid by passing the mixture through a filter is called filtration.
5. **Winnowing:** The method of separating husk from seed grains using wind is called winnowing.

D. 1. Differences between a compound and a mixture

Compound	Mixture
A compound is a pure substance formed by the chemical combination of two or more elements.	A mixture is an impure substance having two or more distinct chemical substances in any proportion.
The constituents of a compound cannot be separated by simple physical methods like filtration, evaporation, but can be separated by chemical methods like electrolysis.	The constituents of a mixture can be separated by simple physical methods like filtration, sieving, evaporation, etc.
A compound does not retain the properties of its constituent elements. The properties of a compound are entirely different from those of its constituent elements.	A mixture retains the properties of its constituents.
In a compound, the constituent elements are present in the fixed proportion by mass.	In a mixture, the constituents are not present in any fixed proportion. A mixture has a variable composition.
Energy is either absorbed or given out during the preparation of a compound.	No energy is absorbed or given out during the preparation of a mixture.
A compound melts at a fixed temperature.	A mixture does not melt at a fixed temperature.

2. Difference between residue and sediment

Residue	Sediment
A substance that remains in the filter after filtration is called residue.	A substance that settles at the bottom of a liquid is called sediment.

3. Differences between homogeneous and heterogeneous mixtures

Homogeneous mixture	Heterogeneous mixture
● In a homogeneous mixture, the components are mixed together uniformly.	● In a heterogeneous mixture, the components are not mixed together uniformly.
● The components do not have clear boundaries of separation.	● The components have clear boundaries of separation.
● All the components cannot be seen separately with the naked eye.	● The components can be seen separately with the naked eye.

E. 1. An alloy is a homogeneous mixture of two or more metals or a metal and a nonmetal.

2. The components of a mixture are separated for the following purposes (needs):

- To obtain two different but useful components of a mixture (e.g., butter is a useful component which is separated from milk by churning).
- To remove harmful components or impurities from a mixture (e.g., small pieces of stones and husk are separated from rice or *dal* before cooking).
- To remove useless components of a mixture (e.g., tea granules are separated from tea).

3. The process used to separate seed grains from stalk is called threshing.

4. In order to separate common salt from sea water, the sea water is trapped in shallow pits and is left in the sun for long. The sun's heat evaporates all the water leaving the salts behind. This mixture of salts is then purified to obtain common salt.

5. We separate impurities and bran from flour by sieving. This is because the size of the particles of bran and impurities is different from the size of flour. A suitable sieve can, therefore, be used to separate impurities and bran from flour.

6. We can separate a mixture of iron filings and common salt by using a magnet. Iron filings get attracted by a magnet whereas common salt does not.

7. Sugar can be separated from a mixture of sugar and water by the process of evaporation.

The mixture is heated in a china dish till all water evaporates. When water evaporates, sugar is left behind in the china dish.

F. 1. False; **Filtration** is the best method of separating tea granules from the prepared tea.

2. False; Husk can be separated from seed grains by **winnowing.**

3. False; Seeds and solid particles of pulp can be separated from fruit juice by **filtration.**

4. False; Iron can be separated from sugar by **magnetic separation method.**

5. True

G. 1. Filtration is a method of separating insoluble solid components from a liquid by passing them through a suitable filter. Since sugar dissolves completely in water, we cannot separate a mixture of sugar and water by filtration.

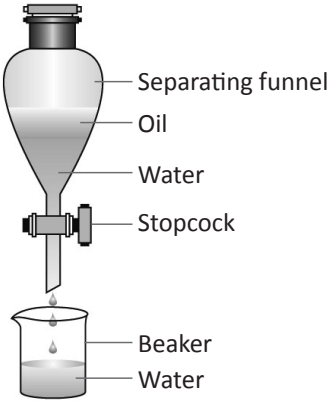
2. Filtration is a better method of separating an insoluble solid component as compared to decantation because during separation by decantation, some insoluble solid component of the mixture may get transferred while pouring/tilting the liquid component.

On the other hand, during filtration, the insoluble substance remains in the filter and the filtrate obtained is a clear liquid.

3. Handpicking can be used to separate only those mixtures in which the components are mixed in small quantities and can be easily picked up by hand.

H. 1. (c) **2.** (d) **3.** (a) **4.** (b)

I. 1.



2. **A**–Funnel; **B**–Beaker; **C**–Filtrate; **D**–Stand; **E**–Glass rod

This apparatus is used to separate the components of a mixture by filtration.

J. Do it yourself.

THINK ZONE

- Water is allowed to stand undisturbed in large water tanks so that most of the insoluble impurities settle down at the bottom of the tank by sedimentation.

- No, a mixture of sugar and salt cannot be separated by adding them to water and then filtering this mixture. This is because both salt and sugar are soluble in water. Filtration can only be used to separate insoluble solid components from a liquid by passing them through a suitable filter.

CHAPTER 4. Matter

Check Point 1

1. Solid **2.** Gas **3.** Gas **4.** Solid **5.** Intermolecular space

Check Point 2

1. False **2.** False **3.** True **4.** False

Check Point 3

1. ice **2.** substance **3.** irreversible **4.** chemical

TEST YOURSELF

A. 1. Air **2.** mass, space **3.** flow **4.** compressed **5.** Liquids, gases **6.** Liquids **7.** Liquids **8.** fusion or melting **9.** sublimation **10.** freezing point **11.** chemical **12.** physical; chemical **13.** irreversible **14.** reversible

B. 1. The process of changing of a substance from solid state into liquid state is known as fusion.

2. The constant temperature at which a solid melts to become a liquid is known as its melting point.

3. The process of changing of a liquid into a gas at a fixed temperature is called boiling.

4. The process of changing of a substance from solid state into gaseous state directly (without changing into the liquid state) and vice versa is called sublimation.

5. The intermixing of particles of two different types of matter on their own is known as diffusion.

6. A change which can be undone or reversed is called a reversible change.

7. A change which cannot be undone or reversed is called an irreversible change.

8. A change in which no new material is formed is called a physical change.

9. A change in which a new material is formed is called a chemical change.

C. 1. Differences between solids, liquids and gases

Property	Solid	Liquid	Gas
1. Arrangement of molecules	Very tightly packed	Loosely packed	Very loosely packed
2. Intermolecular forces of attraction	Very strong	Strong	Negligible
3. Intermolecular space	Negligible	Medium	Maximum
4. Shape	Fixed shape	No fixed shape; takes the shape of the container	No fixed shape; takes the shape of the container
5. Rigidity	Rigid	Not rigid	Not rigid
6. Volume	Definite	Definite	No definite volume
7. Ability to flow	Do not flow	Can flow	Can flow
8. Compressibility	Noncompressible	Can be compressed slightly	Can be compressed easily

2.

Boiling point	Condensation point
The fixed temperature at which a liquid starts changing into a gas is known as boiling point.	The fixed temperature at which a gas changes into a liquid is known as condensation point.

3.

Solidification	Liquefaction
The process of changing a liquid into a solid is called solidification.	The process of changing a gas into a liquid is known as liquefaction.

4.

Physical change	Chemical change
● No new substance is formed in a physical change.	● A new substance is formed in a chemical change.
● Most physical changes are reversible.	● Most chemical changes are irreversible.
● A physical change is usually accompanied by a change in shape, size or state.	● A chemical change is usually accompanied by a change in colour, release or absorption of heat or light, evolution of a gas, production of sound or change in smell.
● Most physical changes are temporary.	● Most chemical changes are permanent.

5.

Reversible change	Irreversible change
• A reversible change can be undone or reversed.	• An irreversible change cannot be undone or reversed.
• A reversible change is a temporary change.	• An irreversible change is a permanent change.

D. 1. On the basis of physical state, matter can be classified as solid, liquid and gas.

2. In solids, the molecules are very closely packed. They have fixed positions and can only vibrate about their fixed positions.

In liquids, the molecules are not very closely packed and their position is not fixed. They can move around easily.

In gases, the molecules are far apart and can move around freely in all directions.

3. On the basis of chemical constitution, matter can be classified as pure and impure substances. Pure substances comprise elements and compounds whereas impure substances comprise mixtures.

4. The properties of matter are as follows:

- Matter is made up of very tiny particles.
- Particles of matter attract each other.
- Particles of matter have space between them.

5. Aim: To show that particles of matter have space between them

Procedure: Half-fill a glass with water. Add a teaspoonful of salt to it and stir.

Observation: We will observe that the common salt disappears. This is because the particles of salt get distributed into the space between the particles of water.

Conclusion: This shows that particles of matter have space between them.

6. We can show that solids cannot be compressed with the help of the following activity:

Aim: To show that solids cannot be compressed

Procedure: Take a disposable syringe and close its nozzle by fixing a rubber cork. Remove the piston from the syringe and fill common salt or sand in it. Note the initial reading of the piston in the syringe. Now, press the syringe. Note the observation.

Observation: We will observe that the piston of the syringe does not move on applying pressure, showing the common salt/sand (both solids) does not get compressed on applying pressure.

Conclusion: We conclude that solids cannot be compressed.

7. We can change the state of matter by two ways as follows:

(a) By changing temperature

(b) By applying pressure

8. On applying pressure on a gas, it gets compressed, i.e., it gets pushed into smaller space. This means that a gas can be liquefied by applying pressure.

9. When we heat a solid, its particles gain energy and vibrate vigorously. The forces of attraction between the molecules are overcome. This enables the particles to move around faster. The intermolecular space increases and the solid changes into a liquid.

10. **Aim:** To compare the extent to which a solid, a liquid or a gas can be compressed

Procedure: Take three disposable syringes with pistons and label them as A, B and C. Close the nozzles of the syringes by fixing them into separate rubber corks.

Now, remove the piston from each syringe. Fill common salt or sand in syringe A and water in syringe B. In syringe C, just put back the piston without filling anything in it. Note the initial readings of the pistons in all the three syringes. Now, press the syringes one-by-one and observe what happens.

Observation: You will observe that:

- the piston of syringe A does not move on applying pressure.
- the piston of syringe B moves a little and a slight change in the reading is noticed.
- the piston in syringe C moves easily and a good change in reading is observed.

Conclusion: It can be concluded that solids cannot be compressed generally, liquids can be compressed to some extent and gases can be compressed easily.

11. Air is a matter as it has mass and occupies space. This can be shown with the help of following activities:

(a) **Aim:** To show that air has mass

Procedure: Place a deflated football on the left pan of a weighing balance. Now, gradually put some sand on the right pan of the balance until the two pans are balanced.

Now, remove the football from the pan. With the help of a pump, fill air into the football and place the inflated football again on the left pan of the balance. Note your observations.

Observation: The pans do not remain balanced. The pans

show that the inflated football has more mass than the sand put on the right pan.

Conclusion: Air has mass.

(b) **Aim:** To show that air occupies space

Procedure: Place a deflated balloon on a table. Mark the space occupied by the balloon with a chalk. Now, fill air into the balloon. Place it on the table and again mark the space occupied by the inflated balloon. Note your observations.

Observation: The space occupied by the inflated balloon is more than the space occupied by the deflated balloon.

Conclusion: Air occupies space.

Thus, it is clear that air has mass and occupies space. So, it is a matter.

12. To show the diffusion of a liquid in another liquid, we can perform the following activity:

Aim: To understand the process of diffusion

Procedure: Half-fill a beaker with water. Put a drop of red or blue ink carefully along the side of the beaker.

Observation: You will observe that the colour of ink spreads evenly in water.

Conclusion: The particles of ink intermix on their own with the particles of water. The particles of ink get into the spaces between the particles of water.

13. Ice melts on heating to form water. On cooling this water in a refrigerator, it changes back into ice. This is a reversible change.

14. When lemon juice is mixed with baking powder, a gas is evolved. Since a gas is evolved, i.e., a new substance is formed, the mixing of lemon juice with baking powder is a chemical change. Also, we cannot get back lemon juice and baking powder once they are mixed.

15. It is an irreversible change. We cannot get back idli batter after making idli.

16. Some conditions are necessary for occurring a chemical change. These are as follows:

Substances must be in contact: For occurring a chemical change, the substances must be in contact with each other.

Formation of a solution: Some chemical changes occur only when the substances that bring about a change are present in the form of a solution.

Presence of heat: For occurring some chemical changes, we require heat.

Presence of light: Some chemical changes like photosynthesis occur only in the presence of light.

Passing current: Water can be broken down into hydrogen and oxygen only when an electric current is passed through it.

Presence of a catalyst: Some chemical changes occur very slowly. In order to increase the speed of a chemical change, a catalyst is used.

17. On adding dilute hydrochloric acid to zinc granules, bubbles of a gas are seen coming out. Two new substances are formed, i.e., zinc chloride (which remains soluble in the solution) and hydrogen gas (which is tested by bringing a burning matchstick near the mouth of the test tube, thus, a 'pop' sound is heard). This change can be represented as follows:

Zinc + Hydrochloric acid $\rightarrow$ Zinc chloride + Hydrogen

18. The characteristics of a chemical change are as follows:

(a) Release or absorption of energy in the form of heat or light

(b) Evolution of a gas

(c) Production of sound

(d) Change in smell

(e) Change in colour

E. 1. False; The molecules in a liquid are **loosely** packed.

2. False; The amount of matter contained in an object is called its **mass.**

3. True

4. False; Kinetic energy of particles of a liquid **increases** with an increase of temperature.

5. True

6. False; Melting of ice is a **physical** change.

7. False; Burning of matchstick to produce smoke and some gases is a **chemical** change.

8. True

9. False; Making of an aeroplane out of a paper is an example of **reversible** change.

F. 1. Inflating a balloon; It is a physical change, others are chemical changes.

2. Frying of potatoes; It is a chemical change, others are physical changes.

G. 1. A chair is considered a solid because it has fixed shape, is rigid, has definite volume, does not flow, and is noncompressible.

2. Water is considered matter because it has mass and occupies space.

3. Solids do not flow because in solids, the forces of attraction between the molecules are very strong. The particles only vibrate about their mean position.

4. Gases can be compressed easily because the forces of attraction between the molecules of gases are negligible and there is a lot of space between the molecules.

5. Solids are rigid because in solids, the forces of attraction between the molecules are very strong. Strong intermolecular forces of attraction hold the molecules together in solids. As a result, the intermolecular space in a solid is negligible.

6. When water is heated, it changes into water vapour. No new substance is formed in this change. Moreover, when this water vapour comes in contact with some cold surface, it again changes into liquid water. Therefore, it is considered a physical change.

7. Mixing of sand with water is considered a reversible change because sand can be separated from water by the method of filtration. Since this change can be undone and is temporary, it is considered a reversible change.

8. When cement is mixed with water, a new substance is formed. This substance cannot be changed back into cement. It is a permanent change and is, therefore, considered an irreversible change.

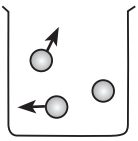
H. 1. (a) **2.** (b) **3.** (b) **4.** (c) **5.** (a) **6.** (c) **7.** (a) **8.** (c)

I. 1. (a) Liquid

(b) Solid

(c) Gaseous state

(d)



2. (a) Figure A (b) Chemical change (c) Irreversible change

THINK ZONE

- Here is given the substances from the weakest to the strongest forces of attraction:

  Air < kerosene < mustard oil < water < duster

- Marble cannot be compressed because it is a solid. The strong intermolecular forces of attraction hold the molecules together

in a solid. Also, the molecules in a solid are very closely packed, and therefore, cannot be compressed.

- Air occupies all the space available inside the balloon. Therefore, a balloon becomes larger when air is blown into it.
- We see steam rising from a cup of hot tea because the particles of hot tea have enough kinetic energy to convert into gaseous form.
- Diffusion becomes faster on heating because on heating, the kinetic energy of the particles increases and they start moving with high speed and intermix faster with each other.
- Baking of clay is an irreversible change.
- Formation of curd from milk is a chemical change.
- Breaking of glass is an irreversible physical change.

CHAPTER 5. Water

Check Point 1

1. About three-fourths.

2. Plants need water to make their food and grow.

3. Sea water is saline as it contains lots of salts dissolved in it. On the other hand, rainwater is considered the purest form of naturally occurring water.

4. Rain, snow, river, lakes, seas and groundwater are various sources of water.

5. Transpiration

Check Point 2

1. False **2.** True **3.** True **4.** True

TEST YOURSELF

A. 1. transpiration **2.** respiration, evaporation; transpiration

3. acid rain **4.** potable water **5.** three-fourths

B. 1. Water cycle **2.** Sewage **3.** Water table **4.** Alum

C. 1. Three uses of water are as follows:

- Water is used for drinking, cooking and washing.
- Plants use water to make food and grow.
- Seeds need water to germinate.

2. Water can be made safe for drinking by boiling, distillation and by adding chlorine tablets.

3. Water vapour enters the air by transpiration, evaporation and respiration.

4. Yes, condensation plays an important role in water cycle. The water vapour that enters the air, rises upwards. As the water vapour rises higher and higher, it gets cooler. The water vapour then condenses into tiny droplets of water. These tiny droplets of water form clouds.

5. The continuous circulation of water from the Earth's surface to the air and from the air back to the Earth's surface is called water cycle.

Water from seas, oceans and other water bodies evaporates due to heat from the Sun. This water vapour formed mixes with the air.

Plants also lose water from their leaves by the process of transpiration. Plants and animals also release water vapour during respiration. Thus, water vapour enters the air through transpiration, evaporation and respiration.

The water vapour that enters the air, rises higher and higher, and gets cooler. The water vapour then condenses into tiny droplets of water. These tiny droplets of water form clouds in the sky. The tiny drops in the clouds join together to form larger drops. These larger drops of water fall down on the Earth in the form of rain. In very cold places, these water drops fall down in the form of hail or snow.

Some of the rainwater gets absorbed by the soil and seeps under the ground. The rainwater also fills back the rivers, lakes and ponds. The water from rivers flows to seas and oceans. In this way, the water cycle is completed.

6. Plants lose water in the form of water vapour from their leaves by the process of transpiration. This water vapour mixes with air. Plants also release water vapour during respiration.

7. Acid rain is a serious environmental problem. It can affect the Earth in many ways. It can cause:

- contamination of lakes, rivers, etc., which may kill fish and other creatures living in water.
- damage to buildings, monuments, statues (especially made of marble and limestone).
- damage to steel bridges, railway lines, etc., and metal work may also get corroded.

8. The water is purified in a town water supply system which comprises different tanks.

Loading Tank: The water from rivers and lakes is passed to the loading tank. Here, some alum and other chemicals are added to the water which load the lighter particles floating in water and make them heavy. As a result, these particles settle at the bottom during sedimentation.

Sedimentation Tank: The water after loading is passed through large tanks called sedimentation tanks. Here, the water is allowed to stand for a day. Most of the insoluble solid impurities settle down at the bottom of the tank. Some lighter particles remain suspended in water.

Filtration Tank: The water is then passed through another tank. Here, water passes through the layers of sand, gravel and charcoal which remove the remaining suspended impurities.

Chlorination Tank: The water from the filtration tank is directed into the chlorination tank. Here, chlorine gas is bubbled through water which kills all the germs present in water. The water is now fit and safe for drinking.

Storage Tank: The safe drinking water is then stored in a closed tank or reservoir from where it flows through pipes to our homes.

9. Water pollution can be reduced by various ways:

(a) **Pre-treatment of wastes from factories:** The toxic wastes released from the factories should be treated to remove harmful chemicals before disposing them into water bodies.

(b) **Use of appropriate amount of fertilisers and pesticides:** Fertilisers and pesticides should not be used in excess as they may get washed away with rainwater, causing water pollution.

(c) **Proper sewage treatment:** Sewage from homes, factories, hospitals, offices, etc., should be treated properly before discharging it into water bodies.

(d) **Avoid mixing of excreta with water:** Cattle dung and also human excreta should not be allowed to mix with water in rivers, lakes, ponds, etc.

10. A solution in which no more solute can be dissolved at a given temperature is called a saturated solution.

11. The fertilisers that get washed away by rain into the waterbodies act as nutrients for green aquatic plants called algae and help them grow. These algae grow fast and cover the entire water surface of waterbodies like lakes and ponds. This is termed as algal bloom.

12. Aim: To show that more salt can be added to a saturated solution on heating

Procedure: Take 100 mL of water in a beaker. Add a teaspoonful of salt to it and stir well until the salt dissolves completely. Now, add another teaspoonful of salt and stir. Keep on adding a few teaspoonfuls of salt and keep stirring it. Some salt remains undissolved at the bottom of the beaker. Now, heat this solution and note your observation.

Observation: Salt dissolves in water when a small quantity of it is added to water. On adding more salt, it does not dissolve in water and a saturated solution is formed. On heating this solution, salt dissolves again.

Conclusion: More salt can be added to a saturated solution on heating.

13. (a) If it does not rain in a region for a long time, it leads to extremely dry condition called drought.

(b) If it rains heavily, it causes the water level of lakes, ponds and rivers to rise, leading to a condition called flood.

14. Rainwater harvesting is a method of collection and storage of rainwater from rooftops and land surface for future use. It is a very good method of increasing the availability of water.

The water is generally stored in tanks or is directed to the ground.

15. Conservation of water means to save water. The population of the world is increasing day-by-day and, so, there is a huge demand for water. So, we must use water wisely and avoid wasting it, i.e., conserve it.

16. The effects of drought are as follows:

- The crop yield becomes less. The soil dries up as it continues to lose water by evaporation.
- Lack of water may cause death of livestock.
- Water shortage may cause death of people living in drought area.
- Food and fodder become scarce. It may lead to malnutrition.
- Dehydration and other related diseases are common during drought.
- People of drought-affected areas may migrate due to lack of alternative food sources.

17. Some of the ways by which we can conserve water are as follows:

- Use minimum amount of water for bathing. Use a bucket instead of a shower.
- Wash vegetables in a bucket or tub.
- Never drain the used (for washing vegetables, etc.) water. You can reuse this water for watering plants.
- Never let water run while brushing the teeth, shaving or washing your hands or face.
- Make sure that your house has no leaky taps.
- Avoid flushing the toilets unnecessarily. A lot of water gets washed away.
- Turn off the taps immediately after use.
- Adopt rainwater harvesting.

D. 1. False; The process of **condensation** brings the water back to the earth.

2. False; About **three-fourths** of the earth's surface is covered with water.

3. False; Sea water is more saline than river water.

4. False; The loss of water by plants in the form of water vapour is called **transpiration.**

5. True

6. False; We **need to conserve** water as the demand for water is increasing due to fast increase in population.

E. 1. This is because sea water has lots of salt dissolved in it. These dissolved salts make sea water saline.

2. Water can dissolve many substances, i.e., solids, liquids and even gases. It is, therefore, known as a universal solvent.

3. Fertilisers and pesticides get carried away by rainwater into waterbodies. They get accumulated in the bodies of fish. Humans, who consume the fish, may eventually get poisoned.

Pesticides may even seep into the ground and contaminate groundwater.

4. Rainwater harvesting increases the availability of water by collecting and storing rainwater from rooftops and land surface for future use. So, it should be encouraged.

5. Storage tanks used to store rainwater must have a tight cover to prevent the contamination of water and also to prevent breeding of mosquitoes.

F. 1. (c) **2.** (a) **3.** (d) **4.** (b) **5.** (d)

G. 1. (a) The water vapour condenses on the mirror and changes into liquid water.

(b) She will feel liquid water on her finger.

2. (a) Water cycle (b) Condensation (c) Evaporation

(d) No, water in the seas and oceans is more saline than the water in the river.

THINK ZONE

- Vapour trail is formed by the condensation of water vapour that is emitted from the exhaust of the aircraft.
- The water vapour produced condenses due to low temperature, and therefore, can be seen in the form of cloud.
- Sea water has lots of salts dissolved in it which makes it unfit for the growth of plants or for drinking by animals. On the other hand, rainwater is the purest form of water.
- The continuous circulation of water from the Earth's surface to the air and from the air back to the Earth's surface helps in keeping the amount of water on the Earth's surface constant.
- Formation of clouds.

CHAPTER 6. Air and Atmosphere

Check Point 1

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

Check Point 2

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

TEST YOURSELF

A. 1. nitrogen, oxygen **2.** oxygen **3.** Nitrogen **4.** atmosphere **5.** carbon dioxide **6.** dust **7.** respiration, combustion **8.** Mountaineers **9.** Air

B. 1.–(c) **2.**–(a) **3.**–(d) **4.**–(e) **5.**–(b)

C. 1. A substance that burns in the presence of air to produce heat and light is called a fuel.

2. The process in which a fuel reacts with oxygen present in the air to produce heat and light is called combustion.

3. The process of oxidation of food to release energy, carbon dioxide gas and water vapour is called respiration.

4. The thick layer of air surrounding the earth is called atmosphere.

D. 1. Differences between respiration and combustion

Respiration	Combustion
● The process of oxidation of food inside living cells to release energy, carbon dioxide gas and water vapour is called respiration.	● The process in which a fuel reacts with oxygen present in the air to produce heat and light is called combustion.
● During respiration, only heat energy is released. This energy is liberated in small quantities in step-by-step reactions.	● During combustion, both heat energy and light energy are released. The energy is released in large amount during a series of chemical at once.
● Respiration is a natural process.	● Combustion is not a natural process. It has to be started.
● Respiration occurs inside the body of an organism.	● Combustion does not occur in living organisms.
● Respiration is a slow process.	● Combustion is a fast process.
● It takes place at body temperature.	● It takes place at a comparatively high temperature.

2. Differences between respiration and photosynthesis

Respiration	Photosynthesis
● The process of oxidation of food to release energy, carbon dioxide gas and water vapour is called respiration.	● The process of preparing food by green plants is called photosynthesis.
● Oxygen gas is used up during respiration.	● Carbon dioxide gas is used up during photosynthesis.
● Carbon dioxide gas is released during respiration.	● Oxygen gas is released during photosynthesis.
● Presence of chlorophyll and sunlight is not required.	● Photosynthesis occurs in the presence of sunlight and chlorophyll.

E. 1. Nitrogen **2.** Oxygen **3.** Oxygen **4.** Photosynthesis **5.** Wind **6.** Fuel

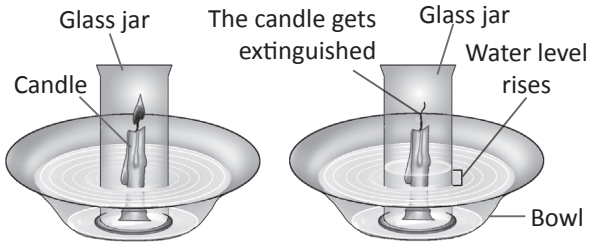
F. 1. Air is a mixture of many gases. The components of air are nitrogen, oxygen, noble gases, carbon dioxide, water vapour, smoke and dust particles. The main gases present in air are nitrogen (78%), oxygen (21%) and other gases (1%) include noble gases (0.95%), carbon dioxide (0.03%) and varying amounts of water vapour.

2. Moving air is called wind. We can feel wind when it blows. When wind blows, we notice rustling of leaves, swaying away of clothes, moving of blades of windmill, etc.

3. (a) Oxygen : 21% (b) Nitrogen : 78%

4. Aim: To show that oxygen is required for burning

Procedure: Take the bowl and fix a small candle in its centre. Pour some water into the bowl. Note the level of water and light the candle. Invert a glass jar over it. Carefully observe the burning candle and the level of water inside the glass jar.



Observation: The candle keeps burning for some time and then gets extinguished. Also, there is a rise in the water level in the glass jar.

Conclusion: A limited amount of oxygen gas is present inside the glass jar. When the oxygen inside the glass jar is used up, the candle gets extinguished. This shows that oxygen gas present in the air is required for burning. The space which was occupied by oxygen is now taken up by water.

5. Aim: To show that air contains water vapour

Procedure: Take a steel glass and place some ice cubes in it. Observe the outer surface of the glass for some time.

Observation: Tiny water droplets appear on the outer surface of the glass.

Conclusion: The water vapour present in the air around the glass comes in contact with the cold surface of the glass and gets condensed in the form of tiny water droplets. This shows the presence of water vapour in the air.

The amount of water vapour in air is not fixed. It varies from place-to-place. In coastal areas, the air has greater percentage of water vapour.

6. Aim: To show that air is dissolved in water

Procedure: Pour some water into a beaker. Ask an elder to heat it. Note your observation.

Observation: On heating the water, some bubbles are seen on the inner surface of the beaker.

Conclusion: These bubbles come from the air dissolved in water. This activity shows that air is dissolved in water.

7. All living organisms (plants and animals) take up oxygen present in the air. The oxygen that they take in combines with food and, in the process, carbon dioxide gas is released along with a lot of energy. This process is called respiration.

Oxygen is being replaced by the process of photosynthesis. Green plants take in carbon dioxide from the atmosphere and, in the presence of sunlight and water, they prepare their food and release oxygen gas into the surroundings.

Thus, respiration and photosynthesis are the two main processes that maintain the balance of carbon dioxide and oxygen in the atmosphere.

8. Yes, carbon dioxide is important for plants. Green plants use carbon dioxide to prepare their food in the presence of sunlight. This process of making food by green plants is called photosynthesis.

9. Aim: To show that exhaled air contains carbon dioxide

Procedure: Fill two-thirds of a beaker with freshly prepared

limewater. Blow into the limewater with the help of a straw. Observe the colour of limewater.

Observation: We will observe that the limewater has turned milky.

Conclusion: This shows that exhaled air contains carbon dioxide because carbon dioxide turns limewater milky.

10. Four important uses of air are as follows:

(a) The moving air (wind) helps to rotate the blades of a windmill. Windmills are used to generate electricity, draw water from tubewells and also to run flour mills.

(b) Air helps to separate husk from grains by winnowing.

(c) Air also helps aeroplanes, helicopters, gliders and yachts to move. Moving air blows on the sails of yachts to travel through water.

(d) Air helps birds to fly.

11. Aim: To show the presence of air all around us

Procedure: Take a water trough and fill it with water. Hold an empty glass in your hand. Dip the glass upside down in water. Note your observation. Now, tilt the glass a little and see if the water enters the glass. Note your observation.

Observation: When the glass was dipped in water without tilting it, no bubbles were seen. This is because the air was occupying the space in the glass. On tilting the glass, the air escapes in the form of bubbles and water fills the empty space that was occupied by air.

Conclusion: The glass was not empty. It was filled with air.

12. Two similarities between combustion and respiration are as follows:

- Both processes involve the oxidation of carbon compound.
- Both processes are exothermic.

13. Four causes of air pollution are as follows:

- Smoke from forest fires
- Smoke, ash and poisonous fumes resulting from volcanic eruptions
- Burning of fuels like coal, petrol, diesel in vehicles and industries, along with burning of wood and dung cakes
- Wastes thrown by people anywhere

G. 1. False; Nitrogen gas makes up about **78%** of the air.

2. False; **Oxygen** gas is necessary for burning.

3. True

4. False; Oxygen gas present in air cannot come to an end because it is being replaced continuously by the process of photosynthesis.

5. True

6. False; We should breathe in air through our **nose.**

H. 1. The amount of oxygen present in the air becomes less and less as we move higher. That is why, mountaineers carry oxygen cylinders with them while climbing high mountains so that they can breathe easily.

2. Nitrogen gas is also used in food packaging to keep the food fresh.

3. Carbon dioxide is used in fire extinguishers because it displaces oxygen. Also, it is very cold as it comes out of the extinguisher so, it cools the fuel as well.

4. When we breathe in air through our nostrils, the dust particles present in the air also enter our nostrils. The fine hair and sticky mucus present inside our nose filter the dust particles present in the air and do not allow them to enter our body.

We should not breathe through our mouth because our mouth cannot filter the dust particles present in air. So, breathing through our mouth will allow these dust particles enter our body and harm us.

I. 1. (c) **2.** (b) **3.** (a) **4.** (d)

J. 1. (a) 78% (b) 1% (c) 21%

2. (a) Oxygen

(b) Respiration

(c) No, the candle will not continue burning for long.

When the amount of oxygen present in the jar is used up, the candle will extinguish.

(d) The space which was occupied by oxygen is now taken up by water.

(e) Nitrogen.

THINK ZONE

- Ozone.
- Noble gases are inert gases, i.e., they are unreactive. Helium and neon are noble gases.
- If the amount of water vapour in air increases, the air becomes humid.
- Oxygen.