Air and Atmosphere

Points to Remember :

1. Air is a mixture of many gases, mainly Nitrogen = 78.1%, Oxygen = 20.9%, Carbon dioxide = 0.03 – 0.04%, Inert gases = 0.9%, [Water vapours, Dust particles and Impurities = Variable].
2. Nitrogen is a colourless, an odourless and a tasteless gas. It is slightly lighter than air.
3. The process of conversion of free atmospheric nitrogen into its compounds is called nitrogen-fixation.
4. Oxygen constitutes about 21% of air by volume. It supports life on earth.
5. Carbon dioxide is present in air in a very small quantity, e. 0.03 – 0.04%. It is essential for the process of photosynthesis.
6. Inert gases like neon, argon do not react with any substance.
7. The harmful substances added to air are called pollutants.
8. Some pollutants are suspended particles like pollen grains, oxides of sulphur and nitrogen, oxides of carbon, chlorofluorocarbons etc.
9. Symbol of oxygen = O ; atomic number = 8, relative mass = 16, molecule formula = O_2.
10. Oxygen is available in free and combined state.
11. A catalyst is a substance that increases or decreases the rate of a chemical reaction without itself undergoing any chemical change.
12. Oxides are binary compounds formed by the chemical combination of substance with oxygen.
13. Rusting is the process in which iron slowly reacts with oxygen in the air and produces a flaky brown substance.
14. Photosynthesis is a process by which C02 and water are used up by green plants in the presence of sunlight to produce glucose and oxygen gases.

A. AIR : A MIXTURE OF GASES

EXERCISE — I

Question 1.
Give one use for each of the following inert gases :
(a) argon
(b) helium
(c) neon
(d) radon
(e) krypton
(f) xenon

Answer:
(a) Argon— Argon is filled into electric bulbs to prevent the oxidation of their filaments.
(b) Helium— It is used in filling up weather observation balloons.
(c) Neon— Neon is used for making advertisement sign boards.
(d) Radon— It is used for treatment of Cancer.
(e) Krypton— It is used in photography.
(f) Xenon— It is also used in photography.

Question 2.
Answer the questions put against each of the following constituents of air :
(a) Nitrogen : Explain its significance for plants and animals.
(b) Oxygen : What is the percentage proportion of oxygen in air ? Why is oxygen called active air.
(c) Carbon dioxide : "Although carbon dioxide plays no role in respiration, all life would come to an end if there is no carbon dioxide in air." Support this statement with relevant facts.
(d) Water vapours : Explain their role in modifying the earth's climate.
Answer:
(a) Plants convert nitrogen into protein. It is an important constituent of proteins, which are necessary for the growth of animals, plants and human beings. Plants convert nitrogen into proteins.
(b) 20.9%, oxygen is called active air because it supports life on earth. It is essential for the process of combustion.
(c) Carbon dioxide is essential for photosynthesis by which green plants prepare their food. It minimises heat loss by radiation. Thus, it balances the temperature on earth.
(d) Water vapour determine the earth's climate conditions. It causes rain. It controls the rate of evaporation from the bodies of plants and animals.

Question 3.
Define the following terms :
(a) pollutants
(b) acid rain
(c) Global warming
(d) smog

Answer:
(a) Pollutants : Air contains substances which are harmful to plants and animals. These harmful substances are called pollutants.
(b) Acid rain : When sulphur trioxide and nitrogen oxide present in the air mix with rainwater they form sulphuric acid and nitric acid respectively. Rainwater containing these acids is called acid rain.
(c) Global warming : An increase in the percentage of carbon dioxide, methane, nitrous oxide and chlorofluorocarbon traps the heat causing the temperature of the earth and its surroundings to rise. This is known as global warming.

(d) Smog : Oxides of nitrogen form a mixture of smoke and fog known as smog which affects our eyes too.

Question 4.
"Air is a mixture". Support this statement citing at least three evidences.
Answer:
"Air is a mixture" The following are in evidences which prove that air is a mixture.

1. The composition of air varies from place to place and from time to time.
2. The components of air retain their individual properties.
3. Liquid air has no definite boiling point.
4. No energy exchange occurs when the components of air are mixed with each other.

Question 5.
What is air pollution ? What are the harmful effects of sulphur dioxide, nitrogen dioxide and hydrogen sulphide present in the air ?
Answer:
Air Pollution : Air is polluted by natural processes like volcanic eruption, crop pollination, etc. mostly it is polluted by human activities like burning of coal, wood, diesel oil, kerosene, petrol etc.
Fossil fuels contain sulphur and nitrogen as impurities. When fuels bum these substances combine with air to produce gasses like sulphur dioxide, nitrogen oxide and hydrogen sulphide. They cause many serious respiratory problems. They can destroy the ozone layer, which protects us from the ultra violet radiations of the Sun. They also cause acid rain, which damages crops and buildings.

Question 6.
(a) What are the causes of air pollution ?
(b) Suggest five measures to prevent air pollution.
Answer:
(a) When fuels bum they produce sulphur dioxide, sulphur trioxide, nitrogen dioxide, hydrogen sulphide when these gases mix with rain water. They produce sulphuric and nitric acid. These acids mix with rain water to form acid rain.
(b) Five measures for the prevention of air pollution are:

1. By using smokeless sources of energy, like solar energy and electrical energy, in place of conventional fossil fuels.
2. By using filters for the. smoke coming out of the chimneys of factories and power plants.
3. By using internal combustion engines in vehicles for complete and efficient burning of fuel.
4. By locating industries away from residential areas.
5. By growing more trees.

Question7.
(a) What is nitrogen-fixation ?
(b) What are the two ways in which nitrogen fixation occurs?
(c) Explain the conversion of nitrogen into nitrates during lightning.
Answer:
(a) Nitrogen fixation : Symbiotic bacteria living in the root nodules of leguminous plants like peas, beans, absorb nitrogen directly from air and convert into nitrates. Thereafter, the plants convert it into proteins. Nitrogen is returned to the soil when plant and animal matter decays. This decomposition work is done by organisms called denitrifying bacteria which reconvert dead organic tissue into its constituent nitrogen.
(b) 1. Natural process.
2. Non-biological fixation.
(c) During lightning, temperatures often reach as high as 3000°C. At such high temperatures, nitrogen and oxygen present in the air combine to form nitric oxide, which further react with oxygen to form nitrogen dioxide

$$N_2 + O_2 \xrightarrow{\text{electric}} 2NO$$

Oxygen constitutes about 21% of air by volume. It is the active part of air.

$$2NO + O_2 \xrightarrow{\text{discharge}} 2NO_2$$

Nitrogen dioxide then reacts with the water vapour present in air to form nitrous and nitric acids.

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

Oxygen constitutes about“21% of air by volume. It is the active part of air.
Nitric acid, so formed, reaches the earth along with rain-water, and reacts with metal carbonates to form metal nitrates.

$$CaCO_3 + 2HNO_3 \longrightarrow Ca(NO_3)_2 + H_2O + CO_2$$

Oxygen constitutes about 21% of air by volume. It is the active part of air.

B. OXYGEN

EXERCISE — II

Question 1.
Name :
(a) The most abundant element in the earth’s crust.
Ans. Oxygen.

(b) A chemical called oxygenated water.
Ans. H_2O_2 (Hydrogen peroxide)

(c) A metal highly resistant to rusting.
Ans. Tin.

(d) A mixture of oxygen and carbon dioxide used for artificial respiration.
Ans. Carbogen

(e) Two substances from which oxygen can be obtained at a large scale.
Ans. Air, water.

(f) An oxide and a carbonate containing oxygen.
Ans. Mercuric oxide and potassium chlorate.

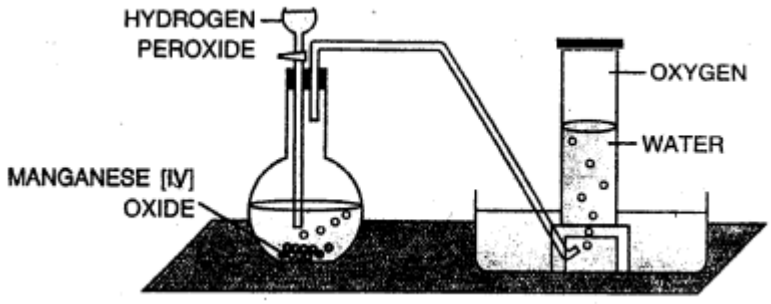
(g) Two substances which undergo rapid oxidation.
Ans. Sodium, carbon.

Question 2.

(a) Taking hydrogen peroxide, how would you prepare oxygen in the laboratory ?
(b) What is the role of manganese dioxide in the preparation of oxygen ?
(c) Write the balanced chemical equation for the above chemical reaction.
(d) Why is hydrogen peroxide preferred in the preparation of oxygen gas ?
(e) Why is oxygen collected by downward displacement of water ?
(f) What happens when a glowing splinter is introduced in a jar containing oxygen ?
(g) What happens when oxygen gas is passed through alkaline pyrogallol solution ?

Answer:

(a) Take manganese dioxide in a round bottom flask and add hydrogen peroxide drop by drop to it, which acts ; a catalyst as shown in the figure. Collect oxygen by downward displacement of water.



(b) Manganese dioxides acts as a catalyst.

(c) Hydrogen peroxide $\xrightarrow{\text{Manganese dioxide}}$ Water + Oxygen

$$2H_2O_2 \xrightarrow{MnO_2} 2H_2O + O_2$$

(d) H_2O_2 is preferred for lab preparation of oxygen because of following reasons.

1. No heating is required.

2. The rate of evolution of oxygen (O_2) is moderate and under control.
   H_2O_2 is a safe chemical.

(e) Since the water is displaced downward by the gas collecting in the jar, the process is called downward displacement of water. The reasons are :

1. Oxygen is only slightly soluble in water. Therefpre it can be collected over water without fear of excessive dilution.
2. Oxygen is slightly heavier than air, so it cannot collected over air.

(f) Introduction of glowing splinter in the jar. The glowing splinter rekindles, but the gas does not catch fire.
(g) Alkaline pyrogallol solution turns brown when oxygen is passed through it.

Question 3.
(a) What happens when

1. **mercuric oxide and**
2. **potassium nitrate are heated ?**

(b) Why is potassium chlorate not used for laboratory preparation of oxygen ?

Answer: (a)

1. When mercuric oxide is heated, it decomposes to give mercury and oxygen.
2. Potassium nitrate on heating gets converted into molten potassium nitrite with the release of oxygen.

(b) Potassium chlorate needs heating for quite sometime (to a high temperature) before it decomposes.

Question 4.
What are oxides ? Give two examples for each of me – tallic and non-metallic oxides.

Answer:
Oxides are binary compounds formed by the chemical combination of a substance metal or a non-metal with oxygen.
Examples :
Metal:

1. Sodium oxide (Na_2O).
2. Calcium oxide (CaO).

Non-metal:

1. Sulphur dioxide (SO_2).
2. Carbon dioxide (CO_2).

Question 5.
Name the three types of oxidation processes. In which of these large amount of heat and light energy are produced?

Answer:
Oxidation can be categorised into three types :

1. Spontaneous oxidation
2. Rapid oxidation
3. Slow oxidation

Out of the above said three types, rapid oxidation produces large amount of heat and light energy.

Question 6.
What do you observe when the following substances are heated and then tested with moist blue and red litmus – paper?
(a) Sulphur
(b) Phosphorus
(b) Calcium
(d) Magnesium

Answer:
(a) Sulphur : Blue litmus turns red.
(b) Phosphorus : Blue litmus turns red.
(c) Calcium : Red litmus turns blue.
(d) Magnesium : Red litmus turns blue.

Question 7.

Complete and balance the following chemical equations.

$KNO_3 \xrightarrow{heat} KNO_2 +$ _____

$KClO_3 \xrightarrow{heat}$ _____ $+ O_2$

$HgO \xrightarrow{heat}$ _____ + _____

$CaO + H_2O \longrightarrow$ _____

Ans. $2KNO_3 \xrightarrow{heat} 2KNO_2 + O_2\,(g)$

$2KClO_3 \xrightarrow{heat} 2KCl + 3O_2$

$2HgO \xrightarrow{heat} 2Hg + O_2$

$CaO + H_2O \longrightarrow Ca(OH)_2$

Question 8.

(a) Give four uses of oxygen.

(b) How is oxygen naturally renewed in air ?

Answer:

(a) Uses of oxygen

1. Oxygen is used by firemen, miners, aviators, sea divers and even by every living being.
2. Oxygen is necessary for burning of fuels.
3. Oxygen mixed with hydrogen as fuel produces.a flame with a very high temperature about 2800°C.
4. As a fuel in spacecraft.

(b) All living beings use atmospheric oxygen in breathing and burning of fuels and in the formation of oxides of nitrogen. Yet amount of oxygen in the air remains more or less constant. This is because green plants return oxygen to the atmosphere by the process of photosynthesis.

Question 9.

(a) What is rust ?

(b) State at least two ways of prevent rusting.

Answer:

(**a) Rust:** Rust is hydrated ferric oxide (Fe_2O_3 . x* H_2O), which forms a brownish red coating over iron. (* x can be any number.)

(b) Two ways of prevention of rusting :

1. Painting with red lead.
2. Oil paint is applied on doors and windows.
3. Enamel coating. Enamel is a mixture of iron, and steel with silicates.
4. Coal tar it is used for coating the lower parts of ships and bridges.

Question 10.

State two differences between : Rusting and burning.

Answer:

Difference between rusting and burning

Rusting	Burning
1. Rusting is the process in which iron slowly reacts with oxygen in the air and produces a flaky substance called rust. 2. Air and moisture are necessary for rusting.	1. Burning is fast oxidation process in which large amount of energy is produced. 2. Only air is necessary for burning.

OBJECTIVE TYPE QUESTIONS

1. Fill in the blanks :

(a) Argon is the most abundant inert gas present in air.
(b) Oxides of sulphur and nitrogen combine with rain water to form **sulphuric acid** and **nitric acid** which cause **acid rain.**
(c) NO_2 and **CO** are the most common air pollutants.
(d) Joseph Priestly discovered the oxygen gas.
(e) Oxygen occupies about **21**% of air by volume.

2. Match the following :

	Column A		**Column B**
	(a) Global warming	**(*i*) Hydrated ferric oxide**
	(b) Acid rain	**(*ii*) Manganese dioxide**
	(c) Rust	**(*iii*) Carbon dioxide**
	(d) Catalyst	**(*iv*) Methane**
	(e) Photosynthesis	**(*v*) Nitrogen dioxide**
Ans.	**Column A**	**Column B**
	(a) Global warming	(*iv*) Methane
	(b) Acid rain	(*v*) Nitrogen dioxide
	(c) Rust	(*i*) Hydrated ferric oxide
	(d) Catalyst	(*ii*) Manganese dioxide
	(e) Photosynthesis	(*iii*) Carbon dioxide

MULTIPLE CHOICE QUESTIONS

1. A fuel when used releases least amount of pollutants in the air.
(a) sulphur dioxide
(b) chlorofluorocarbon
(c) smoke
(d) CNG

2. The natural way of adding oxygen to air which involves green plants is called
(a) photosynthesis
(b) respiration
(c) burning
(d) dissolution

3. Which one of the following is most likely to be corroded?
(a) a stainless steel cup-board
(b) a galvanised iron bucket
(c) an iron hammer
(d) a tin plated iron box

4. The process by which oxidation of food in our body takes place is
(a) photosynthesis
(b) respiration
(c) decomposition
(d) combustion

ADDITIONAL QUESTIONS

A. Air : A Mixture of Gases

Question 1.
What was the ancient belief regarding the nature of matter ?
Answer:
The ancient belief about the nature of matter was that it is com-pound of four elements

1. fire
2. air
3. wood
4. earth

Question 2.
Name the main components of air.
Answer:
The main components of air are

1. nitrogen
2. oxygen
3. carbon dioxide
4. water vapour
5. inert or noble gases

Question 3.
Mention the contribution of the following scientists :

1. Antoine Lavoisier
2. Robert Boyle
3. Joseph Priestley
4. Sir W. Ramsay

Answer:

1. **Antoine Lavoisier**
   Conducted experiments to know the nature of combustion.
2. **Robert Boyle**
   Discovered a rule about how gases behave
3. **Joseph Priestley**
   Prepared oxygen by heating red mercuric oxide with infra red rays from Sun and proved that air was not an element.
4. **Sir W. Ramsay**
   Sir William Ramsay, alongwith Lord Raleigh discovered ar-gon; a noble gas, which is also called as rare gas or inert gas. He also prepared neon, krypton and xenon by distillation of liquid air. In 1910, he discovered radon.

Question 4.
State three uses of water vapour in the air.
Answer:

1. Provides moisture for plant and animal growth.
2. Determines climatic conditions by providing rain, snow, mist etc.
3. Prevents undue drying up of the plant and animal bodies.

Question 5.
State one method by which :

1. Oxygen is added to air
2. Carbon dioxide is added to air
3. Oxygen is removed from the air
4. Carbon dioxide is removed from the air

Answer:

1. Photosynthesis by green plants
2. Combustion of various compounds
3. Respiration by living organisms
4. Plants- during photosynthesis.

Question 6.

Describe a simple experiment to show that l/5th of air is oxygen.

Answer:

Aim : To show that l/5th of the air is oxygen.

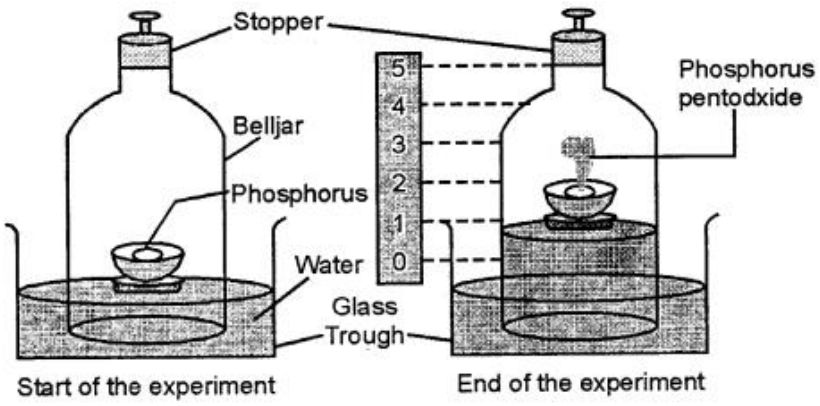
apparatus required : Glass trough, bell jar, stopper, water, phos-phorus, evaporating dish

PROCEDURE

1. a glass trough is filled with water
2. A dry evaporating dish containing white phosphorus is made to float on the water.
3. This apparatus is covered with a well stoppered bell jar with markings on its side.
4. A glowing iron wire is introduced into the bell jar by opening the stopper
5. The phosphorus is carefully ignited.
6. Re-stopper the apparatus
7. The phosphorus bums with a brilliant flame farming dense white fumes of phosphorus pentoxide.
8. Soon the burning ceases and the water level starts rising.
9. The water occupies approximately l/5th of the original volume, as the fumes dissolve in water.
10. Some phosphorus is left unburnt in the dish. The air left behind in the bell jar does not allow the phosphorus to burn.

INFERENCE : The experiment shows that the volume of air oc-cupied by oxygen is 1 /5th.

DIAGRAMMATIC REPRESENTATION



Question 7.
Give reasons to support the fact that air is a mixture.
Answer:
Air is a mixture can be supported by the following evidences.

1. Variable composition at different places
2. Lacks distinct properties of its own
3. Has no definite boiling point
4. Components of air cannot be easily seperated by physical means.
5. Formation of air does not involve any energy change.
6. Cannot be represented by a chemical formula.

Question 8.
Name the products formed when a candle burns in air.
Answer:
Carbondioxide and water vapour are formed due to the burning of candle.

OBJECTIVE TYPE QUESTIONS

Question A.
Fill in the blank spaces by choosing the correct words from the given list.
List: oxygen, carbonic, sulphurUioxide gas, precipitation, helium

1. Sulphur dioxide gas can cause acid rain.
2. Every nine parts of water by weight contains eight parts by weight of oxygen.
3. Dust particles help in the precipitation of water vapour in air.
4. Helium gas is used for filling weather observation balloons.
5. Solution of carbon dioxide in water is called carbonic acid.

Question B.
Statements given below are incorrect. Write the correct statements :

Question 1.
Carbon dioxide gas allows the earth to radiate out heat rapidly.
Answer:
Carbon dioxide gas does not allow the earth to radiate out heat rapidly.

Question 2.
Helium gas at low pressure is used for filling electric bulbs.
Answer:
Argon gas at low pressure is used for filling electric bulbs.

Question 3.
Symbiotic bacteria are present in nodules of cereal plants such as wheat.
Answer:
Symbiotic bacteria are present in nodules of pod bearing plants such as peas, grams, etc.

Question 4.
During thunder and lightning, nitrogen and oxygen combine to form nitrogen dioxide gas.
Answer:
During thunder and lightning, nitrogen and oxygen combine to form nitric oxide gas.

Question 5.
The percentage of oxygen in air by volume, varies from 21% to 22%.
Answer:
The percentage of oxygen in air by volume, varies from 20.8% to 20.9%.

Question C.
Match the statements in Column A, with those in Column B.

Column A		Column B
1. Largest constituent of air, which dilutes the activity of oxygen.	(a)	Oxygen
2. A gas used for filling weather observation balloons.	(b)	Carbonic acid
3. An acid formed by the dissolution of sulphur dioxide gas in water.	(c)	Sulphuric acid
4. An acid formed by the dissolution of carbon dioxide in water.	(d)	Helium
5. A gas vital for respiration.	(e)	Nitrogen

Ans. Column A		Column B	
1.	Largest constituent of air, which dilutes the activity of oxygen.	(e)	Nitrogen
2.	A gas used for filling weather observation balloons.	(d)	Helium
3.	An acid formed by the dissolution of sulphur dioxide gas in water.	(c)	Sulphuric acid
4.	An acid formed by the dissolution of carbon dioxide in water.	(b)	Carbonic acid
5.	A gas vital for respiration.	(a)	Oxygen

Question D.

Write 'True' or 'False' in front of following statements.

Question 1.

Atmospheric nitrogen is directly absorbed by the plants to form plant proteins.

Answer: False. Atmospheric nitrogen cannot be directly absorbed by the plants to form plant proteins.

Question 2.

Water containing dissolved carbon dioxide can dissolve marble.

Answer: True.

Question 3.

Nitrogen is a gaseous non-metal essential for respiration.

Answer: False. Oxygen is a gaseous non-metal essential for respiration.

Question 4.

The area where a lot of fuel burns has more percentage of carbon dioxide.

Answer: True.

Question 5.

The trapping of solar heat energy in the earth's atmosphere is called greenhouse effect.

Answer: True.

Question E.

Tick (√) the most appropriate answer.

1. A gas which dilutes the activity of oxygen in air is :

(a) carbon dioxide

(b) sulphur dioxide

(c) nitrogen
(d) noble gases

2. Symbiotic bacteria is not present in the nodules of :
(a) gram plant
(b) rice plant
(c) sweet peas plant
(d) peas plant

3. The presence of water vapour in air is essential for :
(a) health and comfort of animals
(b) rate of evaporation from plants and animals
(c) growth of plants
(d) all the above

4. Which is not a polluting gas for the air?
(a) Sulphur dioxide gas
(b) Nitrogen dioxide gas
(c) Carbon monoxide gas
(d) Neon gas

5. The humans pollute the air by :
(a) burning a vast amount of coal
(b) burning waste materials
(c) using petrol and diesel vehicles
(d) all the above

STUDY QUESTIONS

Question 1.

Briefly state the importance of following constitutents of air :
(a) Oxygen,
(b) Nitrogen,
(c) Carbon dioxide,
(d) Water vapour.

Answer:

(a) Oxygen in the air is essential for respiration and burning.
(b) Nitrogen dilutes the activity of oxygen in air. Its compounds are very useful for the growth of plants.
(c) Carbon-dioxide acts as a food for plants and in the regeneration of oxygen. It also helps in trapping heat radiations on earth.
(D) Water vapour controls climatic conditions and is very essential for the health and comfort of all living beings.

Question 2.
(a) What do you understand by the term polluted air?
(b) State and explain two ways by which air gets polluted in nature.

Answer:
(a) When the air contains harmful or undesirable substances, generated by the activities of man or nature, such that their concentration interferes with human health or is injurious to plants or animals, it is said to be polluted air.
(b) Air gets polluted in nature by following ways :

- During forest fire, a large amount of carbon particles (smoke) and carbon-monoxide pollute the air.
- When volcanoes erupt, a huge amount of ash and sulphur-dioxide is added in the air as pollutants.

Question 3.
(a) Name and briefly explain four ways by which pollution of air is caused by humans.
(b) Name and briefly explain four ways by which pollution of air caused by humans is minimised.

Answer:
(a) Pollution of air is caused by humans in the following ways :

1. Large amount of coal burnt in thermal plants throw out huge amounts of smoke and ash in the atmosphere.
2. Vehicles using petrol or diesel give out a lot of smoke and harmful gases like carbon-dioxide, lead, carbon- monoxide.
3. Burning of garbage causes a lot of pollution due to the formation of carbon-monoxide, sulphur dioxide and nitrogen dioxide.
4. Pesticides spread in the fields also cause air pollution.

(b) Pollution of air by humans can be minimised in the following manner :

1. In the thermal power plants, steel plants etc., electric precipitators should be used to reduce the smoke and ash entering the air.
2. Efficient internal combustion engines should be used in vehicles.
3. Improved chulha or stoves should be used to minimise the production of smoke and carbon-monoxide.
4. We must grow more trees as they absorb harmful gases.

Question 4.
(a) What is greenhouse effect?
(b) How is greenhouse effect produced?

Answer:
(a) The trapping of solar heat energy in earth's atmosphere is called greenhouse effect.
(b) The solar heat radiations consist of very short wavelength infrared radiations. These radiations can easily pass through the atmosphere. These radiations are absorbed by the Earth's surface and temperature of the Earth rises during the daytime. At night, the Earth radiates out heat radiations of very long wavelength which cannot easily penetrate through the atmosphere because carbon-dioxide and clouds act as excellent reflectors. Thus, heat radiations are trapped in the atmosphere which keep the Earth warm during night. This trapping of outgoing solar heat energy in Earth's atmosphere is greenhouse effect.

Question 5.
Discuss harmful effects of greenhouse effect.
Answer:
Large amount of carbon-dioxide in the polluted air results in increase of greenhouse effect which has raised the average temperature of the Earth by 2°C. This results in global warming which, in turn, will melt ice on the polar caps, thereby raising the level of sea water by a few metres. This can result in submerging of coastal areas and islands causing excessive damage.

Question 6.
Discuss two useful applications of greenhouse effect.
Answer:
Two useful applications of greenhouse effect are :

1. **Growing vegetables and flowers in snow-bound regions** : Sheds using glass walls are built which allow smaller wavelength of solar heat radiations to pass into the shed but does not allow the longer wavelength of heat radiations to pass out during night. This keeps the shed reasonably warm for flowers and vegetables to grow.
2. **Use of glass in keeping homes warm :** In cold countries, the glass windows and doors allow the smaller wavelength
of heat radiations of solar energy to pass into the rooms but does not allow longer wavelength of heat radiations to pass out. Thus, greenhouse effect takes place and rooms keep reasonably warm.

Question 7.
What is the significance of water vapour in air?
Answer:
Significance of water vapour in atmosphere is as follows:

1. Presence of water vapour in air determines the climatic conditions. Excessive water vapour causes rain. They also produce snow, fog, mist, hails and other phenomenon, depending upon the temperature.
2. The presence of water vapour controls the rate of evaporation from the plants and animals.
3. The presence of water vapour is very essential for the growth of plants.
4. It is very essential for the health and comfort of animals.

Question 8.
Name three noble gases present in the air. State their one industrial use^
Answer:
Three noble gases present in the air are :

1. **Helium :** It is used for filling weather observation balloons.
2. **Argon :** It is used for filling electric bulbs at low pressure.
3. **Neon :** It is used for making advertising glow tubes, used on big shops, hotels etc. at night.

Question 9.
What problems are caused by the presence of following in excessive amount in the air?
(a) dust particles
(b) smoke particles
(c) sulphur dioxide gas
(d) nitrogen dioxide gas
(e) carbon monoxide gas
(f) hydrorgen sulphide

Answer:
(a) Excess of dust particles can cause serious respiratory problems.
(b) Excess of smoke particles in air can cause serious respiratory problems.
(c) Excess of sulphur dioxide gas can lead to acid rain and cause respiratoiy problems.
(d) Excess of nitrogen dioxide gas can lead to acid rain damaging plants and properties. They also cause respiratory problems. They lead to thinning of ozone layer too.
(e) Excess of carbon monoxide leads to breathing problem and can be fatal.
(f) Excess of hydrogen sulphide can lead to serious respiratory problems as it is very toxic. It can also affect the nervous system in humans.

B. Oxygen

Question 1.
Fill in the blanks:

1. **Joseph Priestley** discovered the oxygen gas.
2. Oxygen is slightly **heavier** than air.
3. Manganese dioxide acts as a **catalyst.**
4. Oxygen is collected by the **downward** displacement of **water.**
5. Oxygen occupies about **1/5 th** of air by volume.
6. Oxygen is **neutral** to litmus testing.

Question 2.
(1) What happens when (a) mercuric oxide and (b) potassium nitrate are heated ?
Answer:

(*i*) (a) Mercuric oxide $\xrightarrow{\text{heating}}$ Mercury + Oxygen

$2HgO \longrightarrow 2Hg + O_2$

Action of heat on mercuric oxide : Mercuric oxide is a red powder. When it is heated in a test tube, it decomposes to give mercury and oxygen.

(b) Potassium nitrate (white crystalline solid) $\xrightarrow{\text{heating}}$ Potassium nitrite (molten form) + Oxygen (g)

$2KNO_3 \xrightarrow{\text{heating}} 2KNO_2 + O_2\ (g)$

2. Why is potassium chlorate is not used for laboratory preparation of oxygen ?
Ans.
(ii) Potassium chlorate is a white solid. When it is heated strongly, first it melts and then it begins to boil, giving of oxygen. Potassium chlorate needs strong heating. That is why it is not used for laboratory preparation of oxygen.

Question 3.
What happens when the following substances burn in oxygen ? Also give the balanced chemical equations for each of the reactions.

1. Sulphur
2. Carbon
3. Phosphorus
4. Sodium
5. Magnesium
6. Iron

Answer:

1. Sulphur bums with a bright bluish flame, giving the pungent smell of sulphur dioxide.

$$S + O_2 \xrightarrow{heat} SO_2 + heat$$

2. Carbon bums with bright sparks, forming carbon dioxide

$$C + O_2 \xrightarrow{heat} CO_2 + heat.$$

3. Phosphorus bums with a dazzing flame, producing dense white fumes of phosphorus pentoxide.

$4P + 5O_2 \rightarrow 2P_2O_5 + heat$

4. Sodium bums brightly, with a brilliant yellow flame.

$4NA + O_2 \rightarrow 2Na_2O + heat$

5. Magnesium bums with a bright dazzling light, forming the white powder of magnesium oxide.

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

6. Red hot iron bums with a bright sark, forming an oxide of iron.

$3Fe + 2O_2 \rightarrow Fe_3O_4 + heat$

Question 4.

Give balanced equations to obtain oxygen from :

1.
    1. Silver oxide
    2. Potassium chlorate
    3. Hydrogen peroxide
    4. Mercuric oxide
    5. Lead dioxide

Ans. (*i*) Red lead

$$2\,Pb_3O_4 \longrightarrow 6\,PbO + O_2 \uparrow$$

(red) (yellow litharge)

(*ii*) Silver oxide

$$2\,Ag_2O \longrightarrow 4\,Ag + O_2 \uparrow$$

(*iii*) Potassium chlorate

$$2KClO_3 \longrightarrow 2KCl + 3O_2 \uparrow$$

(*iv*) Hydrogen peroxide

$$2\,H_2O_2 \xrightarrow{MnO_2} 2H_2O + O_2 \uparrow$$

(*v*) Mercuric oxide

$$2HgO \longrightarrow 2Hg + O_2 \uparrow$$

(Orange red) (silvery grey)

(*vi*) Lead dioxide

$$2PbO_2 \longrightarrow 2PbO + O_2 \uparrow$$

(chocolate brown)

Question 5.

State the use of manganese dioxide in the laboratory prepa-ration of oxygen from potassium chlorate.

Answer:

In the laboratory preparation of oxygen from potassium chlor¬ate, manganese dioxide acts as a catalyst i.e. it increase the rate of production of oxygen without getting itself consumed.

Question 6.

State the precautions while preparing oxygen in the labo-ratory.

Answer:

The various precautions are :

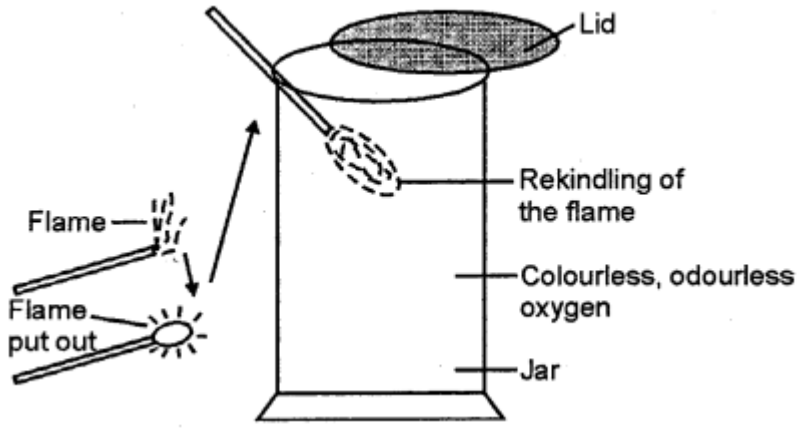
1. Donot collect the first-few bubbles of the gas produced as it is the air in the delivery tube which is driven out
2. Method of collection of gas should be appropriate Arundeep's M.S. Chemistry-7th 126

3. Keep all inflammable and bummg apparatus away as oxygen is j a supporter of conbustion.

Question 7.
How will you obtain dry oxygen in the laboratory ?

Answer:
Dry oxygen can be obtained if the gas so collected is passed f over a tower containing drying agents like phosphorus pentaoxide, fused calcium chloride or bubbling the gas through concentrated sulphuric acid. Then the dry gas is collected by downward displacement of mer – cury.

Question 8.
How will you identify oxygen in the laboratory ?
Answer:
Oxygen is a colourless and odourless gas which rekindles a glow¬ing splinter.



Question 9.
Classify the following oxides. Also give a balanced equa¬tion to prepare each.

1. **Water**
2. **Carbon dioxide**
3. **Calcium oxide**
4. **Aluminium oxide**
5. **Copper oxide**
6. **Carbon monoxide**
7. **Sulphur dioxide**
8. **Phosphorus pentoxide**
9. **Nitric oxide**
10. **Magnesium oxide**

Ans. (*i*) Water → neutral oxide

$2H_2 + O_2 \rightarrow 2H_2O.$

(*ii*) carbon dioxide → acidic oxide

$C + O_2 \rightarrow CO_2$

(*iii*) calcium oxide → Basic oxide

$2Ca + O_2 \rightarrow 2CaO.$

(*iv*) aluminium oxide → amphoteric oxide

$4Al + 3O_2 \rightarrow 2Al_2O_3$

(*v*) copper oxide → Basic oxide

$2\,Cu + O_2 \rightarrow 2CuO.$

(*vi*) carbon monoxide → acidic oxide

$2C + O_2 \rightarrow 2CO$

(insufficient oxygen)

(*vii*) sulphur dioxide → acidic oxide

$S + O_2 \rightarrow SO_2$

(*viii*) Phosphorus pentaoxide → acidic oxide

$4P + 5O_2 \rightarrow 2P_2O_5$

(*ix*) Nitric oxide → acidic oxide

$N_2 + O_2 \xrightarrow{3000^\circ C} 2NO$

(*x*) Magnesium oxide → Basic oxide

$2Mg + O_2 \rightarrow 2MgO.$

Question 10.

State two characteristics of each :

1. Acidic oxides
2. Basic oxides

Answer:

Acidic oxides

1. Formed when non metals are burnt in oxygen
2. When dissolved in water form acids, eg. carbon dioxide [CO_2]

Basic oxide

1. Formed when metals are burnt in air
2. turn red litmus to blue.
   eg. potassium oxide [K_2O]

Question 11.

Complete and balance the following equation

(*i*) P_2O_5 + H_2O →

(*ii*) S + O_2 →

(*iii*) N_2 + O_2 $\xrightarrow{3000°C}$

(*iv*) Al + O_2 →

(*v*) K_2O + H_2O →

(*vi*) CaO + H_2O →

Ans. (*i*) $P_2O_5 + 3H_2O \rightarrow 2H_3PO_4$

(*ii*) $S + O_2 \rightarrow SO_2$

(*iii*) $N_2 + O_2 \xrightarrow{3000°C} 2NO$

(*iv*) $4Al + 3O_2 \rightarrow 2Al_2O_3$

(*v*) $K_2O + H_2O \rightarrow 2KOH$

(*vi*) $CaO + H_2O \rightarrow Ca(OH)_2$

OBJECTIVE TYPE QUESTIONS

Question A.

Fill in the blank spaces by choosing the correct words from the given list.

List: sulphurous, nitric acid, red lead oxide paint, oxygen, phosphoric

1. Potassium nitrate crystals on heating strongly yield potassium nitrite and **oxygen** gas.
2. Sulphur dioxide gas dissolves in water to form **sulphurous** acid.
3. Phosphorus pentaoxide on dissolving in water forms **phosphoric** acid.
4. To prevent rusting, the underside of the ships is coated with **red lead oxide paint.**

5. The nitric oxide gas reacts with the oxygen and water vapour to form **nitric acid** vapour.

Question B.
Statements given below are incorrect. Write the correct statements :
Question 1.
Oxygen is prepared in laboratory by treating hydrogen oxide with manganese dioxide.
Answer:
Oxygen is prepared in laboratory by treating hydrogen peroxide with manganese dioxide.

Question 2.
Calcium burns in oxygen with a golden yellow flame.
Answer:
Sodium burns in oxygen with a golden yellow flame.

Question 3.
The oxygen gas turns moist blue litmus red.
Answer:
The oxygen gas does not turn moist blue litmus red.

Question 4.
Moist oxygen causes rusting in carbon.
Answer:
Moist oxygen causes rusting in iron.

Question 5.
Potassium nitrate on strong heating decomposes into potassium nitrite and nitrogen gas.
Answer:
Potassium nitrate on strong heating decomposes into potassium nitrite and oxygen gas.

Question C.

Match the statements in Column A, with those in Column B.

Column A	Column B
1. A mixture of oxygen and carbon dioxide used for artificial respiration.	(a) Manganese dioxide
2. A compound which on strong heating yields oxygen gas.	(b) Sodium
3. The process of coating zinc on the surface of iron to prevent rusting.	(c) Carbogen
4. A catalyst used in laboratory preparation of oxygen from hydrogen peroxide.	(d) Potassium nitrate
5. A metal which burns with a golden yellow flame in oxygen.	(e) Galvanising

Ans.

Column A	Column B
1. A mixture of oxygen and carbon dioxide used for artificial respiration.	(c) Carbogen
2. A compound which on strong heating yields oxygen gas.	(d) Potassium nitrate
3. The process of coating zinc on the surface of iron to prevent rusting.	(e) Galvanising
4. A catalyst used in laboratory preparation of oxygen from hydrogen peroxide.	(a) Manganese dioxide
5. A metal which burns with a golden yellow flame in oxygen.	(b) Sodium

Question D.

Write 'True' or 'False' in front of following statements.

1. The catalyst used in laboratory preparation of oxygen gas from hydrogen peroxide gas is magnesium oxide.

Ans. False. The catalyst used in laboratory preparation of oxygengas from hydrogen peroxide gas is magnesium dioxide.

2. Under laboratory conditions, the oxygen gas is insoluble in water.

Ans. True.

3. The rust formed on the surface of iron easily crumbles.

Ans. True.

4. Enamelling is the process of baking a mixture of silicates on the surface of aluminium at a high temperature.

Ans. False. Enamelling is the process of baking a mixture of silicates on the surface of iron at a high temperature.

5. Liquid oxygen is used for burning fuel in spaceships.

Ans. True.

Question E.

Tick (√) the most appropriate answer.

1. The catalyst used in the preparation of oxygen from hydrogen peroxide is :

(a) Magnesium oxide
(b) Manganese oxide
(c) Manganese dioxide
(d) Manganese hydroxide

2. Sodium burns in oxygen with a flame which is :

(a) brick red in colour
(b) golden yellow in colour
(c) blue in colour
(d) crimson in colour

3. Galvanising is the process of coating iron with a layer of molten :

(a) zinc
(b) tin
(c) copper
(d) silver

4. Magnesium burns with a dazzling white flame to form magnesium oxide, a powdery mass. The colour of magnesium oxide is : .
(a) milk white
(b) grey
(c) silvery
(d) yellow

5. When sulphur burns in oxygen, the colour of the flame is :
(a) dazzling white
(b) golden yellow
(c) parrot green
(d) brilliant blue

STUDY QUESTIONS

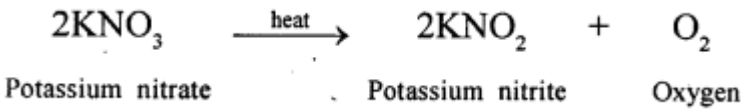
Question 1.

Describe your observations when potassium nitrate crystals are heated strongly in a test tube and a glowing splint is held near the mouth of test tube. Write a fully balanced chemical equation for the decomposition of potassium nitrate crystals.

Answer:

The following observations are made when potassium nitrate crystals are heated strongly in a test tube and a glowing splint is held near the mouth of test tube :

1. The white crystals of potassium nitrate slowly melt to form a colourless liquid.
2. The glowing splint bursts into flame, showing that molten potassium nitrate gives off oxygen gas.

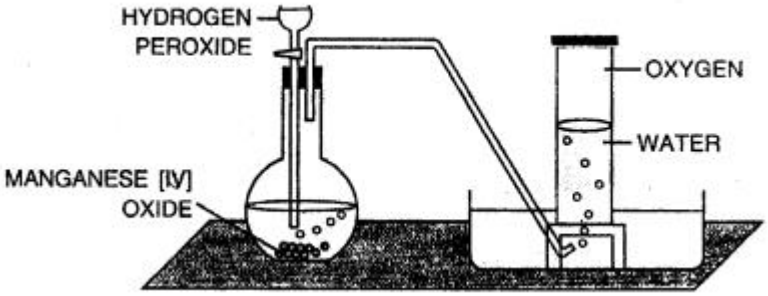


Question 2.

(a) Starting from hydrogen peroxide how is oxygen gas prepared in laboratory?
(b) What is the function of manganese dioxide?
(c) Write fully balanced equation for the liberation of oxygen from hydrogen peroxide.
(d) Why is the above method preferred to any other method?

Answer:

(a) When 20% hydrogen peroxide is poured in funnel and allowed to drip into the flask containing 5g of manganese dioxide, oxygen gas is evolved which is apparent from the bubbles coming out of the water trough. Allow the first few bubbles to escape, as they contain air. Place a glass cylinder filled with water in inverted position over the beehive shelf. The oxygen will collect in the cylinder by the downward displacement of water.



(b) Manganese dioxide does not take part in the chemical reaction. However, it accelerates the rate of decomposition of hydrogen peroxide acting as a catalyst.

(c) $2H_2O_2 \xrightarrow[\text{Catalyst}]{MnO_2} 2H_2O + O_2$

Hydrogen peroxide — Water — Oxygen

(d) This method is preferred to any other method to prepare oxygen because :

- The oxygen gas is evolved at room temperature. No heating is required.
- The rate of evolution of oxygen is fairly fast.
- Hydrogen peroxide or manganese dioxide are not dangerous chemicals and hence, can be handled easily.

Question 3.

State any four physical properties of oxygen gas.

Answer:

Physical properties of oxygen gas are :

1. Oxygen is a colourless, odourless and tastless gas.
2. Under laboratory conditions, oxygen is practically insoluble ip water.
3. Oxygen is slightly heavier than air.
4. Under high pressure and low temperature, oxygen can be changed to liquid state. Liquid oxygen is slightly bluish in colour.

Question 4.

Describe what you will observe and write fully balanced equations when the following are introduced in a jar of oxygen.

(a) Red hot coal (carbon)

(b) Burning sulphur

(c) Burning sodium

(d) Burning magnesium

(e) Burning phosphorus

Answer:

(a) When red hot coal (carbon) is introduced into a jar of oxygen, it bums brightly producing sparkles and a crackling sound. It forms a colourless gas known as carbon dioxide.

$$\underset{\text{Carbon}}{C} + \underset{\text{Oxygen}}{O_2} \longrightarrow \underset{\text{Carbon dioxide}}{CO_2}$$

(b) When burning sulphur is taken into the jar of oxygen, it bums with a brilliant blue flame forming sulphur dioxide

$$\underset{\text{Sulphur}}{S} + \underset{\text{Oxygen}}{O_2} \longrightarrow \underset{\text{Sulphur dioxide}}{SO_2}$$

(c) When burning sodium is taken into the jar of oxygen, it bums with a brilliant golden yellow flame to form sodium oxide.

$$\underset{\text{Sodium}}{4Na} + \underset{\text{Oxygen}}{O_2} \longrightarrow \underset{\text{Sodium oxide}}{2Na_2O}$$

(d) When burning magnesium is taken into the cylinder of oxygen, it bums with a dazzling white flame to form magnesium oxide.

$$\underset{\text{Magnesium}}{2Mg} + \underset{\text{Oxygen}}{O_2} \longrightarrow \underset{\text{Magnesium oxide}}{2MgO}$$

(e) When burning phosphorus is taken into a jar of oxygen, it bums with dazzling white flame producing dense white fumes of phosphorous pentoxide.

$$\underset{\text{Phosphorus}}{4P} + \underset{\text{Oxygen}}{5O_2} \longrightarrow \underset{\text{Phosphorous pentoxide}}{2P_2O_5}$$

Question 5.

How will you prove that

(a) oxide formed by burning sodium is basic in nature,

(b) oxide formed by sulphur is acidic in nature?

Answer:

(a) The sodium oxide dissolves in water to form sodium hydroxide, which turns red litmus paper blue. Hence, sodium oxide is basic in nature.

$$\underset{\text{Sodium oxide}}{Na_2O} + \underset{\text{Water}}{H_2O} \longrightarrow \underset{\text{Sodium hydroxide}}{NaOH}$$

(b) Sulphur dioxide gas turns moist blue litmus paper red, because it reacts with water to form sulphurous acid. Hence, it is acidic in nature.

$$\underset{\text{Sulphur dioxide}}{SO_2} + \underset{\text{Water}}{H_2O} \longrightarrow \underset{\text{Sulphurous acid}}{H_2SO_3}$$

Question 6.

Write fully balanced equations for the following :

(a) $CO_2 + H_2O \longrightarrow$

(b) $Ca(OH)_2 + CO_2 \longrightarrow$

(c) $SO_2 + H_2O \longrightarrow$

(d) $P_2O_5 + H_2O \longrightarrow$

(e) $Na_2O + H_2O \longrightarrow$

(f) $MgO + H_2O \longrightarrow$

Ans. (a) $CO_2 + H_2O \longrightarrow H_2CO_3$

Carbon dioxide — Water — Carbonic acid

(b) $Ca(OH)_2 + CO_2 \longrightarrow CaCO_3 + H_2O$

Lime water — Carbon dioxide — Calcium carbonate — Water

(c) $SO_2 + H_2O \longrightarrow H_2SO_3$

Sulphur dioxide — Water — Sulphurous acid

(d) $P_2O_5 + 3H_2O \longrightarrow 3H_3PO_4$

Phosphorous pentoxide — Water — Phosphoric acid

(e) $Na_2O + H_2O \longrightarrow 2NaOH$

Sodium oxide — Water — Sodium hydroxide

(f) $MgO + H_2O \longrightarrow Mg(OH)_2$

Magnesium oxide — Water — Magnesium hydroxide

Question 7.

(a) State three uses of oxygen, other than artificial respiration.

(b) Give tests for oxygen gas.

Answer:

(a) Uses of oxygen are :

- **Spaceships** : Liquid oxygen is used for burning fuel in rockets and spaceships as there is no air in the space.
- **Cutting and welding :** Oxygen and hydrogen are made to bum in a specially designed torch. The oxy- hydrogen flame can easily melt metals and used for cutting and welding them.
- **Chemical industry :** Oxygen is used in large amount for preparing sulphuric acid from sulphur and nitric acid from ammonia.

(b) Tests for oxygen gas are :

- It rekindles glowing wooden splinter.
- If mixed with colourless nitric oxide gas, it forms reddish brown fumes of nitrogen dioxide.
- It dissolves in alkaline pyrogallol solution and turns it brown.

Question 8.
(a) What is (1) rust (2) rusting?
(b) State two most important conditions for rusting.
(c) State four ways of preventing rusting.
Answer:
(a) 1. The hydrated oxide of iron formed when iron comes in contact with moist air is called rust. This rust is brownish flaky residue and easily crumbles from the metal surface.
2. The slow conversion of iron into its hydrated ferric oxide, in the presence of moisture and air is called rusting.

$$4Fe + 3O_2 \longrightarrow 2Fe_2O_3$$
Iron — Oxygen — Ferric oxide

$$Fe_2O_3 + xH_2O \longrightarrow Fe_2O_3.xH_2O$$
Ferric oxide — Water — Hydrated ferric oxide (rust)

(b) Two most important conditions for msting are (1) presence of air and (2) moisture.
(c) Rusting Can be prevented by :

1. **Galvanising** – iron metal is coated with zinc.
2. **Enamelling** – iron surface is baked with mixutre of silicates at high temperature.
3. Coating with red lead oxide paint or tar on iron surface.
4. Oils and grease coating on iron surface cuts off moist air and prevents rusting.