RRC INTERNATIONAL

RRC Study Text Sample

NEBOSH
Environmental Management Certificate

Unit EMC1: Environmental Management
Unit EMC2: Assessing Environmental Aspects and Associated Impacts

nebosh LEARNING PARTNER GOLD 335

The Scope and Nature of Environmental Management

IN THIS SECTION...

- Understanding and managing the environment requires knowledge of many topics, including geography, geology, hydrogeology, planning, public health, sociology, pollution and pollution controls.
- Barriers to good environmental management are:
  - The complex nature of the environment.
  - Conflicting demands in an organisation.
  - Difficulties in changing people's behaviour.
- Environmental impacts can be local, national or regional; and international or global.
- Some key environmental issues include:
  - Local pollution from noise, waste, lighting and odour.
  - Carbon emissions and climate change.
  - Loss of biodiversity.
  - Air pollution causing poor air quality.
  - Release of pollutants causing the protective ozone layer in the stratosphere to become depleted.
  - Land grabbing.
  - Use of fossil fuels.
  - Inappropriate disposal of waste.
  - Impacts occurring from poor agricultural practices.

Definition of the Environment

The 'environment' is everything that surrounds us. This encompasses:

- the physical resources of the Earth, including the atmosphere, water, the land and raw materials;
- the living resources of animal and plant life; and
- human populations.

Environmental management is concerned with understanding these elements and how they interrelate. The international environmental management system standard **ISO 14001:2015** defines the environment accordingly as:

> *"The surroundings in which an organisation operates, including air, water, land, natural resources, flora, fauna, humans and their interrelationships.*
>
> *Surroundings can extend from within an organisation to the local, regional and global system."*
>
> (Source: **ISO 14001:2015**)

DEFINITIONS

NATURAL RESOURCES

Land or raw materials that occur naturally in the environment.

FLORA

Plant life.

FAUNA

Animal life.

ENVIRONMENTAL MEDIA

Air, land and water.

The Multidisciplinary Nature of Environmental Management

DEFINITIONS

GEOLOGY

Study of the physical materials that make up the Earth.

HYDROGEOLOGY

Study of the movement of groundwater in the soil and rocks.

SOCIOLOGY

Study of human social activity.

Environmental management clearly has a very broad scope. One of the fascinations of studying the environment is the breadth of topics and disciplines that are involved. Environmental management typically involves concepts from scientific and technical disciplines, e.g. physics, chemistry, biology, geology and engineering, but it also has social and political dimensions, e.g. town and country planning, public health and legislation.

In studying an environmental course such as this, you will be given a general, but not specialist, understanding of a wide variety of topics included in these disciplines.

Barriers to Good Standards of Environmental Management

Many organisations of all types and sizes successfully manage their environmental impacts. But we need to recognise at the outset that the broad scope of environmental management poses a number of barriers to good environmental management, for example:

- **Complexity**

  Organisations are complex, with numerous environmental impacts, such as waste generation and disposal, energy use, emissions to air, or discharges to water. Deciding which impacts to address and how to achieve improvements requires background knowledge of environmental impacts, how they interact, and options for improvement. An understanding of how changes of process or procedure can affect the business is also important.

- **Competing and Conflicting Demands**

  Organisations need to operate in an efficient and effective manner to deliver the right product or service to their customers, on time, and at a competitive price. Commercial companies need to make a profit in order to survive. Individual people in an organisation may be driven by financial, rather than environmental, pressures.

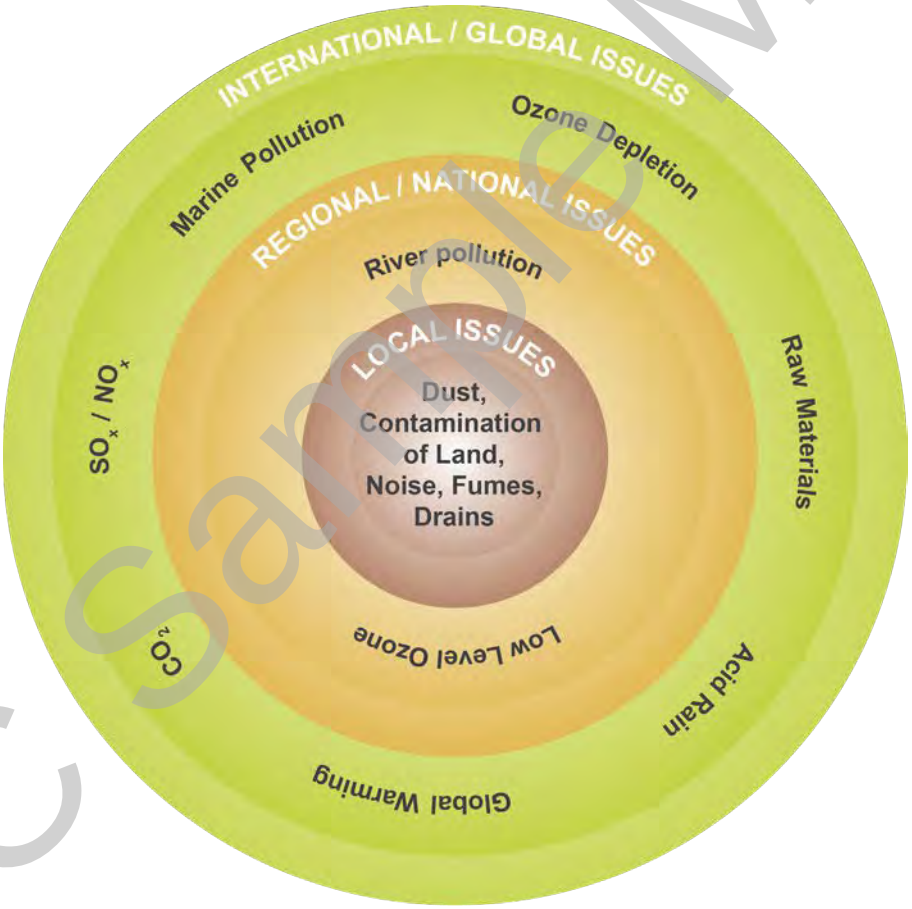
All organisations need to comply with applicable legislation. There is often conflict between environment and health and safety. For example, to protect workers from high dust levels in the workplace, dust is ventilated to the atmosphere. If not controlled, this may cause an environmental problem, with plants being covered in dust, or a nuisance being caused to nearby residents.

- **Behavioural Issues**

  Changing the way people behave in any given situation is one of the most difficult things to achieve. In recent years, the cost of fuel and generally running a car has increased significantly, yet people are still unwilling to give up car ownership and use. This is in spite of significant publicity regarding the negative environmental impact of car use, from contributing to climate change to decreasing local air-quality standards. This is no different from attitudes in the workplace; if we are to be successful in changing behaviour patterns, we must be prepared for it to take time and we must provide people with good reasons to change.

Size of the Environmental Problem

We have seen that the environment covers a wide range of issues and disciplines. When we think about our own organisations, we need to recognise that we can contribute to local, regional and global environmental issues. The following figure illustrates this.



Relationship between local, national and international environmental issues

The various sections of this course cover the main environmental issues in some depth, but let's begin by taking an overview of some of the key local, regional and global environmental concerns that society is dealing with today.

Local Effects of Pollution

These can include:

- Poor air quality due to the pollution caused by high levels of vehicle traffic or local industrial processes. For example, vehicles emit a mixture of gases and particulate material that can cause harm to the environment and damage human health. Oxides of sulphur and nitrogen are often referred to as SO_x and NO_x respectively. NO_x can react with atmospheric gases, in the presence of sunlight, to produce harmful low-level ozone.
- Contaminated land from industrial processes where spills or accidents have occurred, leaving ground contaminated with pollutants such as heavy metals (cadmium, lead, etc.).
- Water pollution from accidental spillages from industry.

High volume of traffic, even at night

Pollution by noise, odour and light is becoming an increasing problem and all of these types of pollution are often controlled through legislation. Operating conditions may also be imposed on businesses located in sensitive areas under planning law, or through industrial environmental permits.

Waste is often heavily regulated, e.g. under the **Waste Framework Directive (2008/98/EC)** in the European Union. This is because unregulated and uncontrolled disposal of waste can lead to the spread of disease through contact with the waste itself, or an increase in numbers of vermin species, such as rats, which aid the spread of disease. Waste can also contaminate land and water.

Carbon Emissions and Climate Change

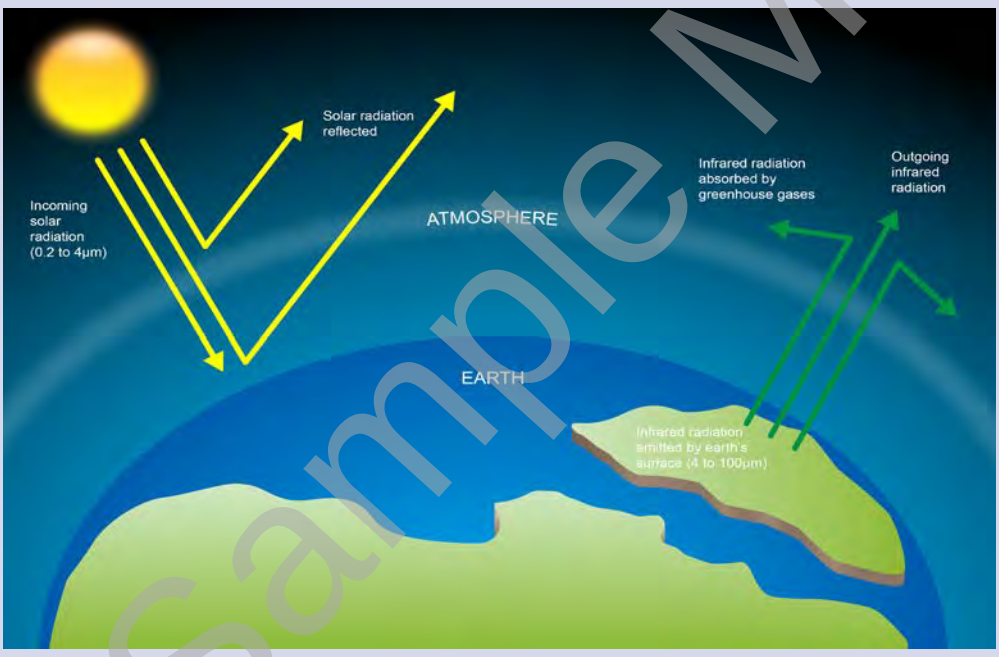
TOPIC FOCUS

Global Climate Change

The first decade of the 21st century was the warmest on record and measurements over the last 150 years show that the temperature of the atmosphere has increased by around one degree Celsius. This phenomenon is commonly known as climate change.

There is now strong evidence that climate change is related to pollution of the atmosphere, through the mechanism known as the 'greenhouse effect'.

What is the greenhouse effect? It is actually a natural phenomenon. The Sun irradiates the Earth with energy and as the Earth warms, it emits energy back into space as infrared radiation. Some of this radiation is absorbed by greenhouse gases that occur naturally in the atmosphere (primarily water vapour, carbon dioxide and methane); the effect of this is to reduce heat loss from the Earth. Were it not for the greenhouse effect the temperature of the Earth would be well below zero degrees Celsius.



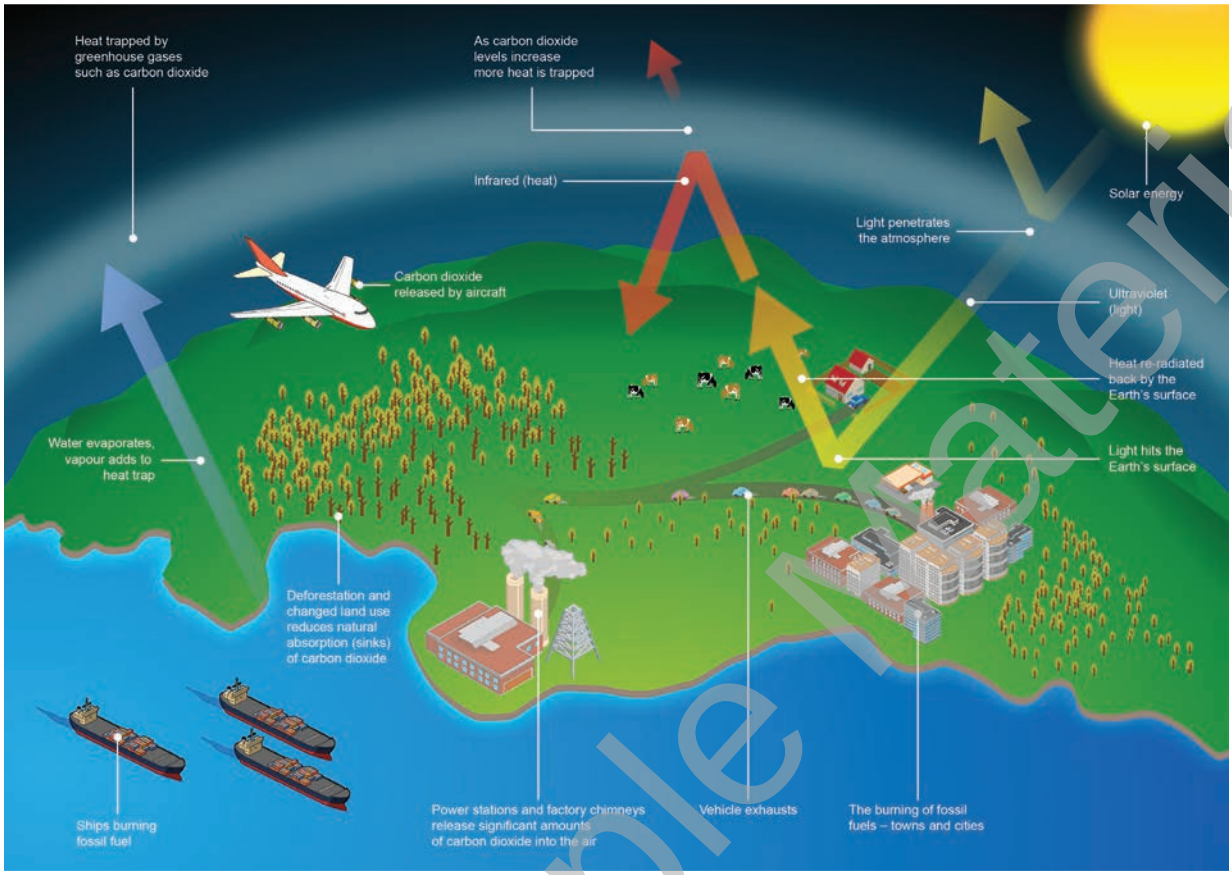
The greenhouse effect

The problem is that burning fossil fuels (e.g. coal, oil, gas, petrol, diesel), which account for more than 85% of the world's energy consumption, releases large quantities of carbon dioxide into the atmosphere. Levels of carbon dioxide in the atmosphere have consequently increased significantly during the past 50 years.

Enhanced levels of carbon dioxide in the atmosphere are now believed to be artificially increasing the greenhouse effect, leading to climate change.

What is so alarming about a warmer planet?

- Sea levels will rise - primarily through the melting of the polar ice caps. This could result in widespread coastal flooding.
- Climate change - the warming of the Earth is likely to trigger changes in the Earth's climate. This could potentially have very serious consequences. For example, major food-producing areas might begin to suffer droughts, reducing our ability to feed ourselves. There are also likely to be more extreme and disruptive weather events, such as high winds and floods.



The main man-made sources of carbon dioxide emissions and the greenhouse effect (reproduced courtesy of Scottish Power)

MORE...

Further information on the science behind climate change can be found in the Intergovernmental Panel on Climate Change (IPCC) *Fifth assessment report - climate change 2013: The physical science basis*, available at:

www.ipcc.ch/report/ar5/wg1

To reduce fossil-fuel burning (mainly power stations and road vehicles), we must:

- **Reduce energy consumption**, e.g. by improved insulation, double-glazing, attention to heating and ventilation, turning lights off.
- **Increase efficiency of energy use**, e.g. through best practice in the operation of plant and processes, use of fuel-efficient vehicles (diesels give about 30% better performance than petrol-driven vehicles but generally emit more air pollutants to atmosphere).
- **Use alternative energy sources**: e.g. wind, water, or nuclear energy.
- **Burn fuels which release less carbon dioxide**: natural gas (methane) produces more than twice as much energy (per kg), and carbon dioxide makes up only 75% of the combustion products compared with coal.

Climate Change Greenhouse Gas Management Hierarchy

The IEMA publication, *Pathways to net zero: using the IEMA GHG management hierarchy*, advocates the use of a hierarchy of control for greenhouse gas emissions. The hierarchy is as follows:

GHG management hierarchy

Source: Based on *Pathways to net zero: using the IEMA GHG management hierarchy*, IEMA, 2020

Biodiversity Loss

Biodiversity is simply diversity, or variety, of plants, animals and other living things in a particular area or region. Diversity within the natural environment is important.

The Earth's biological resources are vital to economic and social development because they:

- Provide us with sustainable materials.
- Maintain the quality of our air, soils, waters and climate.
- Contribute to our health and enjoyment of life.

Estimates of global species diversity vary enormously, as it is difficult to estimate how many species there may be in less well-explored habitats, such as untouched rainforests. Rainforest areas that have been sampled have shown a very high level of biodiversity.

Extinction is a fact of life. However, species are now becoming extinct at an alarming rate, almost entirely as a direct result of human activities. Previous mass extinctions evident in the geological record are thought to have been brought about mainly by massive climatic or environmental shifts. Predictions and estimates of future species losses abound. One such estimate calculates that a quarter of all species on Earth are likely to be extinct, or on the way to extinction, within 30 years.

Air Pollution and Ground-Level Ozone

The main causes of air pollutants are vehicle exhaust emissions and industrial activities. Vehicles emit a mixture of gases and particulate material that can cause harm to the environment and damage human health. Oxides of sulphur and nitrogen are often referred to as SO_x and NO_x respectively. NO_x can react with atmospheric gases, in the presence of sunlight, to produce harmful low-level ozone. While we need ozone in the stratosphere part of the atmosphere, at low altitudes where people live it is a poisonous gas. These same SO_x and NO_x gases can also combine with moisture in the atmosphere to produce dilute sulphuric or nitric acid (falling as so-called 'acid rain'), which causes damage to buildings, especially many older buildings that are made from materials such as marble and limestone.

Air Pollution and the Ozone Layer

Life on Earth is protected from the damaging effects of ultraviolet radiation by a layer of ozone molecules (O_3) in the lower stratosphere, between 15 and 25 km above the Earth's surface. Ozone absorbs ultraviolet radiation, one of the major causes of skin cancers. Certain chemicals (ozone depleters) can destroy the ozone layer.

Although ozone has been depleted in other regions, ozone depletion is most dramatic over the polar regions, due to particular upper atmospheric conditions, and a continent-sized hole has developed over Antarctica.

Most ozone depleters are chemically-stable compounds containing the halogen elements chlorine or bromine. These compounds have typically been used as refrigerant gases, as propellants for aerosol sprays, as foam-blowing agents, as solvents and in fire-fighting systems, e.g. chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), carbon tetrachloride, trichloroethane, halons.

These ozone-depleting compounds are very stable and if they are released by human activities they can persist unchanged in the atmosphere until they drift upwards to reach the ozone layer in the stratosphere. At this altitude, the compounds are exposed to higher levels of UV radiation, which liberates charged chlorine and bromine atoms from the parent molecules. These charged atoms are known as 'free radicals' and are highly reactive. Chlorine and bromine free radicals are able to react with, and break down, ozone molecules in a variety of ways, for example:

A chlorine-free radical reacts with ozone to produce chlorine monoxide and molecular oxygen:

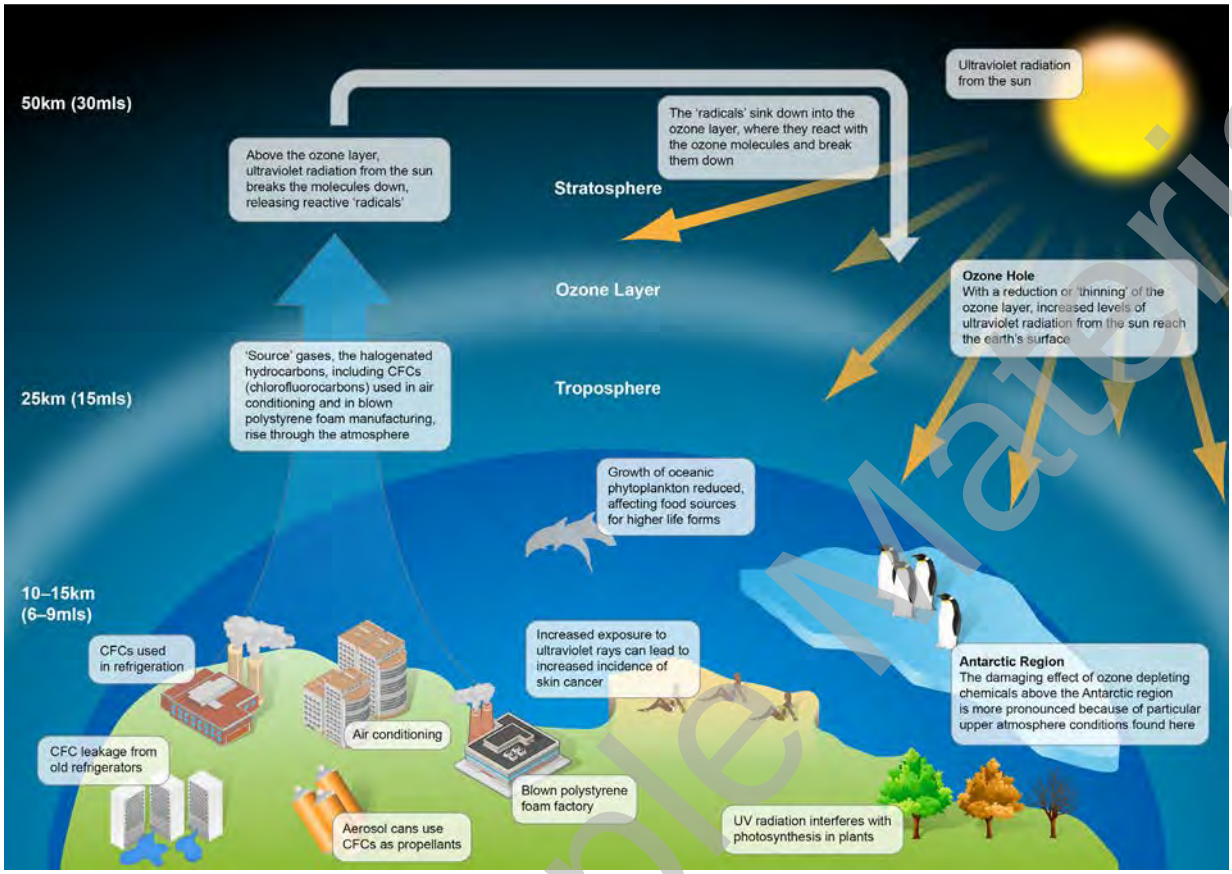
$$Cl + O_3 \rightarrow ClO + O_2$$

The chlorine monoxide so formed may then react to break down more ozone:

$$ClO + O_3 \rightarrow Cl + 2O_2$$

International agreements (especially the Montreal Protocol (see later in this element)) are in place to curb the production and use of ozone depleters.

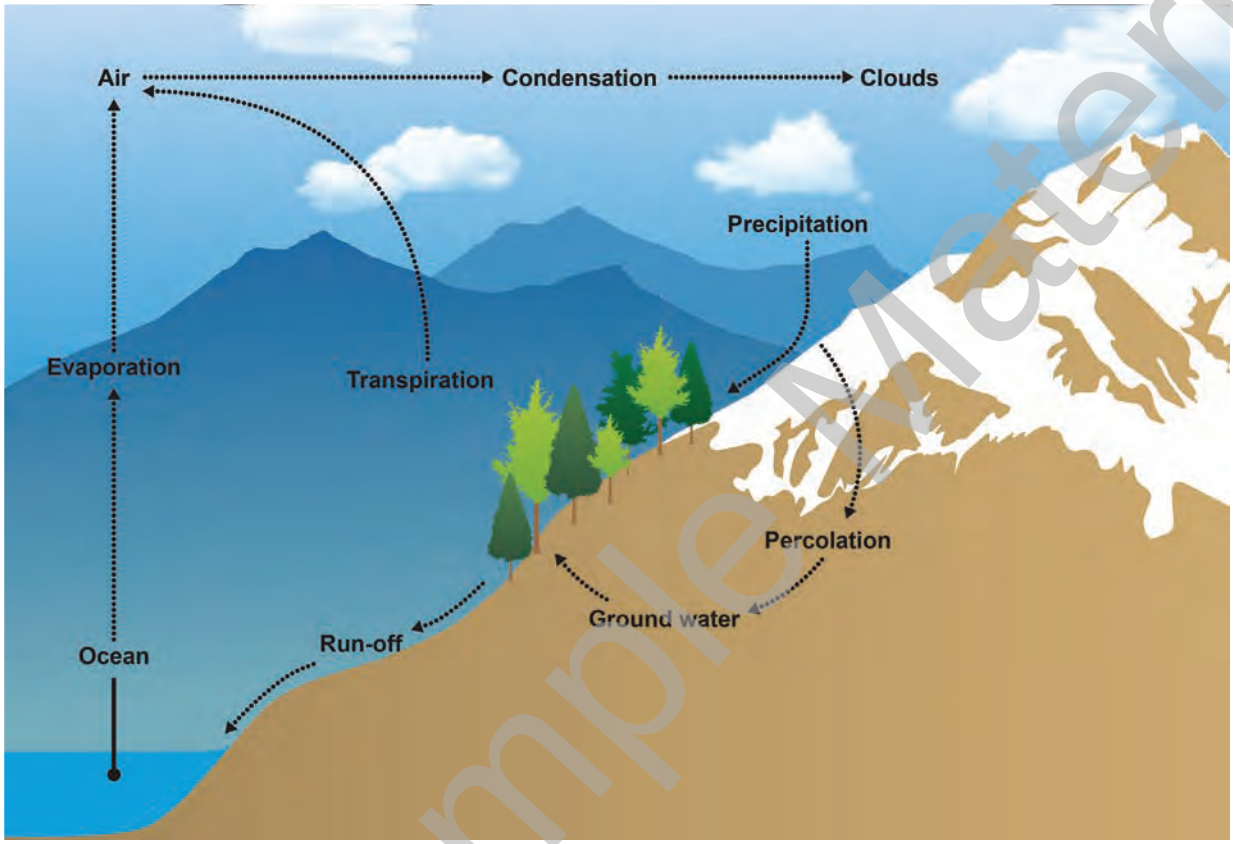
Unfortunately, even if all ozone-depleters were banned today, the chlorine molecules already in the atmosphere would continue to affect stratospheric ozone levels for at least a century.



Depletion of the ozone layer

Water Resources

Water is an essential resource and is recycled naturally in the environment through the hydrological cycle, as shown in the figure below. The demand for water is increasing due to the increase in population and in the amount of water used by individuals; this is especially the case in developed countries, where water is seen as a plentiful and cheap resource.



Natural hydrological cycle

Because of this cycle, there can be an accumulation of pollutants through water catchments, making prevention of pollution particularly important.

DEFINITION

WATER CATCHMENTS

Areas of land that drain water from rain, snow, etc., into a single water body, such as a river and its tributaries.

Water can be polluted:

- Directly, by discharges to rivers and lakes (point sources).
- Indirectly, through:
  - Run-off from land, particularly contaminated land.
  - Deposition of airborne pollutants (non-point sources) into watercourses.

