

**2. Give short answers.****i. List two main sources of acid rain.**

**Ans:** Acid rain is caused mainly by the burning of fossil fuels such as gasoline. Oxides of nitrogen and sulphur are released into the air when fossil fuels are burnt and when they mix with the precipitation in clouds acid rain is formed.

**ii. List four human activities which contribute to air pollution.**

**Ans:**

- i. Burning fossil fuel
- ii. Cutting trees
- iii. Use of freon gas
- iv. Production of methane from dead plant material

**iii. What is the function of stratospheric ozone?**

**Ans: Importance of stratospheric ozone:**

Ozone saves us from harmful effects of incoming ultraviolet radiations from the sun. The energy is converted into heat, warming the air. Ozone layer protects the living things on Earth from dangerous ultraviolet radiations from sun.

**iv. What is the role of automobile in air pollution?**

**Ans:** Exhaust fumes of automobiles including dangerous gases such as carbon monoxide, oxides of nitrogen, hydrocarbons and particulates. These exhaust fumes of automobiles are responsible for air pollution.

**v. Define atmosphere.**

**Ans: Atmosphere:** The envelope of gases and water vapour surrounding the planet Earth is called atmosphere.

**3. Explain temperature variation in stratosphere and troposphere?**

**Ans: Temperature variation in stratosphere:**

In the stratosphere, temperature varies from  $-55^{\circ}\text{C}$  to  $-55^{\circ}\text{C}$ .

**Temperature variation in troposphere:**

As altitude increases in the troposphere temperature decreases from  $17^{\circ}\text{C}$  to about  $-55^{\circ}\text{C}$ . On average for every 1km increases in altitude the air gets about  $6.5^{\circ}\text{C}$  cooler.

**4. List components of stratosphere and troposphere?**

**Ans: Components of Stratosphere:**

This layer contains little water vapours. Interesting information about this layer is that it contains maximum amount of ozone (about 10ppm/parts per million). The presence of ozone is responsible for the rise in temperature in the stratosphere.

**5. Describe sources of air pollutants.**

**Ans: Sources of air pollution:**

**i. Natural sources:**

Many natural processes such as forest fires or dust storms release smoke and dust particles into the air. Volcanoes emit clouds of dust and poisonous gases along with ash. Termites and cows also release large amount of methane in air. Considerable electrical discharges in the atmosphere produce nitrogen oxides.

## ii. Human activities:

Most of the air pollution is the result of 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 or oil release poisonous gases in the air. Burning fossil fuel and incineration release Carbon monoxide(CO), Nitrogen oxides (NO, NO<sub>2</sub>) and sulphur oxides (SO<sub>2</sub>, SO<sub>3</sub>).



### Chlorofluorocarbons:

Chlorofluorocarbons have been widely used as solvents for cleaning electronic circuit boards, as refrigerant in fridges and air-conditioning units as propellants in aerosol sprays (air fresheners, hand sprays, deodorants, spray paints). Such products are not "Environment friendly". During manufacture, in use and after disposal, these compounds escape into the air.

### Lead particles:

Lead particles in the air mainly come due to the combustion of leaded petrol or fuel used in motor vehicles or from lead based paints.

### Ozone:

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



**6. Describe acid rain and its effects.****Ans: Acid rain and its effects:**

Acid rain is defined as rain having pH less than 5.6.

Normal rain water is saturated with carbon dioxide. It has pH of 5.6 however the acidity of rain greatly increases in polluted areas during thunderstorm.

Sulphur dioxide from power plants using fossil fuels and nitrogen oxides from exhaust fumes of automobile dissolve in rain water producing acids.



Therefore, during thunderstorm the pH of rain water can be much lower because of sulphuric acid and nitric acids formed by lightening. This rain may have pH as low as 2.1. This value is lower than the pH of vinegar and lemon juice.

**Effect of acid rain:**

Acid rain falls hundreds of kilometers away from their sources. Acid rain corrodes metals, stone buildings and statues. Marble statues are slowly eroded by acid rain.

**Sulphuric acid and metals:**

Sulphuric acid eats away metals to form water soluble salts and hydrogen.



Acid rain also kills fish, and destroys trees. Lakes and rivers may become too acidic for living things to survive. Trees destroyed by acid rain. Fish are killed by acid rain.

## 7. Describe ozone depletion and its effects.

### Ans: Ozone depletion and its effects:

Over recent years scientists have discovered a reduction in the amount of ozone in stratosphere.

### Ozone Hole:

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

### Chlorofluorocarbons:

Chlorofluorocarbons (fro aerosol cans, air conditioning systems, referigerator etc) escape into the atmosphere. CFCs are low boiling liquids. They are so inert that they do not react with any other chemicals in the troposphere. They slowly diffuse into the ozone layer. UV radiation breaks CFCs molecule produces chlorine free radicals.



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



### Net reaction:

The chlorine free radical that reacts in step 1 is regenerated in step 2. One Cl can therefore destroy thousands of ozone molecule. Figure 14.10 shows depletio of ozone layer over the years.



Satellite images. the blue area of normal ozone level is getting progressively smaller as time goes

**8. Describe global warming.**

**Ans: Global warming:**

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

**Global warming as green house effect:**

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 risk of flooding in both regions and drought in others.
- Polar ice may melts and cause significant increase in sea levels.
- So the atmosphere becomes hotter.

**9. Differentiate between stratosphere and troposphere.**

**Ans: Location:**

Troposphere is the layer of the atmosphere that touches Earth. From the surface of the Earth, the troposphere extends out 6-8 kilometers from the poles and 17 kilometers from the equator.

Between the troposphere and stratosphere is a small layer of atmosphere called tropopause. The stratosphere is about 50kilometers above from the surface of earth.

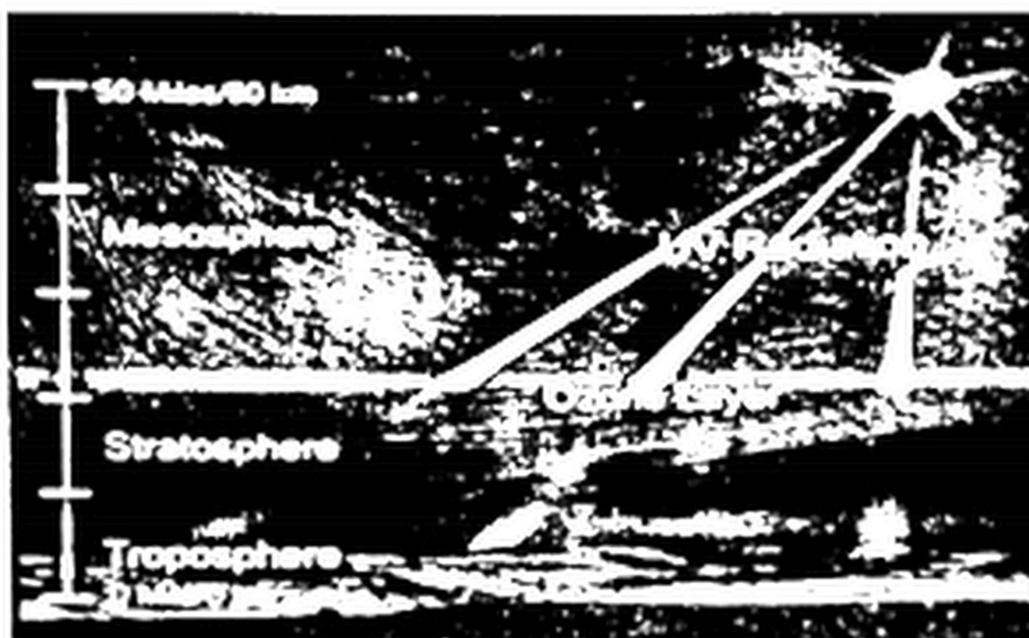
**Temperatures:**

The temperature in the troposphere decreases by 6.5 degrees. Celsius for every kilometer away from the Earth's surface. The temperature stabilizes at around 12kilometers.

The stratosphere's temperature is about -50 degrees celsius where it is closest to earth. The upper layer are actually warmer and average -18 degrees celsius. The reason for the warming, as this layer gets farther from the Earth is the presence of Ozone. Ozone absorbs sunlight and reflects it away from Earth.

**10. Explain ozone formation.****Ans: Ozone formation:**

Ozone is an allotropic form of oxygen comprising three oxygen atoms.  $O_3$  ozone is an important gas in the stratosphere.



### Ozone layer

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 an oxygen molecule and an atomic oxygen.



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



These reactions maintain the level of ozone in the stratosphere. Both the destruction and 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.

### 11. Why is global warming referred to as the greenhouse effect?

**Ans:** The **enhanced greenhouse effect** (or accelerated greenhouse effect) is the warming effect caused by all the **extra** carbon dioxide greenhouse gas

that man has put into the atmosphere in the past 100 years by burning fossil fuels (coal, oil and natural gas). Global warming is the warming of earth because of this enhanced green house effect.

**12. There is scientific evidence that CFCs contribute to the evolution of ozone. Why?**

**Ans: Ozone Hole:**

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

The CFCs are so stable that only exposure to strong UV radiations break them down. When that happens the CFC molecule releases atomic chlorine. One chlorine atom can destroy over 100,000 ozone molecules.

**13. Sulphur dioxide is a common pollutant from burning coal. State two effects caused by this pollutant.**

**Ans: Sulphur Oxides (SO<sub>x</sub>):**

In the air the sulphur dioxide is converted into sulphur trioxide, for acid rain.

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

### Think-Tank

**14. Dibenzothiophene (C<sub>12</sub>H<sub>8</sub>S) is a common sulphur containing compound of coal. It is responsible for acid rain. How?**

**Ans:** Dibenzothiophene ( $C_{12}H_8S$ ) is a sulphur containing compound of coal on burning it produces sulphur dioxide. In the air sulphur dioxide is converted into sulphur Trioxide, which is responsible for acid rain.

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

**Ans:** Sulphur containing compound of coal on burning produces Sulphur dioxide is converted into sulphur trioxide, which is responsible for acid rain. Therefore various attempts to remove sulphur from coal before it is burned have been done.

**16. Examine the option there are some ways to reduce pollution caused by cars?**

**Ans: Catalytic converter:**

A catalytic converter converts 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. Government of Pakistan should direct car manufacturers to install catalytic converters in car exhaust system. Government should make strict laws in this regards.

Similar to scrubbers on power plants, catalytic converters reduce  $NO_x$  emission from cars.

**17. Certain human activities are responsible for a significant increase in green house effect, argue.**

**Ans:** Primarily by two actions: **Burning of Fossil fuels**, with a smaller contribution from **clear cutting forests**, known as deforestation.

**Green house gases trap heat::**

When we extract and burn fossil fuels such as coal or petroleum, we cause the release of carbon dioxide and other heat trapping "greenhouse gases" into the atmosphere.

**Losing forests makes it worse:**

Clearing forests also releases large amounts of carbon dioxide. On top of that, plants and trees use it to grow. Worldwide deforestation means we don't have as many trees to absorb the extra carbon dioxide.

This means more of carbon dioxide stays in the atmosphere, trapping more heat.

**So what do we need to do about it?**

To make real progress at the global level we need to convince leaders to create laws and improve our energy policy and push companies to adopt sustainable business practices.

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

**Ans:**

- i.** Encourage your family to walk to the neighbourhood market.
- ii.** As far as possible use public forms of transport.
- iii.** Reduce the uses of aerosols in the household.
- iv.** Look after the trees in your neighbourhood.
- v.** If possible share your own room with others when the airconditioner, cooler or fan is on.
- vi.** Do not burn leaves in your garden; put them in a compost pit.
- vii.** Cars should, as far as possible, be fitted with catalytic converters.
- viii.** Use only unleaded petrol.

## 19. Compare and Contrast between stratosphere and troposphere?

### Ans: i. Stratosphere:

The second layer as one moves upwards from Earth's surface is called stratosphere. The stratosphere extends from top of the troposphere to about 50km above Earth's surface. Srato- means "layer" or "spread out". The lower stratosphere is cold about  $-55^{\circ}\text{C}$ , but the upper stratosphere is warmer than the lower stratosphere.

### Components of Stratosphere:

This layer contains little water vapours. Interesting information about this layer is that it contains maximum amount of ozone (about 10ppm/parts per million). The presence of ozone is responsible for the rise in temperature in the stratosphere.

### Functions of Ozone:

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. Ozone layer protects the living things on Earth from dangerous ultraviolet radiations from sun.

### Temperature variation in stratosphere:

In the stratosphere, temperature varies from  $-55^{\circ}\text{C}$  to  $-55^{\circ}\text{C}$ .

### ii. Troposphere:

Tropo means "turning" or "changing". Conditions in troposphere are more variable than in other layers. Troposphere extends to about 12km above Earth's surface. The atmospheric layer closest to the Earth's surface is called troposphere. Troposphere contains most of the mass (75-80%) of the atmosphere. It is the layer of atmosphere in which we live.

### Components of Troposphere:

Nearly all the dust particles and water vapours in the troposphere. Weather occurs in this layer. Most of the clouds are formed in troposphere. Aircrafts fly in the region.

**Temperature variation in troposphere:**

As altitude increases in the troposphere temperature decreases from  $17^{\circ}\text{C}$  to about  $-55^{\circ}\text{C}$ . On average for every 1km increases in altitude the air gets about  $6.5^{\circ}\text{C}$  cooler.

**Project**

**Global warming has become one of the most serious environmental issues in the world in recent times. Prepare a report on this issue in terms of:**

- a)** The gases contributing to the problem and their sources
- b)** Which of these gases are causing most concern?
- c)** Suggest some ways to reduce this problem.

