CHAPTER 14

THE ATMOSPHERE

TOPICAL MULTIPLE CHOICE QUESTIONS

Q.No.1 Encircle the correct option from the given multiple choices.

Composition of dry air

(1) The percentage of nitrogen in atmosphere is

(a) 79% (b) 78% (c) 21% (d) 68%

(2) The percentage of hydrogen in atmosphere is

(a) 0.01% (b) 0.001% (c) 0.015% (d) 0.00005%

Layers of atmosphere

(3) About 99% of atmospheric mass lies within

(a) 20km (b) 30km (c) 11km (d) 25km

(4) The atmosphere is divided into how many layers

(a) 3 (b) 2 (c) 4 (d) 5

(5) Thermosphere, the layer of atmosphere is further divided into

(a) Ionosphere (b) Exosphere (c) Upper thermosphere (d) Both (a) and (b)

Troposphere

(6) The temperature range of troposphere is

(a) 2°C to -5°C (b) 17°C to -55°C (c) -55°C to -93°C (d) -5°C to -93°C

(7) The maximum height of troposphere is

(a) 12 km (b) 50km (c) 80km (d) 400km

(8) The most of the atmospheric mass found in troposphere is

(a) 75% (b) 75 – 80% (c) 80 – 85% (d) 90 – 95%

(9) In troposphere the temperature rises due to presence of

(a) Little amount of water vapours (b) Ozone

(c) CO_2 (d) Both (a) and (c)

(10) Which layer is closed to earth surface

(a) Troposphere (b) Mesosphere (c) Stratosphere (d) Thermosphere

Stratosphere

(11) The temperature range of stratosphere is

(a) 5°C to 6°C (b) -55°C to -5°C (c) 2°C to -55°C (d) -5°C to -93°C

(12) The maximum height of stratosphere is

(a) 50km (b) 80km (c) 400km (d) 60km

Mesosphere

(13) **The temperature range of mesosphere is**

(a) 5°C to -55°C (b) -6°C to 93°C (c) -5°C to -93°C (d) -2°C to -6°C

(14) **Which atmospheric layer protect earth surface from being hit by most meteoroids**

(a) Mesosphere (b) Troposphere (c) Thermosphere (d) Stratosphere

Thermosphere

(15) **Temperature range of thermosphere is**

(a) -93°C (b) 600 to1800°C (c) -5°C to -55°C (d) -93°C to1800°C

(16) **The outermost layer of earth atmosphere is**

(a) Troposphere (b) Mesosphere (c) Stratosphere (d) Thermosphere

Air Pollutants

(17) **Which of the following is not pollutant**

(a) CO_2 (b) NO_2 (c) N_2 (d) O_3

(18) **Which of the following air pollutant is the cause of emphysema**

(a) NO_2 (b) CO_2 (c) SO_2 (d) CH_4

(19) **Which of the following as a result of photochemical reaction in the air forms irritating and toxic compounds**

(a) NO_2 (b) CO_2 (c) CH_4 (d) CO

(20) **Which of the following air pollutants effect the brain development in human beings**

(a) SO_2 (b) O_3

(c) Lead compounds (d) Compounds of nitrogen

(21) **Which is reddish brown gas**

(a) NO (b) NO_2 (c) SO_2. (d) O_3

(22) **Most air pollution is caused by**

(a) O_3 (b) Acid rain

(c) Carbon monoxide (d) The burning of fossil fuels

(23) **The colour of ozone gas is**

(a) Greenish yellow (b) Light blue (c) Dirty green (d) Brown

(24) **Termites and cows also release large amount of _____ gas in the air**

(a) Ethane (b) Methane (c) Butane (d) None of these

(25) **Which of the following is colourless gas with unpleasant and irritating odour**

(a) Methane (b) CO_2 (c) SO_2 (d) NO_2

Interesting information

(26) **The waste treatment process in which solid waste is burned at high temperature is called**

(a) Condensation (b) Destruction distillation

(c) Incineration (d) Sublimation

Global warming

(27) Which of the following is the cause of Global warming

(a) CFC's (b) CH_4 (c) CO_2 (d) All of these

Acid rain

(28) The pH of normally acidic rain water is

(a) 6 (b) 7 (c) 6.5 (d) 5.6

(29) Due to acidic oxides dissolve in rain water the pH of rain water is reduced upto

(a) 4 (b) 3 (c) 2.1 (d) 4.5

(30) The rain having pH less than 5.6% called

(a) Normal rain (b) Acidic rain

(c) Better rain for crops and vegetation (d) None of these

Ozone depletion

(31) Ozone is _____ form of oxygen

(a) Isotopic (b) Allotropic (c) Amorphous (d) Isomorphic

(32) The ozone layer is found in

(a) Mesosphere (b) Thermosphere (c) Stratospheric (d) Troposphere

ANSWER KEY

Q.	Ans.	Q.	Ans.	Q.	Ans.	Q.	Ans.
1	b	11	b	21	b	31	b
2	d	12	a	22	d	32	c
3	b	13	c	23	b		
4	c	14	a	24	b		
5	d	15	d	25	d		
6	b	16	d	26	c		
7	a	17	a	27	d		
8	b	18	c	28	d		
9	d	19	a	29	c		
10	a	20	c	30	b		

TOPICAL SHORT QUESTIONS

Composition of atmosphere

Q.1 What is the composition of dry air?

Ans: percentage of water has not been mentioned in the chart because it is the % age composition of dry air in which water is not in so %age of water is not given there.

- Nitrogen & Oxygen.
- Nitrogen i.e. 78%.
- Hydrogen i.e. 0.0005%.

Layers of atmosphere

Q.2 What is the altitude of atmospheric layers?

Ans: Altitude of atmospheric layers.

- Thermosphere (Above 80 km) (-93°C to 1800°C).
- Mesosphere (50-80 km) (-5°C to -93°C).
- Stratosphere (12-50 km) (-55°C to -5°C).
- Troposphere (0-12 km) (17°C to -55°C).

Q.3 Define atmosphere also write the names of layers of atmosphere?

Ans: Atmosphere:

The envelope of gases and water vapours surrounding the planet earth is called atmosphere

Atmosphere is divided into four layers.

(i) Troposphere

(ii) stratosphere

(iii) Mesosphere

(iv) Thermosphere

Q.4 Write the features of troposphere

Ans: Troposphere:

The features of troposphere are given below

- Tropo means "turning" or "chaihing".

- Closest to earth and it expands to about 12km.
- Contains most of the mass (75 – 80%) of the atmosphere
- Nearly all the dust particles and water vapours are in the troposphere.
- As altitude increases, the temperature decreases from 17°C to about – 55°C.
- On average for every 1km increase in altitude, the air gets 6.5°C cooler.

Q.5 Why temperature increases in the stratosphere?

Ans: Increase of temperature in stratosphere:

This layers contains little water vapours and maximum amount of ozone (1 ppm) and due to UV radiation many exothermic reactions takes place in that region. This is responsible for rise in temperature in stratosphere

Air Pollutants

Q.6 What are pollutants? Give examples.

Ans: Anything that is in the air, water or soil while has a harmful effect on some part of environment is called pollutant.

In other words we can say "any unwanted, unnecessary material that enter into the atmosphere and represents harmful effects on that environment is called Pollutants"

Examples:

Oxides of carbon (CO_2, CO)

Oxides of Nitrogen (NO and NO_2)

Oxides of sulphur (SO_2 and SO_3)

Q.7 How methane is produced in the environment and it acts as air pollutant?

Ans: Mehtane:

Methane is produced when dead plant materials decay in the absence of air. It is released in the air form marshes, swamps and rice paddy-fields.

Acts as Air Pollutant:

As a result of photochemical reactions in the air, methane forms irritating and toxic compounds. Methane is excellent heat absorber and causes global warming.

Q.8 What is the effect of SO_2 on human health?

Ans: SO_2 is readily absorbed in the respiratory system. Being powerful irritant it aggravates the symptoms of people who suffer from asthma, bronchitis, emphysema and other lung diseases.

Q.9 How nitrogen containing compounds are emitted naturally?

Ans: the nitrogen containing compound are emitted naturally by electrical discharges in the air. first nitric oxide (NO) is produced. Then on further oxidation it is converted into nitrogen dioxide (NO_2)

$$N_2 + O_2 \xrightarrow[\text{lighteing}]{\text{electrical}} 2NO$$

$$2NO + O_2 \longrightarrow 2NO_2$$

Sources of air pollution

Q.10 Write the sources of air pollution

Ans. Sources of air pollution

- Some air pollution occurs naturally. But mainly due to human activities.
- Many natural processes such as forest fires, and dust storms release smoke and dust particles in air.
- Burning fossil fuels and incineration release carbon monoxide (CO), nitrogen oxides (NO, NO_2) and Sulphur oxides (SO_2, SO_3)

$C_{(s)} + O_{2(g)(\text{limited})} \longrightarrow CO_{(g)}$

$S_{(s)} + O_{2(g)} \longrightarrow SO_{2(g)}$

$N_{2(g)} + O_{2(g)} \longrightarrow 2NO_{(g)}$

$2NO_{(g)} + O_{2(g)} \longrightarrow 2NO_{2(g)}$

Ozone is produced when electrical discharges pass through oxygen in air.

$$3O_{2(g)} \underset{\text{discharge}}{\overset{\text{Electrical}}{\rightleftharpoons}} 2O_{3(g)}$$

Global warming

Q.11 Define global warming also write effects.

Ans: Global warming

The warming (increasing temperature) of the atmosphere which is due to the influence of the green house effect is known as global warming.

Effect of global warming

→ Temperature of earth will gradually increased

→ The earth climate will changed.

→ Polar ice may melt and cause significant increase in sea level.

Q.12 Why the flood risks are increasing?

Ans: Due to global warming in the air the atmospheric temperature increase every year by 0.05°C. This results on melting of glaciers and ice caps which are the reasons of increasing flood risks.

Q.13 What do you know about green-houses? Also discus its importance.

Ans: Green-houses are constructed from glass or transparent polymer films. Sun light can pass through these materials and is used by the plants for photosynthesis. The plants radiate some energy in the form of infrared or heat radiation which cannot pass through these materials and is reflected back. As a result the atmosphere inside the green-house becomes hot enough to promote plant growth. The temperature inside a green-house can be 10°C to 15°C higher than outside.

Q.14 What is global warming? And what happens when it continues?

Ans: The warming of the atmosphere which is due to our influence on the green-house effect is known as global warming.

Global warming is due to an upset in the natural balance of the concentration of green-house gases in the atmosphere. If global warming continues, then

- Temperature of the earth will gradually increase.
- The earth climate may change, affecting both where there is rainfall and how much there is of it. This could cause both increased risks of flooding in some regions and drought in others.
- Polar ice may melt and cause signification increase in levels.
- So the atmosphere becomes hotter.

Acid Rain and its effects

Q.15 Define acid rain?

Ans: The normally rain water is acidic having PH 5.6 due to dissolving of CO_2 in rain water. The rain water absorbs other pollutants like SO_2, NO_2 etc and converter into there corresponding acid so pH reaches less then 5.6. Such rain is called acidic rain

Q.16 What is the effect of Acid rain?

Ans: Effect of acid rain:

(i) Acid rain attack the calcium carbonate present in the marble and lime stone buildings. Thus, the buildings are getting dull and eroded day by day.

(ii) Acid rain increases the acidity of soil. This retard the growth of plant.

(iii) The acid rain directly affect the leaves of trees and plant thus limiting there growth. Plants ability to bear cold or diseases reduces to get it die.

(iv) Acid rain also kills fish. Lakes and rivers may become too acidic for living things to survive

Q.17 How aquatic life is effected by acid rain.

Ans: Aquatic life is effected by acid rain because acid rain on soil and rocks leaches heavy metal Al, Hg, Pb, Cr etc. Which is discharge into river and lakes. Due to high concentration of these metal equal life suffer e.g high concentration of Aluminium metal clogs the fish gills, which causes suffocation and ultimately the death of fish.

Interesting information

Q.18 What is incineration?

Ans: incineration is a waste treatment process in which solid waste is burned at high temperature. Incineration consumes all combustible materials, leaving behind ash residue and non-combustible material. This process generally reduce the volume of waste by two third, but it is not a clean process. It produces air pollution. It generates considerable smoke and odour. This smoke may contain oxides of nitrogen and sulphur.

Q.19 Why catalytic converter is important to prevent environment from pollution?

Ans: A catalytic converter transforms CO into CO_2, NO into N_2 and O_2, and unburned hydrocarbons to CO_2 and H_2O. Metals like platinum, palladium and rhodium are used as catalyst in the converter.

Q.20 What are Aurora Borealis and how they are produced?

Ans: In the Northern Hemisphere brilliant light displays occur in the ionosphere. These light displays are called aurora boreal.

Production:

Aurora Borealis are caused by particles from the sun that enter the ionosphere near the poles. These particles strike atoms in the ionosphere, causing them to glow.

SELF ASSESSMENT EXERCISES

14.1

(1) What two gases make up most of the air?

Ans: Nitrogen and oxygen

(2) Which gas has highest percentage in the air?

Ans: Nitrogen i.e. 78%

(3) Which gas has lowest percentage in the air?

Ans: Hydrogen i.e. 0.00005%

(4) Why the percentage of water has not been mentioned in the pie chart

Ans: Percentage of water has not been mentioned in the chart because it is the %age composites on of dry air in which water is not involved so %age of water is not given there

14.2

Describe how temperature change as one moves form earth's

Ans: As we move form earth surface to upward temperature varies from surface to 12 Km up in troposphere temperature decreases from 17°C to –55°C and form 12 Km to 50Km in the stature sphere temperature increases from –55°C to –5°C

14.3

1. What are pollutants?

Ans: Any thing that is in the air, water or soil which has a harmful effect of some part of the environment is called pollutant.

2. List some effects of sulphur dioxide on human being.

Ans: Sulphur dioxide is readily absorbed in the respiratory system. Being powerful irritant, it aggravates the symptoms of people who suffer form asthma, bronchitis, emphysema and other hung diseases.

3. List some of the air pollutants

Ans:
(i) Sulphur oxides
(ii) Carbon monoxide
(iii) Nitrogen oxides
(iv) Lead compounds
(v) Ozone

14.4

1. Write the names of main pollutants in the air.

Ans:

(i)	Sulphur oxides	(SO_2, SO_3)
(ii)	Carbon monoxide	(CO)
(iii)	Nitrogen oxides	(NO, NO_2)
(iv)	Lead compounds	(PbO, PbO_2)
(v)	Chlorofluorocarbons	(CFCs)
(vi)	Methane	(CH_4)
(v)	Ozone	(O_3)

2. Complete the following reactions.

(a) $2SO_{2(g)} + O_{2(g)} \longrightarrow 2SO_3$

(b) $C_{(s)} + O_{2(g)} \longrightarrow CO_2$

(c) $2CO_{(g)} + O_{2(g)} \longrightarrow 2CO_2$

Ans: (a) $2SO_{2(g)} + O_{2(g)} \longrightarrow 2SO_3$

(b) $C_{(s)} + O_{2(g)} \longrightarrow CO_2$

(c) $2CO_{(g)} + O_{2(g)} \longrightarrow 2CO_2$

14.5

1. Write three human activates that are responsible for air pollution.

Ans: Three human activities that are responsible for air pollution.

(i) Burning of fossil fuels

(ii) Use of CFC's as solvent, represent as propellant in aerosol sprays.

(iii) Combustion of leaded petrol in motor vehicles.

2. Write three natural processes that are contributing in air pollution.

Ans: Three natural processes that contribution in air pollution.

(i) Forest fires (ii) Dust storms (iii) Volcanic eruption

3. Lis main sources of the following air pollutants.

(a) SO_2 (b) CO (c) NO_2

Ans: **(a) Sources of SO_2:**

Power stations and industrial using fuels

(b) Sources of CO:

Incomplete having of wood, fuels and vehicle

(c) Sources of NO_2 :

Exhaust fumes of motor vehicles, power stations and industries using fossil fuels.

14.6

1. Define global warming

Ans: The warming of the atmosphere which is due to our inference on the environment and green house effect is known as global warming.

2. List some effects of global warming

Ans: Effects of Global warming.

(i) Temperature of the earth will gradually increases.

(ii) Earth climate of any change, affecting both where there is rainfall and how much there is of it. This could cause both increased risks of flooding in some regions and drought in others.

(iii) Polar ice may melt and cause significant increase in seal levels.

(iv) Temperature becomes hotter.

3. List some substances that are responsible for global warming.

Ans: Following are the substance that are responsible for global warming.

(i) Increased level of CO_2

(ii) Gases like water vapors

(iii) Methane

(iv) CFC's

14.7

1. Define acid rain.

Ans: Acid rain: A rain having pH less than 5.6 is called acid rain. In other words we can say that when rain water passes through polluted air then it reacts with those pollutants. (Oxides of non-metals) to form corresponding acids. Such rain containing these acids are called acid rain.

2. Write names of gases that cause acid rain.

Ans: Sulphur dioxide (SO_2) and nitrogen per oxide (NO_2)

3. What is the effect of acid rain on iron and marble? Give balance chemical equation.

Ans: Acid rain corrodes metals, stone buildings and statues. Sulphuric acid eats a away metals to form water soluble slats and hydrogen

$$Fe_{(s)} + H_2SO_{4(aq)} \longrightarrow FeSO_{4(aq)} + H_{2(g)}$$

Marble buildings and statues are disintegrated by acid rain.

$$CaCO_{3(s)} + H_2SO_{4(s)} \longrightarrow CaSO_{4(aq)} + H_2O_{(g)} + CO_{2(g)}$$

$$CaCO_{3(s)} + 2HNO_{3(aq)} \longrightarrow Ca(NO_3)_2 + H_2O_{(g)} + CO_{2(g)}$$

4. List some effects caused by acid rain.

Ans: **(i)** Sulphuric acid eats away metals to form water soluble slats and hydrogen

$$Fe_{(s)} + H_2SO_{4(aq)} \longrightarrow FeSO_{4(aq)} + H_{2(g)}$$

(ii) Marble buildings and statues are disintegrated by acid rain.

$$CaCO_{3(s)} + H_2SO_{4(s)} \longrightarrow CaSO_{4(aq)} + H_2O_{(g)} + CO_{2(g)}$$

$$CaCO_{3(s)} + 2HNO_{3(aq)} \longrightarrow Ca(NO_3)_2 + H_2O_{(g)} + CO_{2(g)}$$

(iii) Acid rain also kills fish, and destroys trees. Lakes and river may become too acidic for living things to survive.

LONG QUESTIONS

Q.1 Write a note on different layer of atmosphere?

Ans: Layers of Atmosphere

The atmosphere g divided into four layers, the troposphere, the stratosphere, the mesosphere and the thermosphere (Figure 14.2). The thermosphere is further divided into the ionosphere and the exosphere. Each atmospheric layer has its own temperature and precise chemical & composition.

The Troposphere

Tropo means "turning' or "changing" Conditions in troposphere are more variable than in the other layers. Troposphere extends to about 12km above earth's surface. The atmospheric layer closest to the Earth's surface is called troposphere. What is the height of he troposphere? What is the minimum and maximum temperature of this layer?

Troposphere contains most of the mass (75- 80%) of the atmosphere It is the layer of atmosphere in which we live. Nearly all the dust particles and water vapours are troposphere. Weather occurs in this layer. Most of the clouds are formed in the troposphere. Aircrafts fly in this region As altitude increases in the troposphere, the temperature decreases from 17°C to about -55°C. On average, for every 1 km increase in altitude, the air gets about 6.5°C cooler.

The Stratosphere

The second layer as one moves upward from the Earth's surface is called stratosphere. The stratosphere extends from top of the troposphere to about 50km above earth's surface. Strato means "layer" or "spread out". What is the height of the stratosphere? What are the minimum and the maximum temperature of this layer?

The lower stratosphere is cold about -55°C, but the upper stratosphere is warmer than the lower stratosphere. This layer contains little water vapours. Interesting information about this layer is that it contains maximum amount of ozone (about 10 ppm). The presence of ozone is responsible for the rise in temperature in stratosphere. Ozone saves us from harmful effects of incoming ultraviolet radiations from the sun. when ozone absorbs energy from the sun, the energy is converted into heat, warming the air. The ozone layer protects the living, things on the Earth form dangerous ultraviolet radiation from the sun. in the stratosphere, temperature varies from -55°C to -5°C.

The Mesosphere

The mesosphere extends from the top of stratosphere to about 80 km from the earth's surface. Meso –means "middle", so the mesosphere is the middle layer of the atmosphere. Above the stratosphere, a drop in temperature is observed. In the outer mesosphere, temperature approaches -93°C. This layer protects Earth's surface from being hit by most meteoroids.

The Thermosphere

The outermost layer of atmosphere is the thermosphere. It extends from 80 km above Earth's surface outward into space. Thermo-means heat. This layer is very hot up to

1800°C. This is because sunlight strikes the thermosphere first. Oxygen and nitrogen molecules convert this energy into heat.

The thermosphere is divided into two layers. The lower layer called the ionosphere extends from 80 km to 400 km above the surface of Earth. The outer layer of thermosphere is the exosphere. It extends from 400km to thousands of kilometre from Earth's surface.

Q.2 Define Air Pollutants. Explain different important air pollutants?

Ans: Air Pollutants:

Any thing that is in the air, water or soil which has a harmful effect on some part of the environment is called pollutant.

Pollutants are thing like industrial wastes, herbicides, pesticides, insecticides, particles of dust and smoke like carbon monoxide, nitrogen dioxide. sulphur dioxide, ozone and lead containing paints. These things have a negative impact on the environment. Such substances effect environment as a result of human activity.

Important air Pollutants are as follows:

Sulphur Oxides (SO_x):

Sulphur dioxide is readily absorbed in the respiratory system. Being powerful irritant, it aggravates the symptoms of people who suffer form asthma, bronchitis, emphysema and other hung diseases.

Carbon Monoxide (CO):

When you burn a piece of wood or any other organic material, mainly two types of gases, carbon monoxide and carbon dioxide are produced. Carbon monoxide is a poisonous gas. It causes headache and dizziness, when inhaled for a long time it may cause death. It is soluble in water.

$$2C_{(s)} + O_{2(g)}(\text{Limited}) \rightarrow 2CO_{(g)}$$

$$C_{(s)} + O_{2(g)}(\text{Excess}) \rightarrow CO_{2(g)}$$

Carbon dioxide is not an air pollutant. Rather, plants consume CO_2 in photosynthesis and produce O_2. it is not poisonous. However, it causes global warming (see section 14.3.1).

Nitrogen Oxides (NO_x):

The important oxides of nitrogen that cause air pollution are nitric oxide (NO) and nitrogen dioxide (NO_2). Collectively they are represented as NO_x. Nitric oxide is a colourless, odourless gas. It is heavier than air and sparingly soluble in water. Nitrogen dioxide is a reddish brown gas with pungent odour. It dissolves readily in water. Both these oxides are highly toxic gases, damage lungs, cause headache, and cough.

Methane(CH_4):

Methane is produced when dead plant materials decay in the absence of air. It is released in the air from marshes, swamps and rice paddy-fields. As a result of photochemical reactions in the air, methane forms irritating and toxic compounds. Methane is excellent heat absorber and causes global warming.

Chlorofluorocarbons (CFCs):

Chlorofluorocarbons are a group of chemically uncreative compounds that have been widely used as solvents. CFCs trap heat in the atmosphere and cause global warming. They have been attacked the ozone layer in the stratosphere very badly for the last three decades. CFCs may also cause skin allergy, damage to liver, kidneys ad nervous system.

Lead Compounds:

Lead particles in the air come mainly due to the combustion of leaded petrol or fuel used in motor vehicles or from the lead based paints etc. Lead and its compounds in the air affect the brain development in human beings especially among children. At high level it can be fatal.

Ozone:

Ozone is a light blue gas and has an unpleasant odour. In the troposphere, ozone causes breathing difficulties, asthma and eye irritation.

).3 What are the sources of air pollution?

ıns: Sources of Air Pollution

Air that contains harmful particles and gases is said to be polluted. Some air pollution occurs naturally. But many types of air pollution are the result of human activities.

Natural Sources

Many natural processes such as forest fires and dust storms release smoke and dust particles into the air, volcanoes emit clouds of dust and poisonous gases along with ash. Which gas is emitted by volcanoes? Termites and cows also release large amount of methane n the air. Considerable electrical discharges in the atmosphere produce nitrogen oxides.

Human Activities

Most of the air pollution is the result f burning fossil fuels, such as coal, petroleum and natural gas. Nearly half of the air pollution comes from cars and other motor vehicles. Factories and power plants that burn coal r oil release poisonous gases in the air. Burning fossil fuels and incineration release carbon monoxide (CO), nitrogen oxides (NO, NO_2) and sulphur oxides (SO_2, SO_3).

$$C_{(s)} + O_{2(g)}\,(\text{limited}) \longrightarrow CO_{(g)}$$

$$S_{(s)} + O_{2_{(g)}} \longrightarrow SO_{2(g)}$$

$$N_{2(g)} + O_{2(g)} \longrightarrow 2NO_{(g)}$$

$$2NO_{(g)} + O_{2(g)} \longrightarrow 2NO_{2(g)}$$

Chlorofluorocarbons have been widely used as solvents for cleaning electronic circuit boards, as refrigerant in fridges and air-conditioning units and as propellants in aerosol sprays (air fresheners, hairsprays, deodorants, spray paints). Such products are not "Environment friendly". During manufacture, in use and after disposal, these compounds escape into the air. Lead particles in the air come mainly due to the combustion of leaded petrol or fuel used in motor vehicles or from lead based paints.

Ozone is produced when electrical discharge pass through oxygen in the air. Yr can feel its presence near photocopier, television set, microwave oven and other electrical equipment.

$$3O_{2(g)} \xrightarrow[\text{discharge}]{\text{Electrical}} 2O_{3(g)}$$

Air Pollutant	Physical Properties	Sources	Harmful Effects
Carbon monoxide	Colourless, odourless and poisonous gas	Incomplete burning of wood, fuels and vehicle exhaust.	Headache, brain damage, death.
Sulphur dioxide	Colourless gas with unpleasant and irritating odour	Power stations and industries using fossil fuels	Breathing difficulties, bronchitis, emphysema, lung cancer, acid rain and green house effect
Oxides of nitrogen	NO is colourless, odourless gas soluble in water. NO_2 is reddish brown gas with pungent odour soluble in water. Both are highly toxic gasses	Exhaust fumes of motor vehicles, power stations and industries using fossil fuels	Coughs, headaches lung diseases, acid rain and greenhouse effect (global warming)
CFCs chlorofluorocarbons	Colourless gases	Aerosol sprays foams, refrigerants, air-conditioning systems.	Green house effect (Global warming), thinning of ozone layer
Lead compounds	Poisonous solid particles	Exhaust fumes form motor vehicles	Brain damage, forest decline

Q.4 How ozone depletes? and what are the effects of this depletion?

Ans: Ozone is an allotropic form of oxygen comprising there oxygen atoms, O_3 Ozone is an important gas in the stratosphere.

Most of the ultraviolet (UV) radiations coming from sun are **filtered** or **screened** out by the ozone layer. Otherwise, sunlight would be much more° hazardous for human beings, animals and plants. On absorbing UV radiation, ozone molecule breaks up to form a oxygen molecule and atomic oxygen.

$$O_{3(g)} \xrightarrow{UV} O_{2(g)} + O_{(g)}$$

Atomic oxygen is very reactive. Atomic oxygen reacts readily with an oxygen molecule to form ozone, thereby releasing heat.

$$O_{2(g)} \xrightarrow{UV} O_{3(g)} + \text{Heat}$$

These reactions maintain level of ozone in the stratosphere. Both the destruction and the reformation of ozone are powered by UV radiation. In the absence of outside intervention, the rates of ozone destruction and formation are equal. However, human activities disturb this natural balance.

Human activity releases many compounds in the atmosphere. Such compounds threaten the stability of ozone in the stratosphere.

The region in which the amount of ozone has been reduced is called as ozone hole. Ozone hole was first observed in October, 1980 over Antarctica.

Chlorofluorocarbons (from aerosol conditioning systems, refrigerators etc) escape into the atmosphere. CFCs are gases or low boiling liquids. They slowly diffuse into the ozone layer. UV radiation break CFCs molecule producing chlorine free radicals.

$$CCl_3F_{(g)} \xrightarrow{UV} \dot{C}Cl_2F + \dot{Cl}$$

Chlorine free radical reacts with ozone to form chlorine monoxide (ClO) and molecular oxygen. ClO reacts with atomic oxygen produced by the decomposition of ozone by UV radiations.

$$\dot{Cl}_{(g)} + O_{3(g)} \longrightarrow \dot{ClO}_{(g)} + O_{2(g)}$$

$$\dot{ClO}_{(g)} + O_{(g)} \longrightarrow \dot{Cl}_{(g)} + O_{2(g)}$$

Net reaction:

$$O_{3(g)} + O_{(g)} \longrightarrow 2O_{2(g)}$$

The chlorine free radical that reacts in step 1 is regenerated in step 2. One $\dot{Cl}$ can, therefore, destroy thousands of ozone molecules.

REVIEW QUESTIONS FROM TEXT BOOK

Q. 1 Select the correct answer.

(i) Which gas has highest percentage in the air

(a) O_2 (b) CO_2
(c) N_2 (d) O_3

(ii) lowest temperature in stratosphere is

(a) -5°C (b) -55°C
(c) 5°C (d) 55°C

(iii) which is/are responsible for acid rain?

(a) SO_2 (b) NO_2
(c) Both NO_2 and SO_2 (d) O_3

(iv) which is reddish brown gas?

(a) NO (b) NO_2
(c) SO_2 (d) O_3

(v) troposphere extends up to

(a) 50 km (b) 12 km
(c) 18 km (d) 80 km

(vi) stratosphere extends up to

(a) 12 km (b) 12 km
(c) 50 km (d) 80 km

(vii) the ozone layer is found in

(a) The troposphere (b) The mesosphere
(c) The thermosphere (d) The stratosphere

(viii) Most air pollution is caused by

(a) Ozone (b) Acid rain
(c) Carbon monoxide (d) The burning of fossil fuels

(ix) Which layer is closest to the Earth?

(a) The stratosphere (b) The troposphere
(c) The mesosphere (d) The thermosphere

(x) The outermost layer of earth atmosphere is

(a) The mesosphere (b) The stratosphere
(c) The troposphere (d) The thermosphere

ANSWER KEY

Q.	Ans.	Q.	Ans.	Q.	Ans.	Q.	Ans
1	c	4	b	7	d	10	d
2	b	5	b	8	d		
3	c	6	c	9	b		

SHORT QUESTIONS

Q.2 Give short answer

(i) List two main sources of acid rain.

Ans: Two main sources of Acid rain.

(a) Sulphur dioxide (SO_2) from power plants using fossil fuels.

(b) Nitrogen oxides (NO and NO_2) from exhaust of auto mobiles.

(ii) List four human activities which contribute to air pollution

Ans: 1 – burning of Fossil fuels

2 – Use of CFC's as a solvent.

3 – Use of leaded petrol produce lead particle.

(iii) What is the importance of stratospheric ozone?

Ans: See question answer of this chapter

(iv) What is the role of automobile in air pollution?

Ans: Due to combustion of fossil fuels in automobiles different pollutants are produced which cause are pollution. Almost half of are pollution in caused due to this factor.

(v) Define atmosphere.

Ans: See question answer of this chapter

Q.3 Explain temperature variation in stratosphere and troposphere

Ans: See in the layers of atmosphere

Q.4 List components of stratosphere and troposphere.

Ans: See in the layers of atmosphere

Q.5 Describe acid rain and its effects.

Ans: See question answer of this chapter

Q.6 Describe acid rain and its effects.

Ans: See question answer of this chapter

Q.7 Describe ozone depletion and its effects.

Ans: See question answer of this chapter

Q.8 Describe global warming.

Ans: See question answer of this chapter

Q.9 Differentiate between stratosphere and troposphere

Ans: See question answer of this chapter

Q.10 Explain ozone formation.

Ans: See question answer of this chapter

Q.11 Why is global warming often referred to as the greenhouse effect.

Ans: See question answer of this chapter

Q.12 There is scientific evidence that CFCs contribute to the depletion of ozone.

Ans: See question answer of this chapter

Q.13 Sulphur dioxide is a common pollutant form burning coal. State two effects. Caused by this pollutant.

Ans: See question answer of this chapter

THINK-TANK

Q.14 Dibenzothiophene ($C_{12}H_8S$) is a common of coal. It is responsible for acid rain. How?

Ans: As a result of combustion of coil dibenzothiophene ($C_{12}H_8S$) produces the oxides of sulphur i.e. SO_2 mainly. This SO_2 reacts with rain water to for acid which comes with rain. In this way it is responsible for acid rain.

Q.15 There have been various attempts to remove sulphur from coal before it is burned. Suggest reason.

Ans: There have been various attempts to remove sulphur from coal before it is burned because without removal of sulphur from coal during its burning, sulphur also burns and changes into their oxides (SO_2 and SO_3). These oxides place very important role in creation of pollution which is highly toxic in difference perspectives.

Q.16 Analyze the option what are some ways to reduce pollution caused by cars?

Ans: Different ways are a reduce pollution caused by cars.

(i) Use of urban transport instead of individual automobiles.

(ii) Prohibit the use of leaded petrol.

(iii) Use of environment friendly fuel transport.

(iv) Use of catalytic converters which convert the sink gasses environment friendly.

Q.17 Suggest reason for the presence of CO in the cars exhausts fumes.

Ans: Presence of CO in car exhaust fumes is due to the limited supply of oxygen during combustion process.

Q.18 As a global citizen, how can you play a part to reduce air pollution at personal level

Ans: I can play important role to reduce air pollution at personal level through following ways.

(i) Use of Urban transport instead of my own automobile.

(ii) Will not use leaded petrol.

(iii) Use of CNG instead of other fuels because it is environment friendly.

(iv) Instalment of catalytic converter in my vehicle's exhaust pathway.

(v) Less use of fossil fuels in room. Stop irrelevant combustion.

(vi) Prohibit the burning of house hold wastes.