

Air and Atmosphere

Exercise

Question 1.

State what do you understand by the term 'air'. Explain its importance to mankind.

Answer:

Air is a mixture whose composition varies at different intervals of time and different places of the world.

Man cannot survive without air and water and hence air is very essential for survival.

Question 2.

Give a brief account of the discovery of air and the scientists involved.

Answer:

1. John Mayow (1674) proved air has two components – active and inactive components.
2. Lavoisier (1789) named active component as oxygen and inactive component as nitrogen
3. Other scientists (1800's) discovered noble gases, CO_2 , water vapours.

Question 3.

What is meant by the term 'atmosphere'. State the role played by the atmosphere for the survival of mankind.

Answer:

A blanket of air around earth is called atmosphere. Without atmosphere life would not be possible as atmosphere protects us from harmful gases. We could not live without air present in atmosphere. In absence of the atmosphere, the earth would get so cold at night that we would not be able to survive. No CO_2 and N_2 for plants without atmosphere.

Question 4.

Explain in brief the different layers of the atmosphere and the basic functions of the main layers.

Answer:

Layers of * atmosphere	Distance from earth (approximate)	Basic function
(i) Troposphere	0 to 10 kilometers	<p>The troposphere contains most of the air and oxygen in the atmosphere. This air is fit for respiration and survival of living organisms. Weather conditions are formed in the troposphere.</p>
(ii) Stratosphere	10 to 50 kilometers	<p>The stratosphere contains the ozone layer which prevents the harmful effects of the sun (U.V. rays.) from reaching the earth.</p>
(iii) Mesosphere	50 to 80 kilometers	<p>The mesosphere is a very cold layer and most meteors burn up in this layer and hence are prevented from entering the earth's atmosphere.</p>
Thermosphere	80 to 320 kilometers	—

Question 5.

Describe a simple experiment with the help of a diagram to show that :

- (a) Air occupies space
- (b) Air has mass
- (c) Air exerts pressure
- (d) Air is highly compressible

Answer:

(a) Air occupies space :

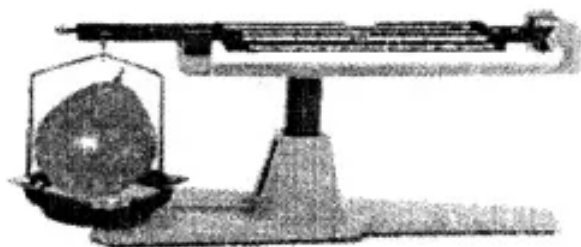


- Press an inverted glass
- Tilt the tumbler to one side, tumbler over the water.

Observation : On tilting the tumbler, bubbles of air are seen coming out. Water slowly enters the tumbler to take place of the trapped air in the tumbler.

Conclusion : Air occupies space (the space in the tumbler was occupied by air).

(b) Air has mass :

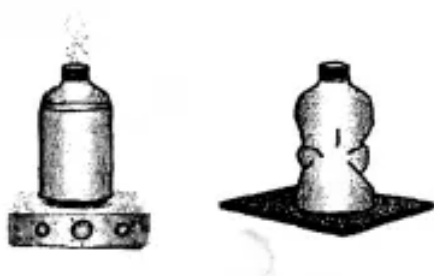


- An inflated balloon is placed on one side of the scale.

Observation : It is seen that the scale moves towards one side. It moves on the side on which the inflated balloon was placed.

Conclusion : Air has mass.

(c) Air exerts pressure :



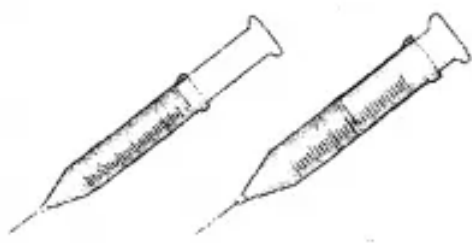
- Take an open can, fill it with water and heat it. On formation of steam, place the cap on tightly and keep the can aside.

Observation : On condensation of the steam the pressure inside the can reduces.

The air outside, exerts pressure on the can which crumples slowly.

Conclusion : Air exerts pressure.

(d) Air is highly compressible :



- A leak proof syringe filled completely with air only (i.e. empty) is taken.

Observation : On pressing the piston of the syringe, the piston moves inwards.

Air (gas) inside the syringe has maximum inter-molecular space and is highly compressible.

Conclusion : Air is highly compressible.

Question 6.

Name the components of air with their approximate percentage by volume in air. Does the percentage by volume of each component remain the same, in the atmosphere of different parts of the world. Explain with reasons.

Answer:

Main components of air are :

1. Nitrogen
2. Oxygen

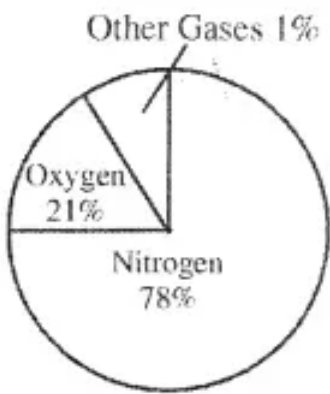
Composition of air by volume :

1. Nitrogen – 78% or $\frac{4}{5}$ th
2. Oxygen 21% or $\frac{1}{5}$ th
3. Carbon dioxide 0.03 – 0.04%
4. Inert gases 0.9%

Water vapours
Dust particles
Other impurities

Variable

OR

Gases	Percentage	Figure
Nitrogen	78%	 <p>A pie chart representing the composition of air by volume. The chart is divided into three segments: a large segment for Nitrogen labeled 'Nitrogen 78%', a medium segment for Oxygen labeled 'Oxygen 21%', and a small segment for Other Gases labeled 'Other Gases 1%'.</p>
Oxygen	21%	
Carbon dioxide	0.03 - 0.04%	
Inert gases	0.9%	
Water vapour	Varies	
Dust particles	Varies	
Other impurities	Varies	

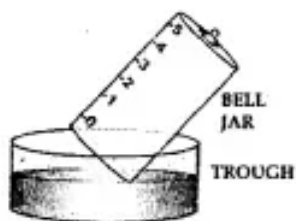
Air is a mixture whose composition varies at different intervals of time and different places of the world.

Question 7.

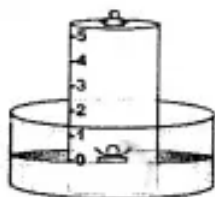
With the help of a labeled diagram, describe a simple experiment to show the presence of oxygen and nitrogen in air using a piece of white phosphorus.

Answer:

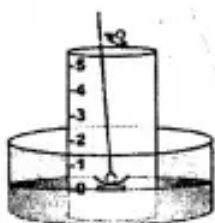
Activity to show the presence of oxygen and nitrogen in air using a piece of white phosphorous.



1. A trough is taken and filled with water.
2. Over it is placed a bell-jar marked with five equal parts.

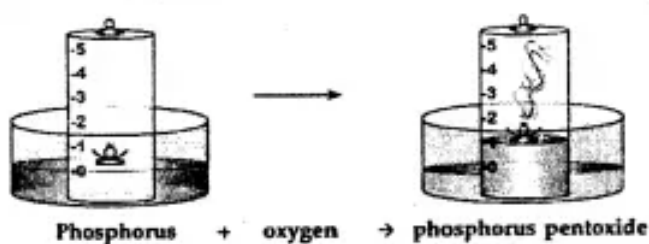


3. A crucible containing white phosphorus is placed on a cork.
4. The cork is made to float on the water.

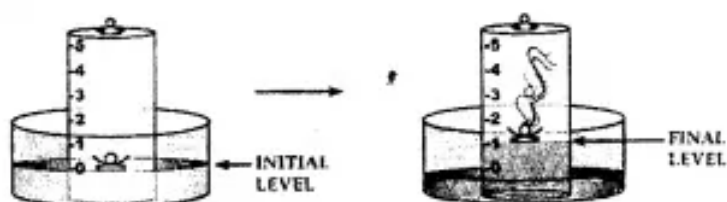


5. A heated iron rod is then taken.
6. The phosphorus is ignited with the heated rod.

Observation : Dense white fumes of phosphorus pentoxide (P_2O_5) are formed when the phosphorus (P) burns in the active component of air (oxygen).



The rise in the level of water in the bell-jar is by $\frac{1}{5}$



Conclusion :

Oxygen	1/5	Supports	Used up in
Active compound	(approx. vol.)	combustion	burning
Nitrogen	4/5	Does not	Remains
In Active component bell-jar	(approx. vol.)	support	behind in the combustion

The active component of air i.e. oxygen ($\frac{1}{5}$ of air) is used up in burning. The remaining inactive component of air i.e. nitrogen ($\frac{4}{5}$ of air) is not used up in burning.

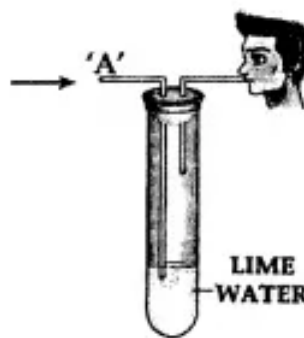
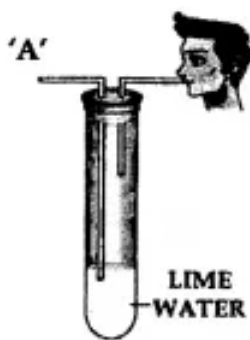
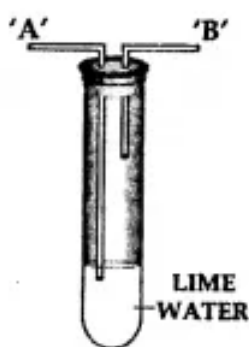
Question 8.

You are given a test tube with two outlets and a bottle of lime water. Using the same, how would you demonstrate experimentally the presence of carbon dioxide in air.

Answer:

Procedure :

1. Take lime water in a test tube with two outlets 'A' and 'B' as shown above.
2. Air is sucked slowly through the outlet 'B'.
3. Air moves in through end 'A' and passes through the lime water.



Observation : The lime water in the test tube turns milky.

Conclusion : Air which is sucked in from end 'A' contains carbon dioxide which turns the lime water milky. Hence, air contains – carbon dioxide.

Question 9.

Give a reason why water droplets appear on the outer surface of a tumbler

containing ice.

Answer:

Water vapour present in air, condenses on the cooler surface of the tumbler. Hence they condenses into tiny water droplets.

Question 10.

Explain the importance of nitrogen of the air for plant growth.

Answer:

Nitrogen of air is converted to soluble nitrogenous compounds in the soil in the presence of air and moisture. These are absorbed by plants and converted to plant proteins.

Question 11.

Give a reason why nitrogen is filled in food packets and not oxygen.

Answer:

Nitrogen being inert or unreactive is filled into food packets to drive out the oxygen and reduce bacterial growth. The food package then stays well preserved.

Question 12.

State what would happen, if the air above the earth contained mainly oxygen and no nitrogen.

Answer:

Nitrogen is utilised by plants for their growth and development. Free nitrogen of the air is converted to nitrogen compounds which are absorbed by the plants and converted to plant proteins. In the absence of nitrogen no plants will be survived on the earth.

Question 13.

State the utility of oxygen for respiration in

(a) living organisms

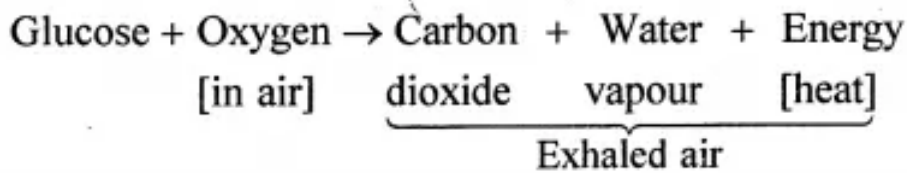
(b) plants.

Answer:

(a) Respiration in living organisms :

Respiration— It is a process whereby living things

1. Use oxygen from their air to oxidize food substances mainly glucose, in their body cells.
2. Release energy in the form of heat.
3. Carbon dioxide and water vapour are also produced and released in the exhaled air.



Process—

1. **Inhaled air** — Oxygen from inhaled air dissolves in the blood stream in the lungs. It is carried to the cells where the food materials i.e. glucose is oxidized by the oxygen.
2. **Exhaled air** — Carbon dioxide, water vapour and heat energy diffuse out of the lungs as exhaled air.
3. **Energy liberated** — The energy liberated is utilized for metabolic activities and maintains the body temperature.

(b) Respiration in plants :

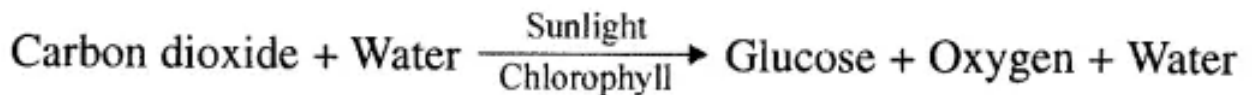
1. Plants respire during the day and night.
2. Plants— Respire through tiny pores on the surface of the leaves called 'stomata'.
3. The stomata help in taking in oxygen of the air and giving out carbon dioxide. Thus, they function as respiratory organs.
4. Plants do not perform bodily activities and hence need less energy than animals. The rate of respiration in plants is thereby slower than in animals.



Photosynthesis in plants :

Photosynthesis is a process by which green plants prepare their own food in the presence of sunlight and chlorophyll.

1. In the leaf of a green plant are present leaf cells which contain chloroplasts in which is present a green pigment called chlorophyll.
2. During photosynthesis which occurs during daytime, carbon dioxide and water in the presence sunlight and chlorophyll is changed into glucose and oxygen is released out.



3. Hence oxygen in the air is renewed by photosynthesis and therefore the amount of oxygen in air does not get depleted or removed from air.

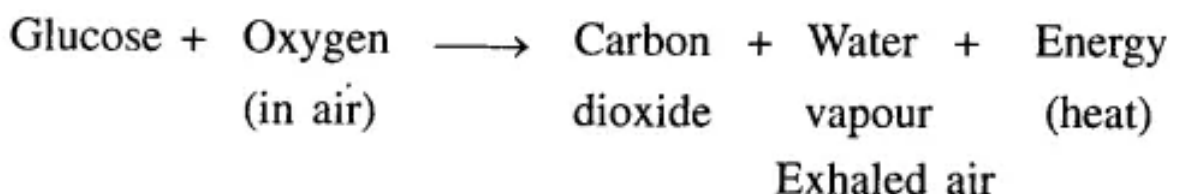
Question 14.

Compare respiration and combustion-both involving oxygen of the air.

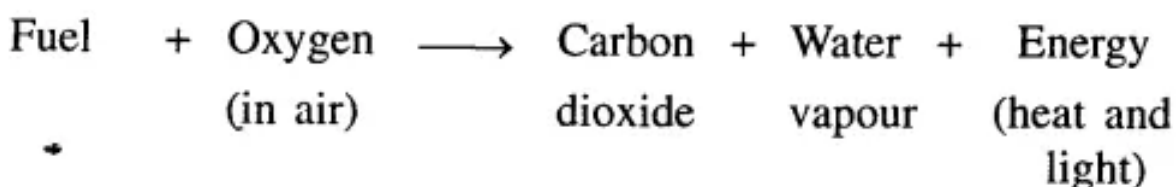
Answer:

Respiration is a process whereby living organisms

1. Use oxygen from the air to oxidize food substances mainly glucose, in their body cells.
2. Release energy in the form of heat.
3. Carbon dioxide and water vapour are also produced and released in the exhaled air.



Combustion or burning, involves oxidation i.e. combination of substances like fuels with oxygen or air generally resulting in production of heat and light.



Carbon dioxide is released into the air as a result of all burning.

Question 15.

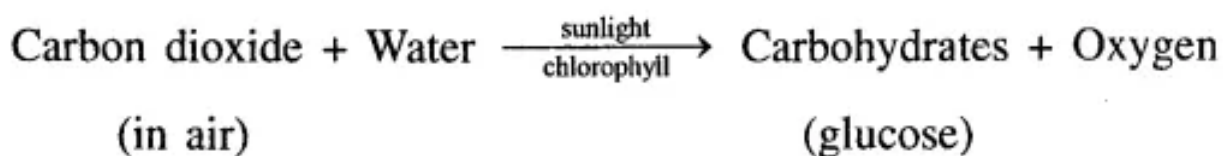
Explain the importance of carbon dioxide for

(a) photosynthesis **(b)** warming the earth's environment. State what would

happen if excess carbon dioxide as a pollutant is released into the atmosphere.

Answer:

(a) During photosynthesis which occurs during daytime, carbon dioxide and water in the presence of sunlight and chlorophyll is changed into carbohydrates and oxygen is released out.



Hence oxygen in the air is renewed by photosynthesis and therefore the amount of oxygen in air does not get depleted or removed from air.

(b) Infrared (I.R.), visible rays and ultra violet (U.V.) rays are present in the earth's surface.

The reflected U.V. rays from the earth's surface pass through the carbon dioxide in the atmosphere, but the

I. R. rays are prevented by the carbon dioxide from being radiated out of the earth's surface. This results in the earth's environment staying warm.

The thick CO₂ layer prevents the heat radiations from being radiated out which reason :

Reason : It results into rise in global temperature.

Question 16.

State in brief how water vapour in the atmosphere determines the climatic conditions.

Answer:

Water vapour in the atmosphere in excess :

(a) Minimizes the rate of evaporation.

(b) Produces rain, mist etc. thereby determining climatic conditions.

The rain serves as a natural source of water for plants and animals.

Question 17.

Give a reason why two different rare (inert) gases find application in advertisement signs and fluorescent bulbs.

Answer:

1. **Neon** – In neon sign advertisements

A brilliant red glow is seen on passage of an electric current through neon gas at low pressure.

The colour can be changed by mixing mercury vapour and argon with neon.

2. **Xenon** – In fluorescent bulbs flash bulbs and lasers. It emits intense white light in discharge tubes.

Question 18.

A mixture has a variable composition. Give three other reasons why air is considered a mixture and not a compound.

Answer:

Air is a mixture because :

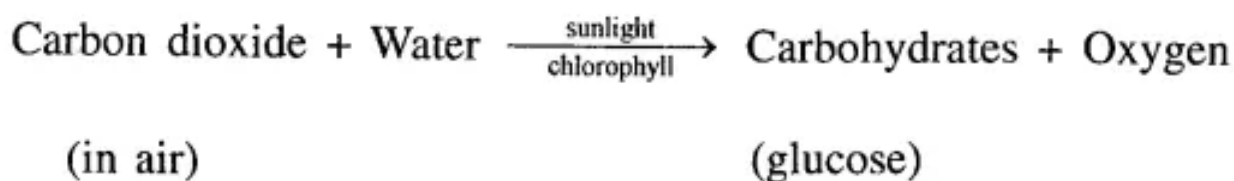
1. Air has no formula, a mixture has no formula whereas compound has a formula.
2. No energy changes are involved to form air from various gases.
3. When air is formed out of its constituents no change in mass nor change in volume takes place.
4. Properties of air vary from place to place and time to time. i.e. there is more CO₂ in towns as compared to villages where more oxygen prevails as compared to towns.
5. Components of air can be separated by simple physical methods.

Question 19.

State a reason why there is a balance in the amount of carbon dioxide in the air, even though carbon dioxide is released into the atmosphere by various processes.

Answer:

By the way of photosynthesis in plants which occurs during daytime, carbon dioxide and water in the presence of sunlight and chlorophyll is changed into carbohydrates and oxygen is released out.



Hence, oxygen in the air is renewed by photosynthesis and therefore the amount of oxygen in air does not get depleted or removed from air.

Question 20.

Name three different appliances where air is utilized.

Answer:

1. **Vehicles** – Run on tyres which are inflated with air.
2. **Brake mechanisms** – Of trains and other machines, work on compressed air.
3. **Pumps and siphons** – Work on air pressure.

Objective Type Questions

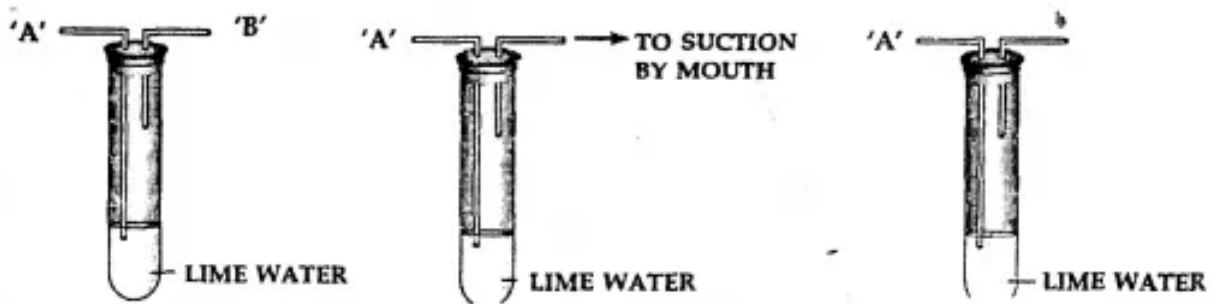
Q.1. Match the statements in List I with the correct answers in List II.

List I	List II
1. An impurity in air	A : Water vapour
2. The component of air which supports combustion	B : Respiration
3. The inert component in air, slightly soluble in water	C : Rare gases
4. The component of air which minimizes the rate of evaporation	D : Sulphur dioxide
5. The process which involves oxidation of food substance in living organisms	E : Helium
6. The component of air which finds application in observation balloons	F : Carbon dioxide
7. The process which involves oxidation of substances, liberating heat and light energy	G : Combustion
8. The component of air which is heavier than air and fairly soluble in water	H : Nitrogen
9. The process by which atmospheric carbon dioxide is absorbed by plants resulting in formation of carbohydrates	I : Photosynthesis
10. The component of air, which is lighter than air and less than 1% in air	J: Oxygen

Answer:

List I	List II
1. An impurity in air	D : Sulphur dioxide
2. The component of air which supports combustion	J : Oxygen
3. The inert component in air, slightly soluble in water	H : Nitrogen
4. The component of air which minimizes the rate of evaporation	A : Water vapour
5. The process which involves oxidation of food substance in living organisms	B : Respiration
6. The component of air which finds application in observation balloons	E : Helium
7. The process which involves oxidation of substances, liberating heat and light energy	G : Combustion
8. The component of air which is heavier than air and fairly soluble in water	F : Carbon dioxide
9. The process by which atmospheric carbon dioxide is absorbed by plants resulting in formation of carbohydrates	I : Photosynthesis
10. The component of air, which is lighter than air and less than 1% in air	C : Rare gases

Q.2. The diagrams below represents an experiment to show the presence of a – component of air.



Question 1.

State why air is sucked from – outlet 'B' and not from outlet 'A'.

Answer:

Because if we suck from 'A', lime water will be sucked out.

Question 2.

State why the air is sucked 'slowly' from the outlet 'B'

Answer:

Because if air is sucked fast, lime water will also be sucked out.

Question 3.

State the observation seen after completion of the experiment.

Answer:

Lime water turns milky.

Question 4.

State the reason for the above observation seen.

Answer:

The reason is the formation of CO_2 .

Question 5.

Name another component which if present in air as a pollutant – would have given a similar observation.

Answer:

Sulphur dioxide.

Q.3. Complete the statements given below by filling in the blanks with the correct word/s from the word/s in bracket.

Question 1.

The ____ [atmosphere /troposphere/stratosphere] is a layer which extends upto about 10-50 kms. above the earth.

Answer:

The **stratosphere** is a layer which extends upto about 10-50 kms. above the earth.

Question 2.

_____ [helium/hydrogen sulphide] is an example of a pollutant present in air.

Answer:

Hydrogen sulphide is an example of a pollutant present in air.

Question 3.

The component of air used in photosynthesis is _____ and the products of photosynthesis is _____ [oxygen/carbon dioxide/nitrogen].

Answer:

The component of air used in photosynthesis is **carbon dioxide** and the products of photosynthesis is oxygen.

Question 4.

The product formed which is common to both combustion and respiration is _____ [oxygen/ carbon dioxide/nitrogen dioxide]

Answer:

The product formed which is common to both combustion and respiration is **nitrogen dioxide**.

Question 5.

The component of air which is variable in air above sea level and in air in general _____ [oxygen/ nitrogen/water vapour].

Answer:

The component of air which is variable in air above sea level and in air in general **water vapour**.

Q.4. Name the following :

Question 1.

The product formed when phosphorus burns in oxygen.

Answer:

Phosphorus pentoxide (P_2O_5).

Question 2.

The layer of atmosphere which contains the ozone layer.

Answer:

Stratosphere.

Question 3.

The active component of air which supports combustion and is used up in

burning.

Answer:

Oxygen.

Question 4.

The main, rare (inert) gas present in air.

Answer:

Argon.

Question 5.

The component of air which is present more in industrial areas.

Answer:

Carbon monoxide, sulphur dioxide, oxides of nitrogen, hydrogen sulphide, dust particles.

Question 6.

The type of bacteria which directly absorb nitrogen from the air and converted soluble nitrates in the soil.

Answer:

Symbiotic bacteria.

Question 7.

The product of respiration released in exhaled air, other than carbon dioxide.

Answer:

Water vapour and energy.

Question 8.

An inert gas which has a low boiling point and is used for producing very low temperatures.

Answer:

Helium.

Question 9.

A process which removes carbon dioxide from the air.

Answer:

Photosynthesis.

Question 10.

The component of air which does not support combustion.

Answer:

Nitrogen.

Q.5. State whether the following statements are 'true' or 'false'. If false write the correct statement.

1. The mesosphere in the atmosphere, contains most of the air, fit for respiration.

Ans. False.

Correct : The troposphere in the atmosphere, contains most of the air, fit for respiration.

2. The percentage of carbon dioxide in the air is between 0.2 to 0.4%.

Ans. True.

3. Carbon dioxide, water vapour and energy in the form of heat are evolved during respiration.

Ans. True.

4. Photosynthesis is a process by which green plants prepare their own food in the presence of sunlight and chlorophyll.

Ans. True.

5. Air is a mixture and not a compound since the components of air cannot be separated by physical methods.

Ans. False :

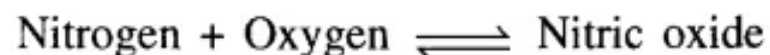
Correct : Air is a mixture and not a compound since the components of air – can be separated by physical methods.

Q.6. Give word equations for the following conversions.

Question 1.

Nitrogen of the air to nitric oxide.

Answer:



The nitric oxide reacts with oxygen to give nitrogen dioxide.

Question 2.

Nitric oxide to nitrogen dioxide.

Answer:



The nitrogen dioxide further reacts with oxygen and water vapour of the air to give nitric acid.

Question 3.

Nitrogen dioxide to nitric acid.

Answer:



The nitric acid formed comes down with the rain and combines with the carbonates in the soil to form soluble nitrates.

Question 4.

Nitric acid to soluble nitrates in the soil.

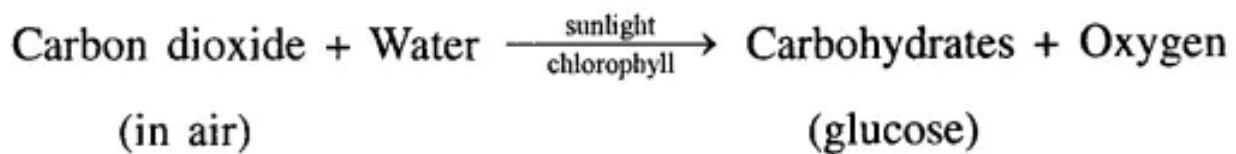
Answer:

Calcium carbonate + Nitric acid → Calcium nitrate + water + carbon dioxide

The water soluble calcium nitrates are absorbed by the plants and converted to plant proteins.

Question 5.

Carbon dioxide in air to carbohydrates in plants.

Answer:

Carbon dioxide and water in the presence of sunlight and chlorophyll is changed into carbohydrates and oxygen is released out.