SCIENCE-8 (ANSWERS)

CHAPTER-1 : THE UNIVERSE

A. Answer the following questions :

1. Universe is what we see as space surrounding the earth and beyond it. The earth and all the heavenly bodies such as the stars, planets, moon, comets, meteors and the sun in the space make the universe.
2. The part of the milky way galaxy in which we live is called the solar system. The sun and its planets, the moons of the planets and other heavenly bodies such as asteroids, comets, meteors and meteorites and vast regions of empty space between the heavenly bodies constitute the solar system.
3. The planets are the heavenly bodies that revolve around the sun in their define orbit. Including the earth there are eight planets that revolve around the sun.
4. (a) **Mercury :** Mercury is the smallest of the planets. It stays close to the sun. It can be seen in the east just before the sunrise or in the west after the sunset. It looks like a pinkish star. This planet spins on its axis very slowly. The side facing the sun stays lit up for months at a time. The temperature on this side goes as high as 450°c whereas the other side of mercury remains dark for months at a time and the temperature drops as low as minus 180°C.

   (b) **Venus :** Venus is the easiest to recognise. It can be seen shining brightly as the morning star. It shines brighter than any other planet as it is the planet closest to the earth and because it is permanently covered with thick clouds. Venus does not contain oxygen and is made up mostly of carbon dioxide gas. Its temperature is scorching 480°C, therefore, anyone on Venus would be suffocated, crushed and roasted.
5. Light year = distance travelled by light in one year.

   1 Light year = distance travelled by light in 1 year.

   $\times 60 \times 60 \times 24 \times 365$

   $= 300000 \text{ km} \times 60 \times 60 \times 24 \times 365$

   $= 9460800000000 \text{ km}$

   $= 9.46 \times 10^{12}$ km (approximately)

   = 9460 billion km.
6. Anything in orbit around another object can be called a satellite.
7. Different shapes of moon as we see are the different phases of the moon. The phases occur because the sun lights up different parts of the moon as it circles around the earth.

   When the moon is directly between the sun and the earth, we can't see it at all because no sunlight falls on the side facing us. This is the new moon phase. After a day or so the sun starts to light up the edge of the moon and we see a slim crescent.

After about a week, half the moon gets lit up and after another week the whole face is lit up (fill moon). After this the face of the moon which is lit up starts decreasing. After about another week only half the face is visible (last quarter phase). A week later, only a slim crescent is left. The moon takes 27 days and 1/3 hours to go through its phases from one new moon to another.

8. Comets are heavenly bodies that revolve around the sun. They originate outside the solar system. They become visible only when they wander in towards the sun. They are lumps of rock, dust and ice. As they get closer to the sun, its heat makes some of their ice melt and turn into gas. With this some of their dust also comes out. A cloud of gas and dust gathers around the comet. This reflects sunlight and makes the comet visible. As the comet travels closer to the sun, more gas and dust are given off. The comet at this stage becomes brighter and also grows a tail.

9. Meteors are small objects made up mainly of stones present in space. They regularly enter the earth's atmosphere. As a meteor enters the earth's atmosphere at high speed, it is heated by friction with air, and in most cases it burns to ashes. As it heats up and burns, it appears as a glowing streak of light and is called a *shooting star*, though it is not a star at all.

   If a meteor is larger, it may fall on the earth's surface before being completely burnt out. Such meteors are called meteorites. The Barringer crater in Arizona, USA was formed when a large meteorite stick the earth

10.

Distinction between a star and a planet	
Star	**Planet**
1. A star is an intense hot glowing ball of gas which emits its own light and heat due to nuclear reactions within it.	1. A planet does not have light of its own. It shines due to the reflected light of the Sun.
2. The stars appear twinkling at night.	2. The planets shine steadily.
3. There are millions of stars.	3. There are 8 planets.
4. Stars are very big in size. They appear small because of their large distance from the Earth.	4. Planets are very small in size as compared to the stars.
5. Stars do not change their position in the sky.	5. Planets change their relative position day by day.
6. Stars appear to be moving from east to west.	6. Planets move around the Sun from west to east.
7. A star is a huge mass of gases and its temperature is very high.	7. A planet is made up of either gas or rocks and its temperature depends upon its distance from the Sun.

11. A group of stars forming some kind of figures or patterns known as constellations.

All stars in a constellation remain in the same group. Constellations appear to move from east to west as the earth rotates from west to east. About 88 constellations are known. Some of the very famous constellation are.

Name	Common Name	Name	Common Name
Ursa Minor	(Little bear or Dhruva Matsaya)	Cassiopeia	(Sarmishtha)
Orion	(Kalpurush of Hunter)	Cygnus	(Swan or Hansa)
Draco	(Dragon or Kaleya)	Lyra	(Svara Mandala)
Ursa Major	(Great Bear or Saptarishi)	Pleiades	(Kruttika)
Auriga	(Charioteer or Sarthi)	Scorpio	(Vrishchika)

12. A man made machine sent into the space and circles around a planet is known as artificial satellite. A number of satellites have been launched. INSAT-3C was launched on 24 January, 2002. On September 28, 2003, INSAT-3E was launched.

Uses of artificial satellites

Artificial satellites have been sent into the space for a number of purposes. Some of them are given below :

Artificial satellites send signals to radios, T.V. sets, mobilephones, etc. These are called communication satellites. Ships, aircraft and even some cars use navigation satellites to find their location.

They send information about the universe.

The scientists can use these satellites to observe the earth and find heavily populated or damaged forests.

Military satellites can send signals about the movement of missiles, ships and soldiers.

The weather satellites take pictures of the movement of the clouds to forecast the weather.

B. Fill in the blanks :

1. Earth, heavenly bodies 2. Sun 3. Earth
4. Mars 5. Neptune 6. 3.26

C. Match the words in column A with those under column B.

1. f 2. h 3. g 4. a 5. b 6. e 7. c 8. d

D. Define the following :

1. Universe is what we see as space surrounding the earth and beyond it.
2. The sun and its planets, the moons of the planets and other heavenly bodies such as asteroids, comets, meteors and meteorites and vast regions of empty space between the heavenly bodies constitute the solar system.

3. The planets are the heavenly bodies that revolve around the sun in their definite orbits.
4. Stars are the large ball of gases held together by their own gravity.
5. A group of stars forming some kind of figures or patterns are called constellations.
6. Light year is the distance tarelled by light in one year.
7. Parsec is a unit of astronomical distance, equal to about 3.25 light years, the distance at which the mean radius of the earth's orbit subtends an angle of one second of arc.
8. The small heavenly bodies that revolve around larger heavenly bodies are called natural satellite.
9. A man-made machine sent into the space and circles around a planet is known as artificial satellite.
10. Comets are the heavenly bodies that revolve around the sun. They originate outside the solar system.
11. Meteors are small objects made up mainly of stones present in space.
12. If a meteor is larger, it may fall on the earth's surface before being completely burnt out. Such meteors are called meteorites.
13. A large number of rocks that lie between the orbit of Mars and Jupiter are called astronomy.
14. The branch of science which deals with the study of the universe is called astronomy.

E. Write T for true and F for false statements .

1. F 2. F 3. F 4. T 5. T
6. T 7. F 8. F 9. T 10. T

CHAPTER 2 : SOIL

A. Answer the following questions :

1. Soil is a mixture of living and non living materials. It includes the rotting remains of plants and animals, tiny living things, air, water and the small bits of rocks.

   Soil is very important natural resource. It gives nourishment and shelter to unicellular as well as multicellular plants and animals. No soil means no plants and no plants mean no animal and that is the end of life.
2. Humus is the organic part of the soil which means it is made of material that was once alive. Most of the humus is made from the leaves, stems and flowers of dead plants. The bacteria, moulds and invertebrates in the soil feed on this dead and decaying plant material. The waste material which these organisms leave behind is full of nutrients that provide food for living plants to grow. Humus also hold air and water in the soil.
3. The type of the soil depends on the kind of rock particles they contain. When a rock containing in the mineral quartz breaks down, it forms sand particles. While a rock containing silicate minerals breaks down, it forms clay particles. Most soils contain sand and clay in varying amounts.

   The best soil for growing plants is *loam*. This type of soil contains a good balance of sand, silt and clay.

4. (i) **Alluvial soil :** It is ideal for the agriculture. It is loamy in texture, has plenty of humus and is fertile. It is most suitable for crops like wheat and rice. It is taken away from their parent rocks by rivers and deposited in low lands. It is found in the plains of Haryana, Uttar Pradesh, Bihar, Bengal, Orissa and Madhya Pradesh.

   (ii) **Black soil :** It is clayey and is known for its capacity to retain water. It is found in Maharashtra, M.P. and outer regions of Gujarat and Tamil Nadu. This soil is rich in iron and magnesium. This type of soil is good for growing cotton and sugarcane.

   (iii) **Red soil :** Generally it is less fertile and is deficient in humus. However, it is capable of growing good crops with the help of manures and fertilizers. The red colour is due to the iron oxide present in the soil. This type of soil is common in Kerala, Tamil Nadu and Karnataka.

   (iv) **Laterite soil :** It is confined to relatively smaller areas in Western Ghats and parts of Tamil Nadu, Andhra Pradesh, Orissa and Assam. It is found in regions with heavy rains. It is not so fertile but supports pastures and shrub forests and is considered good for the plantation of tea, coffee and coconut.

   (v) **Desert soil :** It is dry, sandy and porous soil containing enough minerals. It is rough in texture since the fine layer on top is blown away by wind. It cannot hold much water. It can support plants, growth if irrigated well. It is found in Rajasthan and Gujarat.

   (vi) **Mountain soils :** The soil in mountains varies according to the altitude. It has the highest humus content and is highly fertile. It is found in the Himalayan regions and north-east India

5. The factors on which weathering depends are as follows :

   Change in temperature : During the day time, the surface layer of the rocks get exposed to the heat of sun while underlying layers cannot get exposed to the heat of sun. As a result the surface layer expand but the underdying layers do not expand. Due to this difference in the expansion of the supper layers and the lower layers the surface layers of the rocks crack and gradually get converted into soil particles.

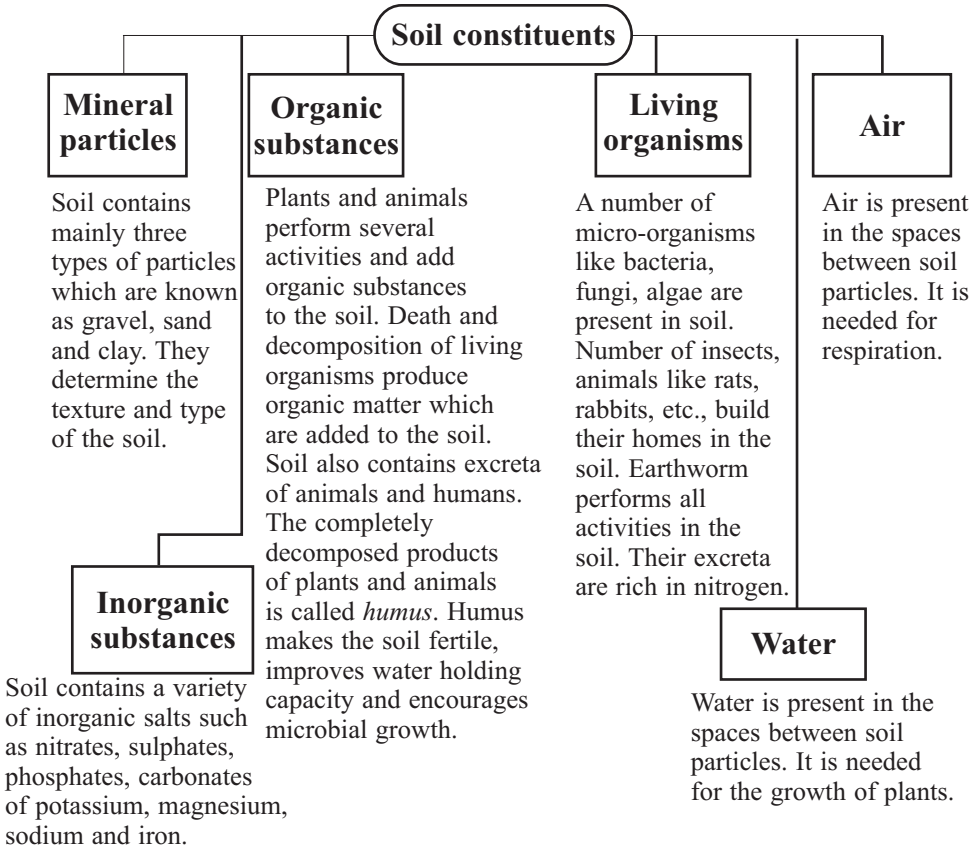
   Water The continuous movement of rain and river water causes abrasions on the rock surface which results in the breakdown of the rock particles to the finer particles and ultimately the soil is formed.

   Sometimes the water gets trapped in the small crevices of rocks. This water, during winter freezes to form ice and hence it expands. This puts pressure on the rocks resulting in breaking into smaller particles of soil.

   Wind : Strong wind blowing across the rocks also produce abrasions on the rocks due to which some rock particles are blown away with the wind and settle down elsewhere as soil particles.

Living organisms : Certain living forms of organisms are also responsible for weathering of rocks. The organisms such as lichens grow on the surface of rocks, they produce acids which keep corroding the surface and due to which it converts into finer particles of soil. Other organisms such as insects, microbes, worms start living and dying in these finer particles of the soil, thus, becomes ready for the growth of plants. Further due to growth of plants, their roots also develop and cause of weathering of rocks and thus produce soil.

6. Different types of soils have different constituents. The constituents of soil depends on the rock from which it is formed. A schematic representation of the basic constituents of soil is given below :



7. (i) **SOIL ORGANISMS :** As mentioned earlier the soil has a number of living organisms. The flora of soil constitutes the bacteria such as nitrogen–fixing bacteria and other plants matter such as algae, mosses, etc. The fauna constitutes animals such as a earthworms which swallow the soil and make it loose and soft. They also add minerals to it hence, making it more fertile. Soil not only provides shelter to animals like such as rabbits, snakes and worms, etc. but also it inhabits a number of micro-organisms that cause the decomposition of dead plants and animals and add minerals back to

the soil. These minerals dissolve in water and are taken up by the plants through their roots once again and hence, the minerals cycle continues

(ii) **Soil water :** The soil holds the water in the spaces present among the particles. The water goes down the particles due to the force of gravity (gravitational water) are held in the soil particles due to the capillary action. This water held by the soil particles is known as *capillary water*.

This is the water available to the roots of the plants for absorption.

(iii) **MINERAL SALTS IN THE SOIL :** Soil contains many minerals like nitrogen, phosphorus, potassium and magnesium, etc. Most of these minerals salts come from the rocks and these rocks lead to the formation of soil. Some of these give the soil a characteristic colour, for example, iron salts give a red colour to the soil.

Sometimes, soil contains lime which comes form limestone. Such soil is alkaline. This is useful for some plants as it helps in their growth and development. Rainwater is slightly acidic and can make the soil acidic. Some plants grow well in acidic soil. However, most plants prefer neutral soil.

8. Most of the people think the soil as mere dust or dirt. But actually it is much more than that. Soil is a necessary source for sustaing life on the earth. The whole world depends on the soil containg humus, it supports plants life by providing the necessary nutrients. Animals and human beings use plants as food and to fulfil other necessities. On the basis of plants dependence on soil and animals dependence on plants we can say that world depends on the soil for its survival.

9. **Soil pollution :** When the undesired substances get mixed with soil, it gets polluted. The polluted soil is harmful for the crops and animals as well as for human beings.

Reducing or degrading the quality and in turn the fertility of soil is called *soil pollution*. The substances that causes soil pollution are called *pollutants*.

Factors responsible for soil pollution :

- When fuel like petrol, diesel, etc. is burnt, some harmful chemicals such as oxides of sulphur get mixed with soil and hence pollute it.
- The animals excreta may add some harmful chemicals to the soil.
- Disposal of agricultural or industrial wastes in the soil makes it polluted. Similarly coal, mining and metal processing units produce toxic wastes in the soil and make it polluted.
- Dumping of solid wastes from big cities or any other source, leads to soil pollution. Further more, it leads to the contamination of groundwater. Many disease- causing worms, such as *helminth* and *roundworms*, thrive in such a soil.

B. Fill in the blanks :

1. permeable 2. alluvial soils 3. mountain soils 4. Clayey
5. alkaline 6. iron oxide 7. slow, thousands 8. permeable

C. Differentiate between the following :

1. Physical weathering involves heating and cooling, weathering and and drying, freezing and thawing of rocks. Whereas, chemical weathering involves separation of rocks into competent parts by chemical reactions further processes like oxidation, hydrolysis and carbonation.
2. (a) **A-Horizon (Zone A) :** It is the uppermost layer of the soil and is called *topsoil*. This layer is soft, porous and holds enough water. It contains lot of humus (dead and decaying organisms) and it is dark in colour. It may contain much of organic matter, such as decayed plant leaves, twigs, animals remains, as well as clay and sand grains. It is the most fertile soil. Plants get their essential nutrients from this layer.

   (b) **B-Horizon (Zone B) :** Soil of B-horizon is called *sub–soil*. It is much lighter in colour and is compact. It has less humus but is rich in soluble minerals and iron oxides. Roots of large trees may reach this level. It has very little humus and so is not suitable for plants growth.

   (c) **C-Horizon (Zone C) :** It is very hard and is made up of small lumps of rock material. It is the lowermost layer of the soil. It is unfertile layer and forms the framework of the soil.

D. Define the following :

1. The process of breaking up rocks into small particles is called weathering.
2. Soil with to much sand lets water go through it easily. This quality of soil is known as its permeability.
3. The soil holds the water in the space present among the particles. This water held by the soil particles is known as capillary water.
4. In areas where the soil particles are to large as in sandy soil, the water sinks through, washing off all the nutrients. This is called teaching.
5. The natural breaking down and wearing away of the soil from one place to another by agencies such as man, rain, wind is known as soil erosion.
6. Preventing the soil from getting eroded is known as soil conservation.

E. Match the column A with the column B.

1. (iii) 2. (vii) 3. (v) 4. (vi)
5. (ii) 6. (i) 7. (iv)

F. Write T true and F for false statement.

1. T 2. T 3. F 4. T 5. T 6. T 7. T

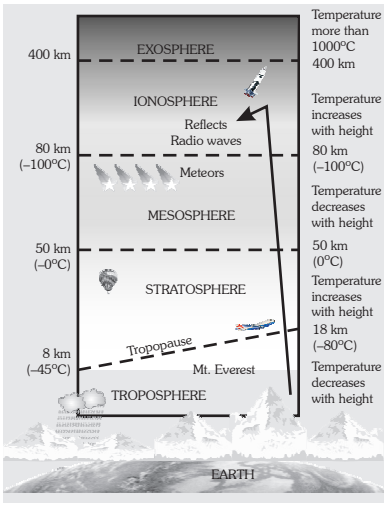
CHAPTER -3 : AIR

A. Answer the following questions :

1. The gaseous envelope around the Earth is called atmosphere. Several layers of air surround our planet. These layers are :

   (i) Troposphere (ii) Stratosphere (iii) Mesosphere
   (iv) Ionosphere (v) Exosphere

   (i) Troposphere : the atmosphere nearest the earth's surface is called the troposphere. Troposphere is about 10 kilometres thick at the poles and 16 kilometers at the equators. This layer contains mainly oxygen, carbon dioxide and nitrogen. Nearly fourth fifth of this layer is nitrogen and the rest is carbon dioxide, oxygen, argon etc.



Structure of the Atmosphere.

   (ii) **Stratosphere :** Stratosphere begins above troposphere. Its composition is very similar to that of the troposphere. There are only a few clouds in the stratosphere. They are made up mostly of ice crystals.

   (iii) **Mesosphere :** It lies above the stratosphere. It is 32 kilometres thick. In this layer most meteorites burn up, higher up there is not enough oxygen for them to burn.

   (iv) **Ionosphere :** It lies above the mesosphere. It contains gases that exist as ions or as charged particles rather than as molecules. It reflects the radio waves back to earth. It is in ionosphere that the long distance communication is set up in the world.

   (v) **Exosphere :** The exosphere is the outermost layer of the atmosphere. It begins from 480 km above the earth, but it does not have a definite formulary with outer space. The exosphere has a high temperature, ranging up to several thousand degrees centigrade.

2. Air exerts pressure on the surface of Earth, this is called atmospheric pressure. Atmospheric pressure is measured using on instrument called barometer.

3. The aneroid barometer is meant for measure the atmospheric pressure.

   The main significance of this barometer is that this does not use any liquid and is light, handy and portable.

4. **(a) Physical properties of oxygen :**
   (i) It is colourless.
   (ii) It is odourless and tasteless.
   (iii) It is slightly heavier than air.

(b) Physical properties of nitrogen :

(i) Nitrogen is colourless, odourless and tasteless gas.

(ii) It is sparingly soluble in water.

(iii) It is slightly lighter than air.

5. **Chemical properties of oxygen**

(i) **Action of litmus :** Oxygen is neutral. It is neither acidic nor basic in character.

(ii) **Combustibility :** It supports burning though it itself does not burn. A burning candle with continue to burn in the presence of oxygen whereas in the absence of oxygen it will get extinguished.

(iii) **Action with metals :** It reacts with active metals to form oxides. A red hot magnesium ribbon burns with oxygen to form a dazzling white flame of magnesium oxide.

$2Mg + O_2 \rightarrow 2\ MgO$

magnesium magnesium oxide

(iv) **Action with non-metals :**

Action with hydrogen : Hydrogen burns with a pale blue flame and produces steam on reaction with oxygen. The steam can be condensed to water on a cold surface.

$2H_2 + O_2 \rightarrow 2H_2O$

hydrogen oxygen steam

Uses of oxygen

(i) Oxygen is necessary for the respiration for all living beings.

(ii) Deep sea divers, aviators, mountaineers, astronauts, firemen and miners carry oxygen cylinders with them for breathing.

(iii) Air is used in welding metals. The gases as such as acetylene and oxygen when burnt, a very hot flame called oxy-acetylene flame is produced. This flame is hot enough to melt most of the metals which can then be welded together. The ends of the two metals to be welded are melted together by heating in oxy-acetylene flame and then brought together and allowed to solidify. In this way the two metal pieces get joined together.

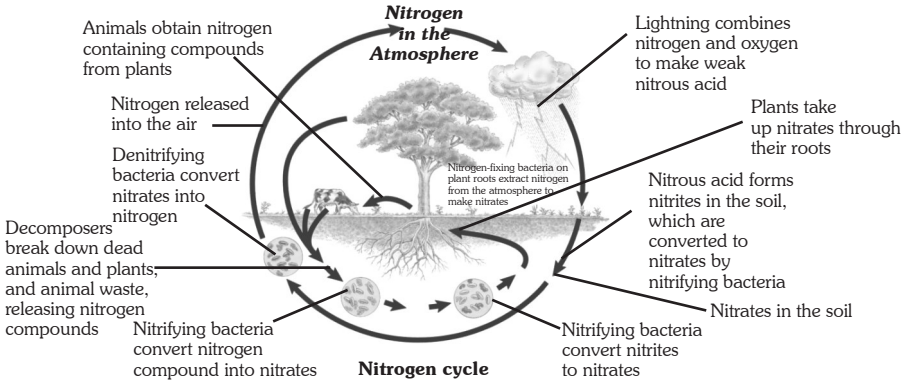
(iv) The liquid oxygen is used as oxidant of rocket fuel. The liquid hydrogen is burnt in liquid oxygen to provide energy needed for propelling rocket.

(v) Oxygen is essential for combustion.

(vi) Oxygen is used during the process of producing steel from cast iron to remove carbon which present as an impurity.

6. **Nitrogen cycle**

Plants get their nitrogen from the soil in the form of nitrates and use it in the production of proteins and other nitrogen-containing organic compounds. Animals eat the plants and convert the nitrogen compounds into substances required for their own growth and renewal



or repair. Animals cannot store excess nitrogen compounds. So these are broken down and expelled from the body. The farmer collects the dropping as manure which is spread over the land to give back the nitrogen to the soil. If the plants are not eaten, they die and rot, and by the action of bacteria and fungi, the nitrogen-containing compounds in them are changed into nitrates once again. Thus, nitrogen from the soil passes through plants and animals back to the soil. This is called the nitrogen cycle.

Uses of nitrogen

(i) Nitrogen dilutes the activity of oxygen.

(ii) Liquid nitrogen is used as a cooling agent in industry

(iii) Large amounts of nitrogen are used to make ammonia, which in turn is used to make fertilizers. Plants need nitrogen for their growth. Therefore, nitrogen containing fertilizers are very useful for them.

(iv) Nitrogen is an important constituent of the cells of our body.

(v) Nitrogen is filled in food cans to stop bacterial growth.

(vi) Nitrogen is filled in bulbs to prevent oxidation of filament.

7. **Greenhouse effect**

A greenhouse keep plants warmer than they would be outside. It does this because the glass traps some of the sun's radiation energy (infra-red radiation) and prevents it getting out.

In a similar way, the atmosphere helps to keep the earth warm. It traps some of the sun's radiation energy that would otherwise escape. This is called the greenhouse effect.

Significance of green house effects.

(i) Without green house effect the average temperature of the earth's surface would be about 33°C lower than it i.e., -18°C instead of a comfortable 15°C.

(ii) Carbon dioxide present in the atmosphere allows the sun's radiation to enter the earth's atmosphere but not allow it to escape back. So excess of carbon dioxide causes the earth's surface to get warmer due to the green house effect. This is called global warming.

8. **Acid rain :** Acid falls to the ground with the rainfall. This is called acid rain.

Effects of acid rain

Air Pollution results chiefly from incomplete combustion of impure fuels. The oxides produced when fuels burn include some acid gases. Two of them are sulphur dioxide and nitrogen dioxide. These oxides mixed with water and form acids.

$$SO_2 + H_2O \rightarrow H_2SO_3$$

sulphurous acid

$$2SO_2 + 2H_2O + O_2 \rightarrow 2H_2SO_4$$

moist air — sulphuric acid

$$2NO_2 + H_2O \rightarrow HNO_3 + HNO_2$$

nitrogen oxide — nitric acid, nitrous acid

Effects of acid rain

1. It is highly corrosive and harmful for both living and non-living things.
2. It damages plants and causes harm to soil, water resources, aquatic life and animals.
3. It damages buildings, monuments, statues, etc.

9. **Some ways by which we can reduce air pollution.**
   (i) **By using electrostatic precipitator :** The electrostatic precipitator removers the unburnt carbon particles present in the smoke.
   (ii) **By using smokeless sources of energy :** Air pollution can be avoided by using smokeless sources of energy i.e. we must try to increase the use of LPG gas, solar energy and wind energy.
   (iii) **By growing more plants :** Plants use carbon dioxide for preparing their food. Thus plants help to reduce excess of carbon dioxide in the air. So we should try to increase the growth of plants.
   (iv) **By minimising the use of automobiles :** Pool your cars or bikes with your friends, if you are going on the same routes. This will save fuel, money and will help preventing the atmospheric pollution.
   (v) By reducing industrial units that emit harmful gases and smoke.

B. Define the following terms :

1. Refer to Q1 point (ii) of part A
2. Refer to Q1 point (iv) of part A
3. Refer to Q2 of part A
4. The process of conversion of free atmospheric nitrogen into its compounds by nitrogen fixing bacteria is called nitrogen fixation.
5. The fouling of air due to various human activities is called air pollution.

6. Green house keeps plants warmer then they would be outside. It does this because the glass traps some of the sun's radiation energy and prevents it getting out.
7. The rain water containing dissolved oxides of sulphur and nitrogen is called acid rain.
8. Instruments the measure atmospheric pressure are called barometer.
9. The atmosphere nearest the earth's surface is called the troposphere.
10. The gaseous envelope around the earth is called atmosphere.

C. Fill in the blanks :

1. stratosphere 2. nitrogen, oxygen, carbon dioxide, inert gases and under vapour. 3. 760 mm 4. barograph
5. acidic, alkaline 6. calcium oxide

D. Complete the following reactions :

1. $2Hg + O_2$ 2. $3MgO$ 3. $2P_2O_5$ 4. $CO_2 + 2H_2O$
5. $NH_4NO_2 + Nacl$ 6. $HNO_3 + HNO_2$

E. Write 'T' for true and 'F' for false statements :

1. F 2. F 3. T 4. F 5. T 6. F 7. T 8. T

4. TRANSFORMATION OF SUBSTANCE

A. Answer the following questions :

1. The main features of the chemical changes can be described as :
   - ✦ The major feature of a chemical change, or reaction, is that new substance/substances are made during the reaction.
   - ✦ Most of the chemical reactions are difficult to reverse.
   - ✦ During a chemical reaction energy can be given out or taken in.
2. There are certain chemical reactions which are accompanied with change in colour of the products.

   For example :

(a) Lead nitrate, white coloured crystals, when heated strongly, decompose to form lead monoxide which is yellow in colour, nitrogen dioxide gas which is reddish brown in colour and oxygen gas. The chemical reaction hence is accompanied with the change in colour from white to yellow and reddish brown colour.

$$\underset{\text{Lead nitrate (white crystals)}}{2Pb(NO_3)_2} \rightarrow \underset{\text{Lead monoxide (yellow)}}{2PbO} + \underset{\text{Nitrogen dioxide (reddish-brown)}}{NO_2} + \underset{\text{Oxygen}}{O_2}$$

(b) When hydrated crystals of copper sulphate, which are blue in colour are heated slowly then the crystals loses five water molecules and the colour changes to white.

$$\underset{\text{Copper sulphate pentahydrate (blue)}}{CuSO_4 . 5H_2O} \xrightarrow{\text{slow heating}} \underset{\text{Copper sulphate (white)}}{CuSO_4} + \underset{\text{Water}}{5H_2O}$$

3. Some chemical reactions are characterised by the change in the state of the products. This means gaseous state of reactants may form the products which may be liquid or solid. Liquid state of reactants form the product which is a solid and so on.

There are many chemical reactions which are accompanied by the change in state.

For example :

(a) Two volumes of hydrogen gas react with one volume of oxygen gas to form water which is in the liquid state.

$2H_2 + O_2$ (gas) $\rightarrow$ $2H_2O$ (liquid)

Hydrogen Oxygen Water

(b) When red hot carbon in solid state is treated with sulphur vapours then it forms carbon disulphide which has a liquid state.

C (solid) + 2S (gas) $\rightarrow$ CS (liquid)

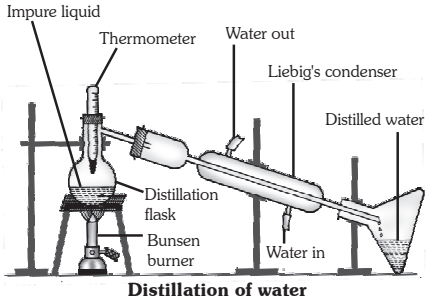
Carbon Sulphur Carbon disulphide

(c) The reaction of hydrochloric acid, a liquid with sodium hydroxide, another liquid, results in the formation of sodium chloride salt which is a solid. This reaction is an example of liquid state of reactants to change into a solid state of the product.

HCl (liquid) + NaOH (liquid) $\rightarrow$ NaCl (solid) + H_2O (liquid)

Hydrochloric acid Sodium hydroxide Sodium chloride Water

4. **To get a pure sample of water by distillation :** A pure sample of water means distilled water. The figure shows the set-up for distillation. Take tap water in a flask. This water is impure. Add a crystal of potassium permanganate. This kills living things like germs, bacteria, etc. Heat the flask and boil the water. Water vapour (steam) rises and goes into the bent tube. This condenses to water and is collected in a flask. The water so collected is free from all impurities. The impurities present in the flask is purple in colour due to the presence of potassium permanganate. The distilled water in the flask is colourless and pure.

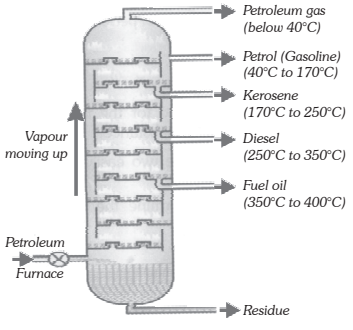


Distillation of water

5. We can separate two or more miscible liquids using the method of *fractional distillation*.

The method is used to separate miscible liquids whose boiling points are close together.

The mixture is boiled in a flask. The vapour thus formed is a mixture of vapours of all the constituents (called *fractions*). This mixture of vapours is passed though a fractionating column fitted over the mouth of the flask. As the



Fractional distillation of petroleum (crude oil)

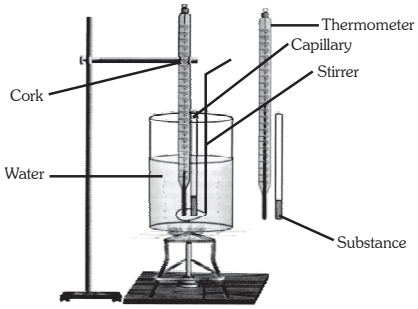
vapour mixture moves up the column, the vapours of the liquid with the highest boiling point condense first. The vapours thus get richer in the low boiling point components.

The main drawback of this method is that the heating of mixture requires very high temperature.

Besides, the component which is collected at last is always contaminated with some impurities.

6. **To determine the melting point of a solid (say area).**

Take a glass capillary tube. Seal one end of the capillary in the flame of the bunsen burner. Fill the powdered urea into it up to a height of about 1-2cm. Fill a beaker to half with water. Place it on the wire gauze kept on a tripod stand. Suspend a thermometer from an iron stand in such a way that its bulb is about 3cm below the surface of water in the beaker. Now lift the thermometer and stick the filled capillary to it so that the filled portion of the capillary is at the level of the thermometer bulb.



A set-up for the determination of the melting point of a substance.

Now start heating the beaker gently. Note down the temperature at which the solid in the capillary starts melting. Allow the solid to melt completely. Now stop heating and note down the temperature at which it starts solidifying.

The mean of the two temperatures gives the melting point of the substance.

Thus, we find that the melting point of the given substance is 132°C.

7. Melting point and boiling point of a substance are very typical characteristics of a pure substance. These temperatures are always fixed, and remain the same as long as the substance is pure.

The melting points and boiling points of most elements and compounds are known accurately. If a substance is not pure, its melting point or boiling point will be different from the known, accurate value. For example, pure water boils at 100°C. But if the water contains impurities, such as salt, the boiling point is higher.

Thus, it is clear that the melting point and boiling point change with addition of any other substance.

8. A displacement reaction is one in which the more reactive clement displaces a less reactive element from a solution of one of its compounds.

Displacement reactions are of two types, namely :

(a) Single displacement reaction (b) Double displacement reaction

(a) Single displacement reaction : In a *single displacement* reaction, one element takes the place of another in a compound. The element can replace the first part of a compound, or it can replace the last part of a compound.

For example :

(a) Zinc metal when dipped in copper sulphate solution displaces copper from the solution. The equation thus formed is

$$\underset{\text{Zinc}}{Zn} + \underset{\text{Copper sulphate}}{CuSO_4} \rightarrow \underset{\text{Zinc sulphate}}{ZnSO_4} + \underset{\text{Copper}}{Cu}$$

In this reaction, copper is displaced as a dark brown solid from copper sulphate solution and is deposited on the zinc strip. The blue colour of copper sulphate fades away as it now becomes a solution of zinc sulphate and not of copper sulphate.

This displacement reaction takes place because zinc is more reactive than copper. If, however, zinc sulphate solution is taken and copper dipped in it, there will be no reaction. This is because copper is less reactive than zinc and therefore cannot displace zinc from zinc sulphate solution.

(b) **Double displacement reaction :** In *double displacement* reactions, the positive portions of two ionic compounds are interchanged. For a double displacement reaction to take place, at least one of the products must be a precipitate or water.

For example :

When clear aqueous solutions of lead (ll) nitrate and potassium iodide are mixed, a double-displacement reaction takes place and a yellow solid appears in the mixture. This solid is lead (ll) iodide, and it precipitates out because it is insoluble in water.

$$Pb(NO_3)_2\,(aq) + 2Kl\,(aq) \rightarrow Pbl_2\,(s) + 2KNO_3\,(aq)$$

9. **Neutralisation reaction :** The reaction of an alkali with an acid or vice versa is called a *neutralisation reaction*. When an acid and a base react, they form salt and water as products. The neutralisation reaction between sodium hydroxide (NaOH) and hydrochloric acid (HCl) is as follows :

$$\underset{\text{Alkali}}{NaOH} + \underset{\text{Acid}}{HCl} \rightarrow \underset{\text{Sodium chloride (Salt)}}{NaCl} + \underset{\text{Water}}{H_2O}$$

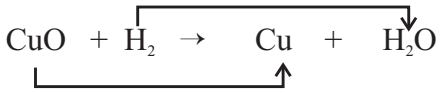
10. A reaction in which oxidation and reduction take place simultaneously is called an oxidation-reduction reaction or redox reaction.

For example, when copper oxide is heated with hydrogen, copper and water are formed.

$$\underset{\text{Copper oxide}}{CuO} + \underset{\text{Hydrogen}}{H_2} \rightarrow \underset{\text{Copper}}{Cu} + \underset{\text{Water}}{H_2O}$$

In this reaction, copper oxide loses oxygen and forms metallic copper. Therefore, reduction of copper oxide takes place.

Hydrogen gains oxygen from copper oxide to form water. So oxidation of hydrogen is taking place.



B. Fill in the blanks :

1. evaporation, condensation 2. positive 3. reverse
4. boiling 5. evolution

C. Differentiate between the following :

1. **Exothermic reaction :** A chemical reaction that releases heat energy is known as exothermic reaction. Some examples are given below :

   When quicklime (calcium oxide) is placed in a beaker containing some water the later becomes very hot and starts boiling.

   It is because of an exothermic reaction.

   $CaO + H_2O \rightarrow Ca(OH)_2 + \text{Heat energy}$

   Calcium oxide — Water — Calcium hydroxide

   Endothermic reaction

   Some chemical changes absorb energy. Chemical reactions that absorb energy are called *endothermic* reactions.

   For example :

   Endothermic change is observed when sodium bicarbonate is heated strongly. Due to absorption of energy the sodium bicarbonate swells up to form sodium carbonate, steam and carbon dioxide gas.

   $2NaHCO_3 + \text{heat energy} \rightarrow Na_2CO_2 + H_2O + CO_2$

   Sodium bicarbonate — Sodium carbonate — Steam — Carbon dioxide

2. **Combination reaction :** Reactions in which two or more substances combine to form a single substance are called *combination reactions*. The general form of this type of reactions is :

   $A + B \rightarrow AB$

   For example, An important combination reaction is the manufacture of hydrogen chloride gas where hydrogen and chlorine are made to react with each other.

   $H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$

   Hydrogen — Oxygen — Water

   Decomposition reaction : A reaction in which a compound breaks up into two or more simpler substances is called a *decomposition reaction*. This is just the opposite of a combination reaction. It can be represented as :

   $AB \rightarrow A + B$

The decomposition of a substance take place due to the energy of heat or light or electricity.

For example;

When calcium carbonate is heated, it decomposes to give calcium oxide and carbon dioxide.

$$\underset{\text{Limestone}}{CaCO_3\,(s)} \xrightarrow{\text{Heating}} \underset{\text{Quicklime}}{CaO\,(s)} + \underset{\text{Carbon dioxide}}{CO_2}$$

3. (a) **Oxidation :** *When a substance gains oxygen or loses hydrogen then oxidation of that substance takes place.*

Oxidising agent : *The substance which supplies oxygen or gains hydrogen is called* **oxidising agent**.

For example

1. Magnesium burns in oxygen to form magnesium oxide.

$$\underset{\substack{\text{Magnesium}\\ \text{[oxidation takes place]}}}{2Mg} + \underset{\text{Oxygen}}{O} \longrightarrow \underset{\substack{\text{Magnesium oxide}\\ \text{[oxidising agent]}}}{2MgO}$$

In the above reaction as magnesium gains oxygen, therefore, oxidation of magnesium takes place. As oxygen is the supplier of oxygen, therefore, oxygen is an oxdising agent.

(b) Reduction : *When a substance gains hydrogen or loses oxygen then reduction of the substance takes place.*

Reducing agent : *When a substance gains oxygen or loses hydrogen, the substance is called* **reducing agent**.

For example :

Heated copper oxide reacts with hydrogen to form copper metal and water.

$$\underset{\substack{\text{Copper oxide}\\ \text{[Reduction take place]}}}{CuO} + \underset{\substack{\text{Hydrogen}\\ \text{[Reducing agent]}}}{H_2} \xrightarrow{\text{Heating}} \underset{\text{Copper}}{Cu} + \underset{\text{Water}}{H_2O}$$

In the above reaction as copper oxide loses oxygen, therefore, reduction of copper oxide takes place. As hydrogen gas gains oxygen from copper oxide, therefore, hydrogen is the reducing agent.

4. **Thermal decomposition**

Decomposition caused by heat energy is called thermal decomposition.

Decomposition of mercuric oxide on heating is an example of thermal decomposition.

$$\underset{\text{Mercuric oxide}}{2HgO} \longrightarrow \underset{\text{Mercury}}{2Hg} + \underset{\text{Oxygen}}{O_2}$$

Electrolysis :

Decomposition caused by passing electricity through the aqueous solution of a substance is called electrolysis.

For example,

When electric current is passed through aqueous sodium chloride salt, it decomposes into sodium metal and chlorine gas.

$$2Nacl \xrightarrow[\text{decomposition}]{\text{electric current}} 2Na + cl_2$$

D. What kinds of reactions taking place in the following :

1. endothermic reaction
2. photochemical reaction
3. neutralisation reaction
4. precipitation reaction
5. Double displacement reaction

E. What happens :

1. When vinegar is poured on baking soda then bubbles of carbon dioxide gas form quickly. Water and sodium acetate are also formed.

$$\underset{\text{Acetic acid (present in vinegar)}}{CH_3COOH} + \underset{\text{Sodium bicarbonate (baking soda)}}{NaHCO_3} \rightarrow \underset{\text{Sodium acetate}}{CH_3COONa} + \underset{\text{Water}}{H_2O} + \underset{\text{Carbon dioxide gas}}{CO_2}$$

2. When silver nitrate is mixed with sodium chloride, a white precipitate of silver chloride is formed.

$$\underset{\text{Silver nitrate}}{AgNO_3} + \underset{\text{Sodium chloride}}{NaCl} \rightarrow \underset{\text{Sodium nitrate}}{NaNO_3} + \underset{\text{Silver chloride (white precipitate)}}{AgCl}$$

3. When sodium bicarbonate is heated strongly, it breaks down to give sodium carbonate, water and carbon dioxide.

$$\underset{\text{Sodium bicarbonate}}{2NaHCO_3} \rightarrow \underset{\text{Sodium carbonate}}{NaCO_3} + \underset{\text{Carbon dioxide}}{CO_2} + \underset{\text{water}}{H_2O}$$

4. When lead reacts with copper sulphate, lead sulphate solution and copper are formed.

$$\underset{\text{Zine}}{Pb} + \underset{\text{Copper sulphate}}{COSO_4} \rightarrow \underset{\text{Lead sulphate}}{PbSO_4} + \underset{\text{Copper}}{Cu}$$

F. Define the following :

1. **Distillation :** It is the process of purifying a liquid from non-volatile impurities. It can also be used for separating mixtures of miscible liquids with different boiling points.
2. **Precipitate :** When two solutions or two compounds undergo a chemical reaction, one of the products, an insoluble salt may settle down in the form of solid substances known as precipitates.
3. **Melting point of a substance :** The temperature at which a solid melts into a liquid is known as its melting point.
4. **Boiling point of a substance :** The temperature at which a liquid starts boiling is known as its boiling point.