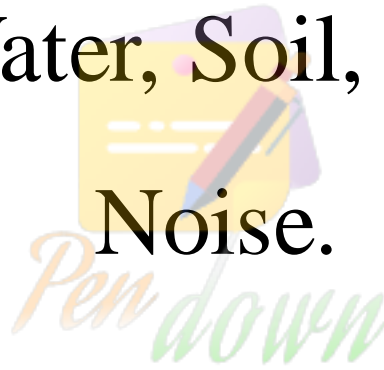


Environmental Pollutions

Air, Water, Soil, Marine,
Noise.



OBJECTIVE:

Man is one of the species who inhabit the earth.

He is the only one who has interfered with various natural processes for use of both biological & physical resources to meet his multiple demands.

man has polluted all the three realms of the earth-lithosphere, hydrosphere & atmosphere.

It is essential for us to know about environment & its pollution.

•Air Pollution



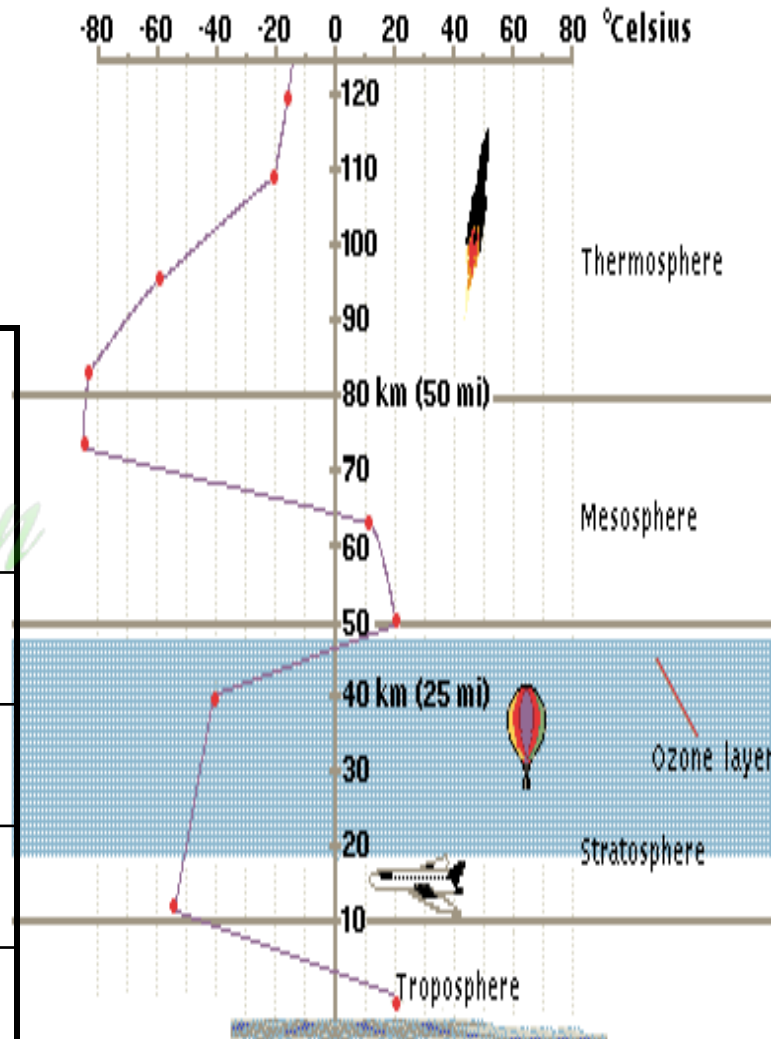
Pollution

- Means: The Presence in or Introduction into the environment of a substance which has **HARMFUL** or **POISONOUS** effect.
- Pollution comes from Latin word, pollutionem.
 - Means To Soil or defile
- It was not initially used in reference to the Environment, but Human Soul.

Atmosphere

- Our current atmosphere is a mixture of many different gases & suspended particles. It is almost same every where up to an altitude of 80 Kms. The atmosphere is divided in to 4 layers-

Name of sphere or layer	Height in Kms.	Temperature	Important Chemical Species (Gas)
Troposphere	0-8	15 to 45	N_2, O_2, CO_2, H_2
Stratosphere	8-50	-55 to 05	O_3, O_2
Mesosphere	50-80	-2 to -90	$N_2 + O_2$
Ionosphere	80-400		O_2, O^+, NO^+
Exosphere	400-1600		H_2, He



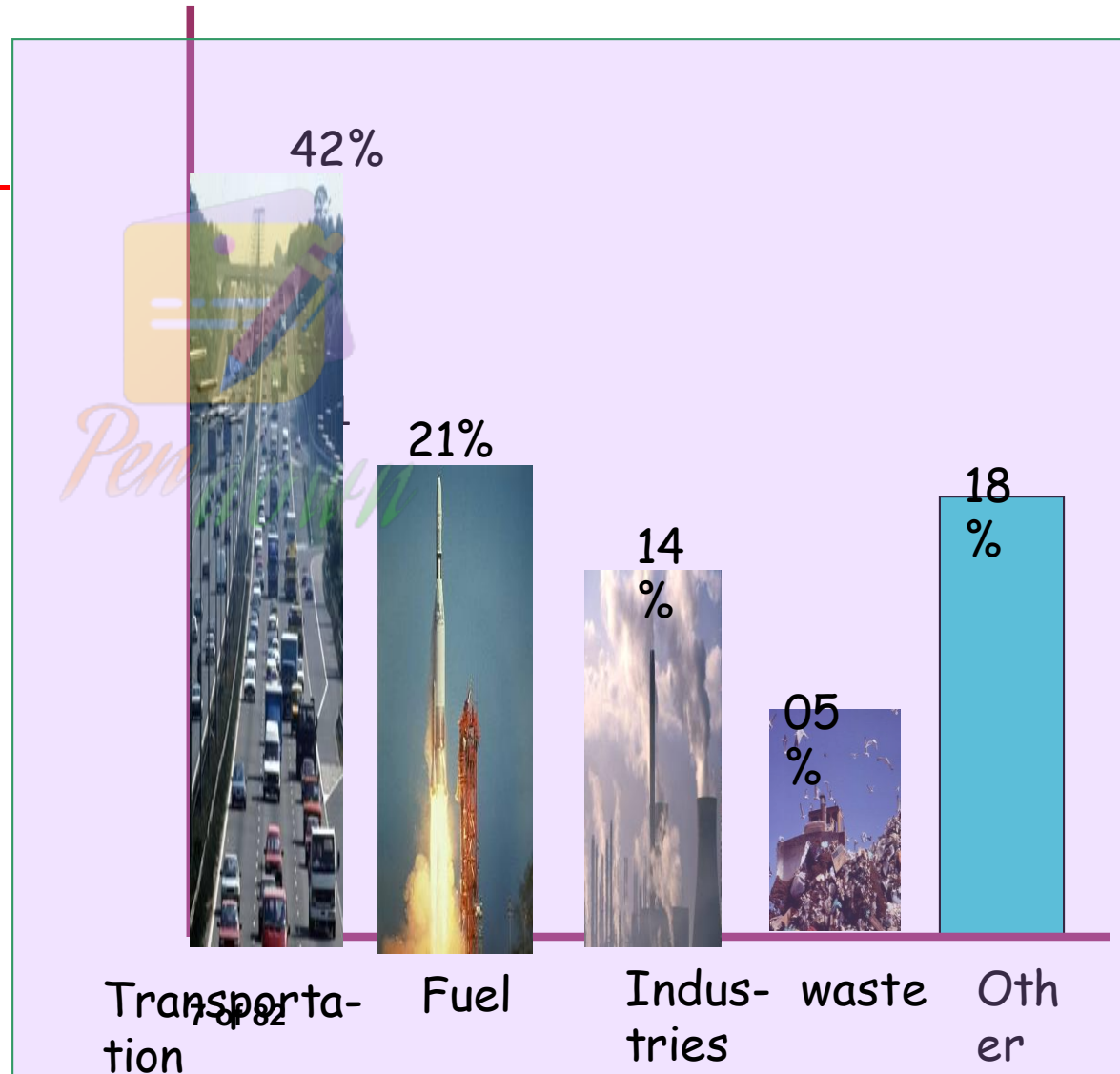
Composition of Atmosphere

Constituent	Symbol	Average concentration	Source	Volume
Nitrogen	N ₂	780900	Biotic	7.809× 10 ¹
Oxygen	O ₂	209400	Biotic	2-094× 10 ¹
Argon	Ar	9300	Radioactive	9.3× 10 ⁻¹
Carbon dioxide	CO ₂	318318	Biotic & industrial	3.18× 10 ⁻²
Neon	Ne	18	Internal	
helium	He	5.2	Radioactive	5.2× 10 ⁻⁴
Methane	CH ₄	1.3	Biotic	1.3× 10 ⁻⁴
Krypton	Kr	1.0	Internal	1.0× 10 ⁻⁵
Hydrogen	H ₂	0.5	Biotic & photochemical	5.0× 10 ⁻⁵
Water	H ₂ O	0.25	Physical	2.5× 10 ⁻⁵
Carbon monoxide	CO	0.1	Photochemical & industrial	1.0× 10 ⁻⁵
Ozone	O ₃	0.02	Photochemical	2.0× 10 ⁻⁶
Ammonia	NH ₃	0-01	Photochemical	1.0× 10 ⁻⁶
Nitrogen dioxide	NO ₂	0.001	Biotic & industrial	1.0× 10 ⁻⁷
Sulphur dioxide	SO ₂	0.002	Photochemical	2.0× 10 ⁻⁸

Atmospheric Pollution

Is an unwanted change in the quality of earth's atmosphere caused by emission of gases caused due to burning of fossil fuel, transportation, industrial institution etc.

<u>Source</u>	<u>Pollution</u>
Transportation	42%
Fuel	21%
Industries	14%
Solid waste disposal	05%
Other	18%



Different Pollutants

1. Gaseous waste: Oxides of nitrogen, SO_2 , CO_2 , CO , Cl , Br , I , O_3 & smog.
2. Complex organic chemicals: Benzene, ether.
3. Acid proplets: H_2SO_4 , HNO_3
4. Agrochemicals: fertilizers, pesticides, herbicides, fungicides, nematocides, weedicides, insecticides etc.
5. Fluorides
6. Metals: Mercury, lead, Cd , Zn , Fe , Ni etc.
7. Solid waste: Garbage, plastic etc.
8. Radioactive waste: Nuclear reactors, uranium, nuclear explosion.
9. Noise waste

Smog is a kind of air pollution, originally named for the mixture of smoke and fog in the air

Classification of Air Pollutants

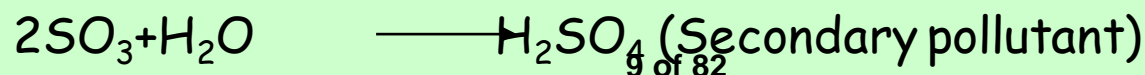
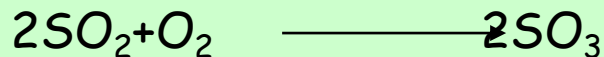


Natural Pollutants: The pollution which comes out from natural sources such as forest fires volcanic eruption decomposition of organic matter & natural radioactivity.

Primary Pollutants: Harmful chemical that directly enters the air as a result of human activity. These are deforestation burning of fossil fuel industrialization warfare etc.

Secondary pollutants : These result from chemical reactions between two or more air components.

Formation of secondary pollutants

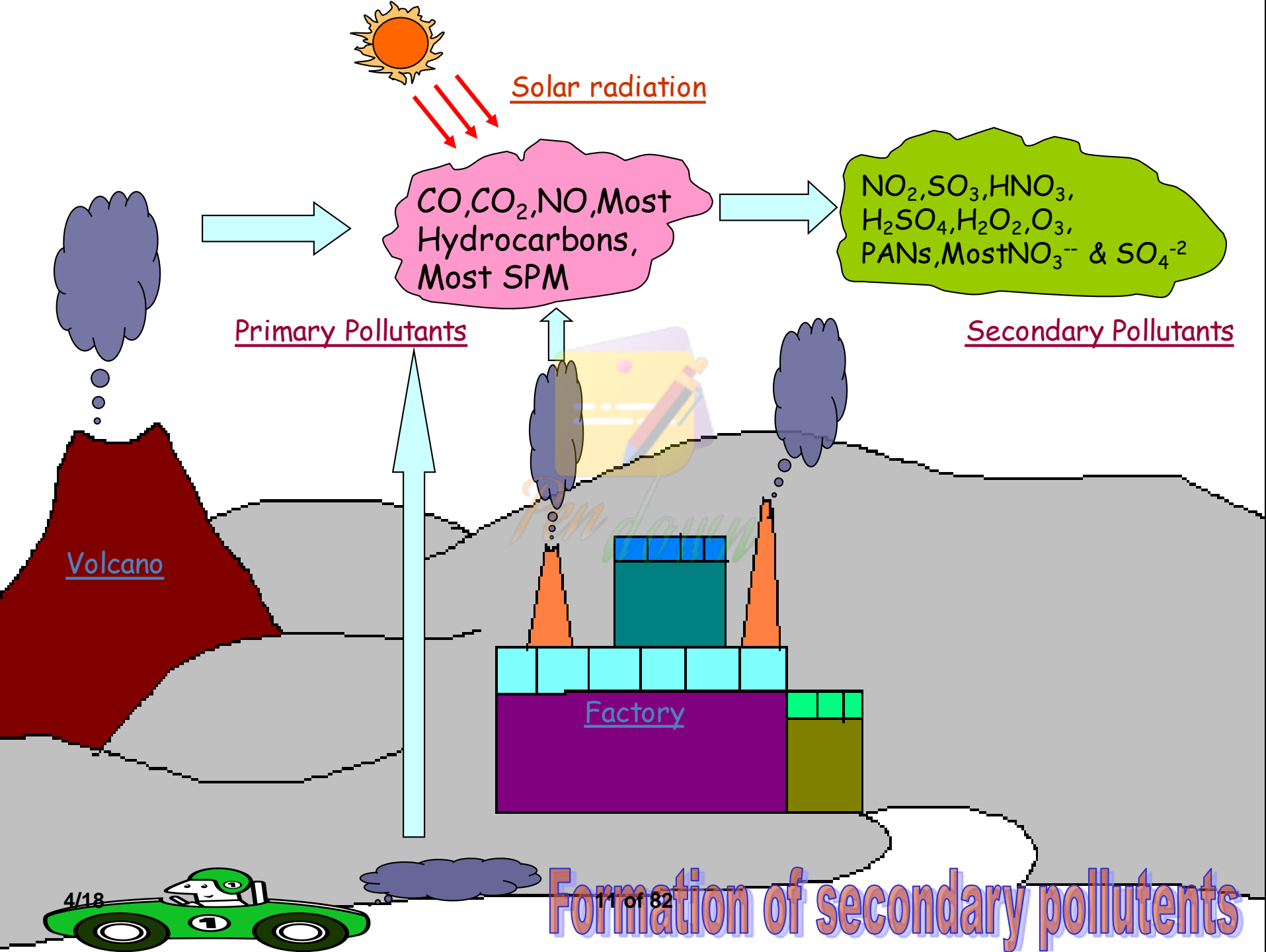


Primary Pollutants

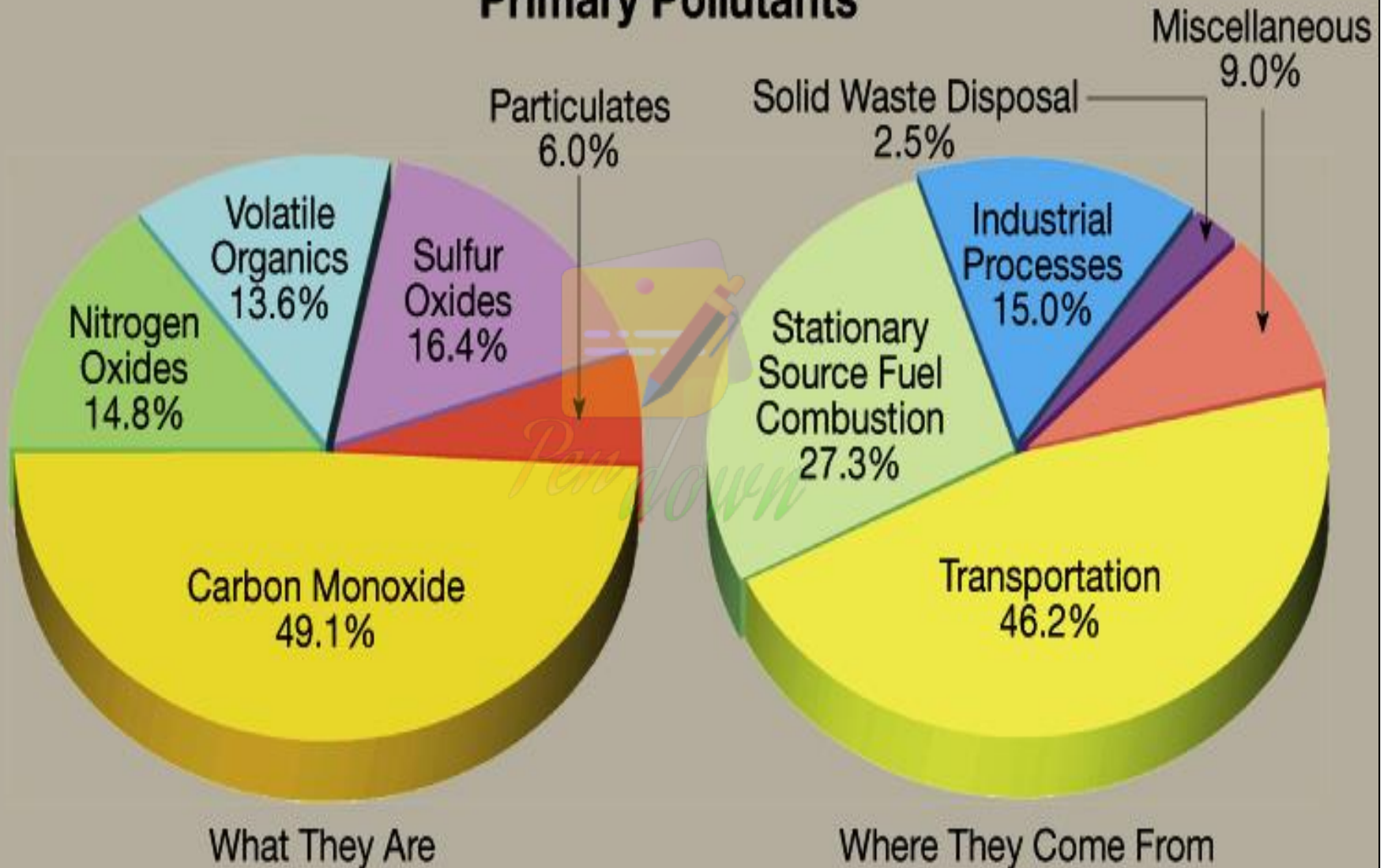
The major primary pollutants include:

- Particulate matter (PM),
- Sulfur dioxide,
- Nitrogen oxides (Nox),
- Volatile organic compounds (VOCs),
- Carbon monoxide, and
- Lead.

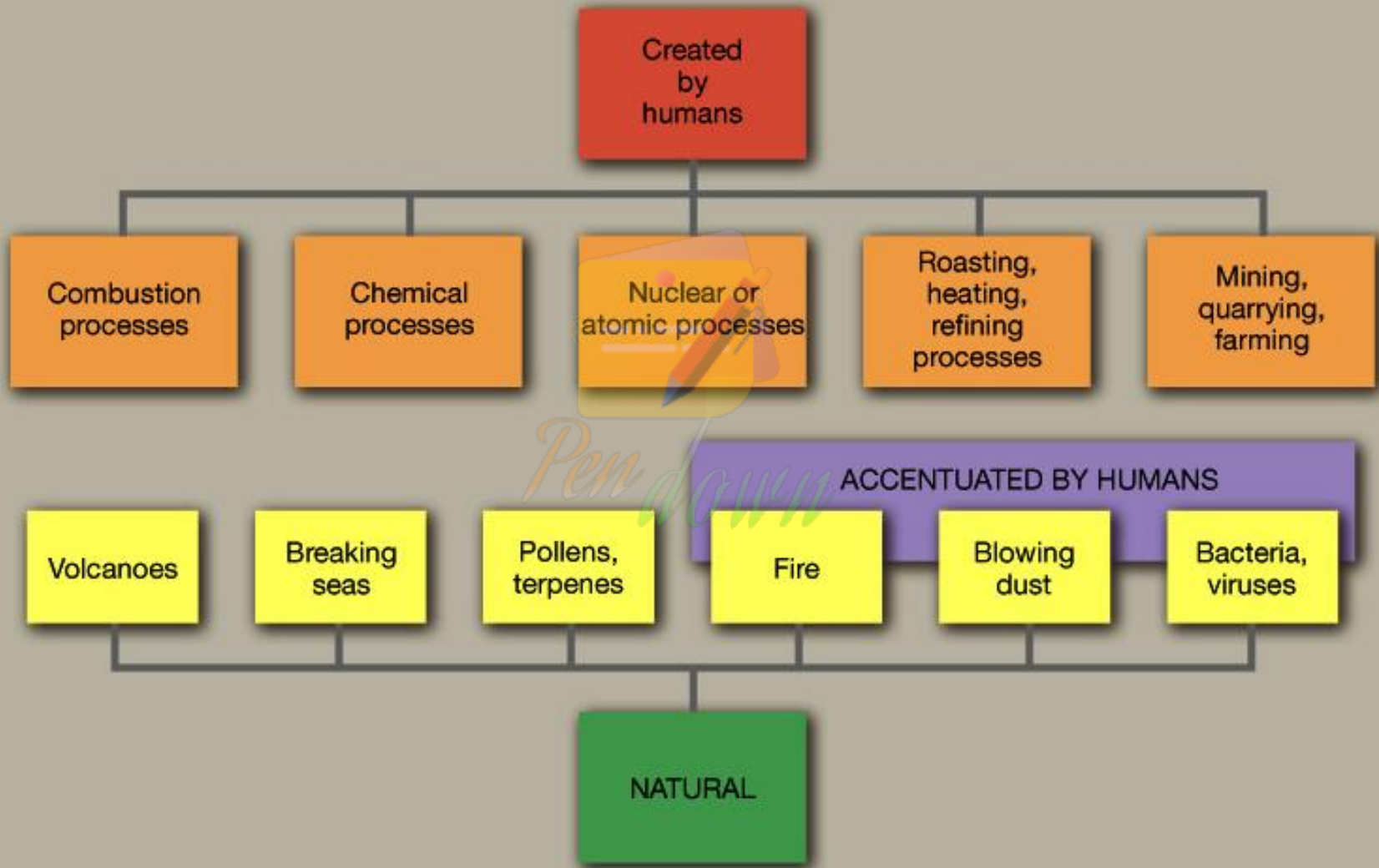




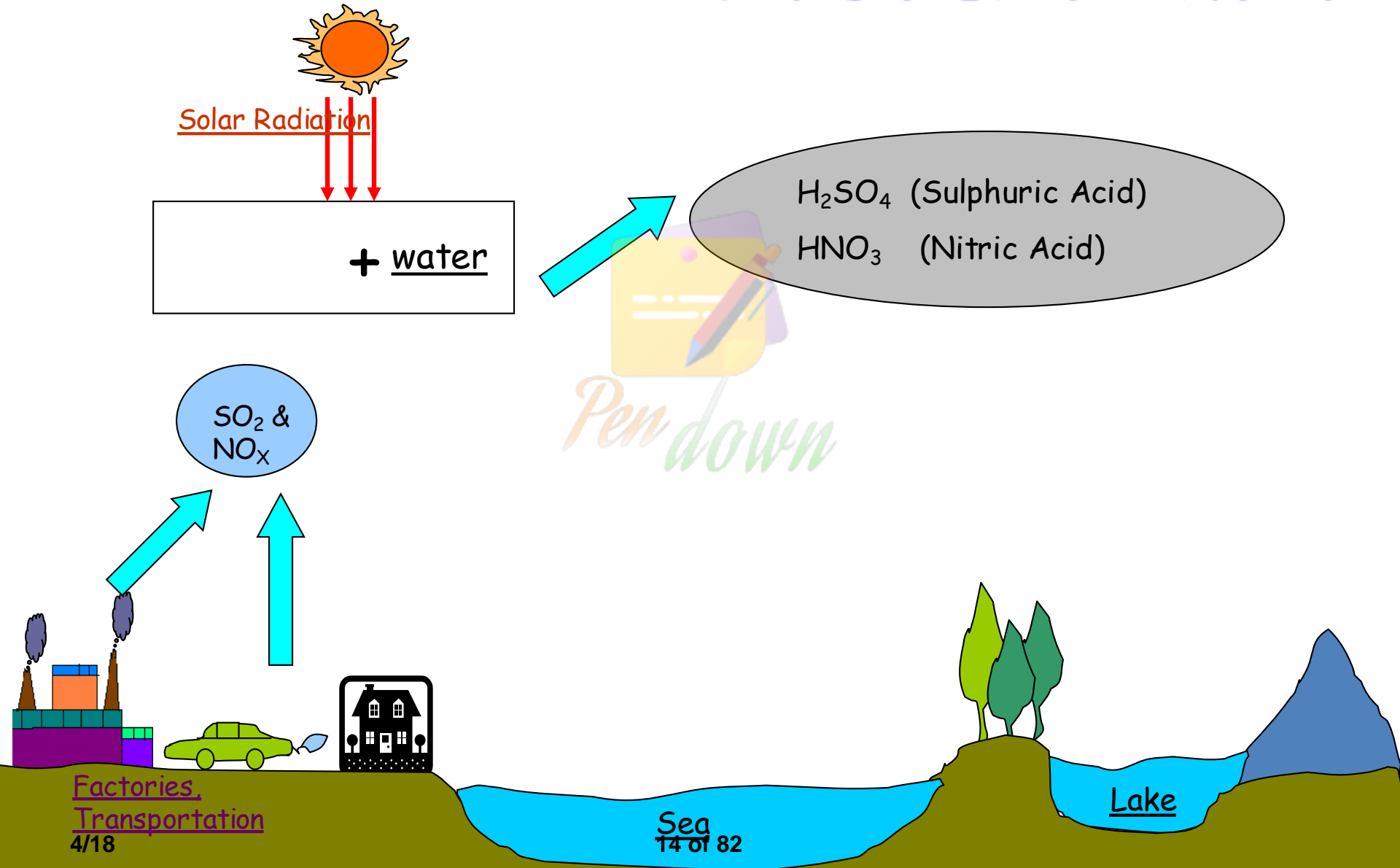
Primary Pollutants



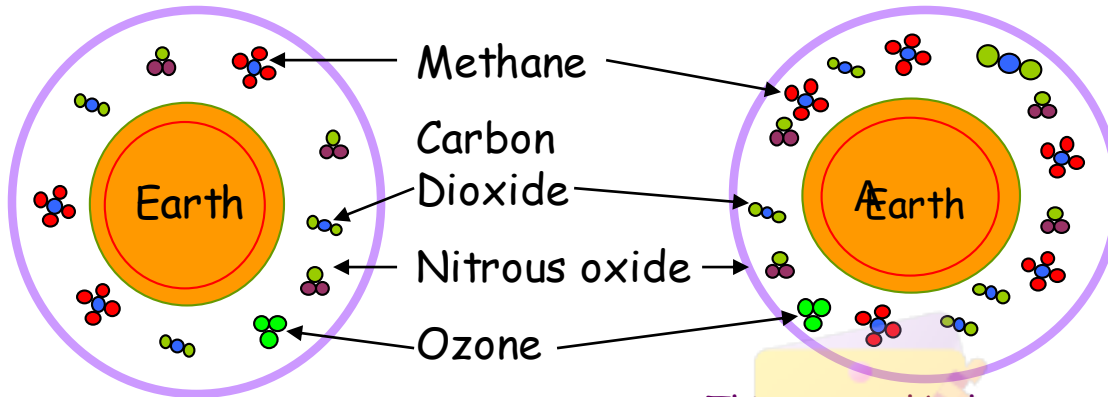
SOURCES OF PRIMARY POLLUTANTS



Acid Rain



Green House Effect

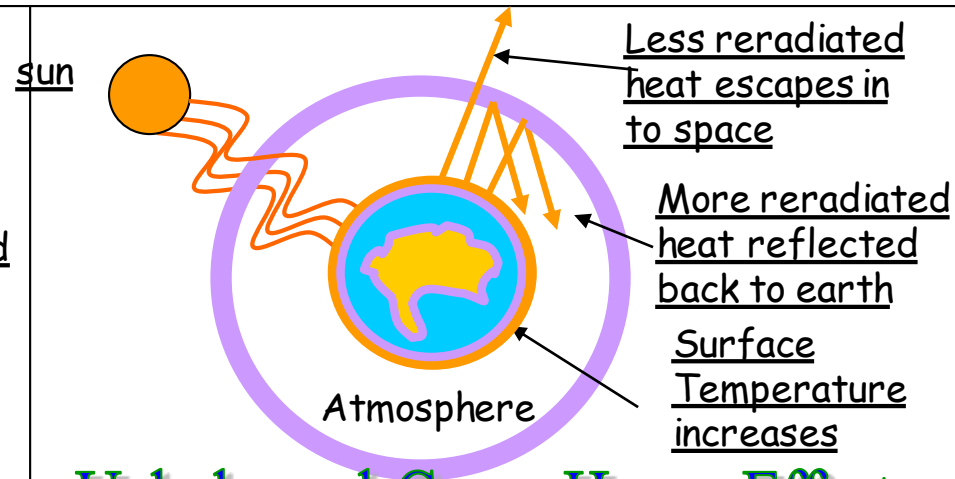
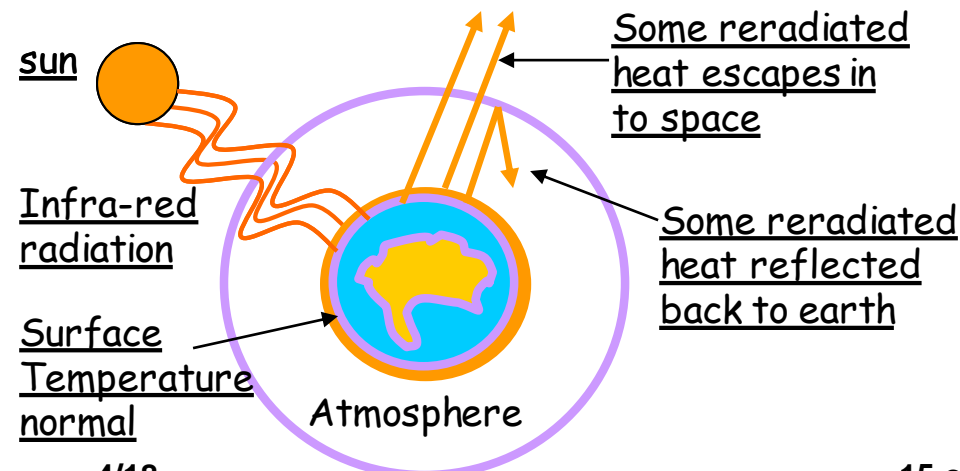


Carbon Dioxide	50%
Methane	18%
Chlorofluorocarbons	14%
Ozone	12%
Nitrous oxide	06%

Contribution of different gases to cause greenhouse effect

Green house gases in natural condition insulates the earth against extreme of temperature by limiting both incoming solar radiation & escape of reradiated heat in to space.

This natural balance may be distorted by Green House Effect as gases such as carbon dioxide have built up in the atmosphere trapping more heat

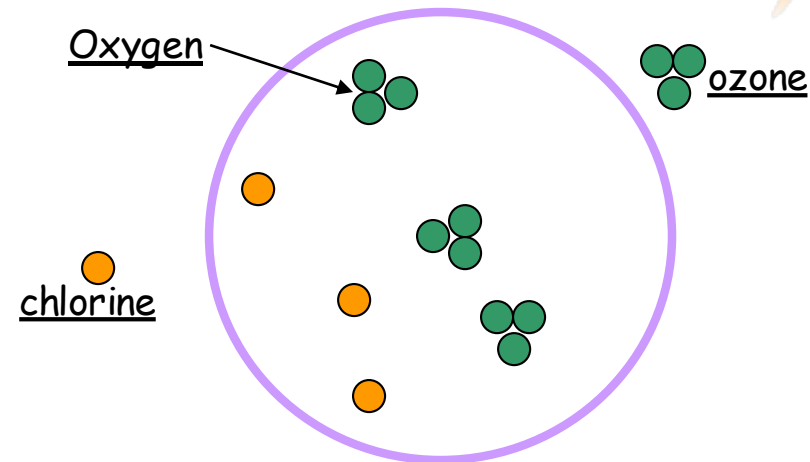
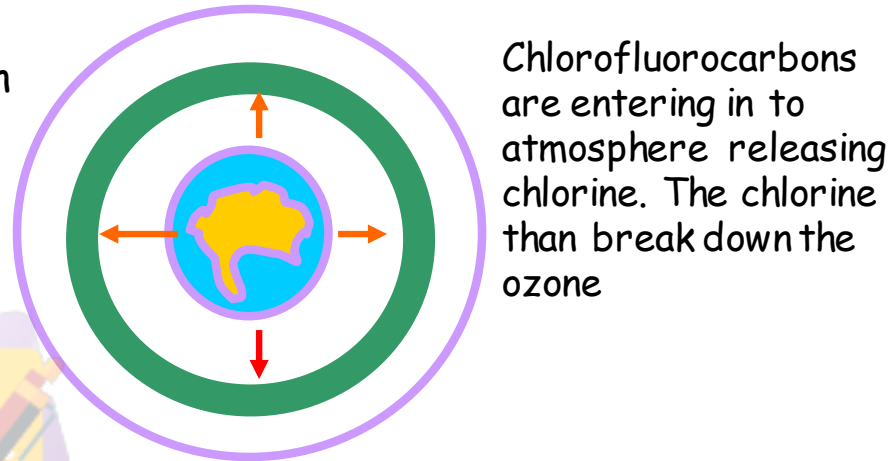
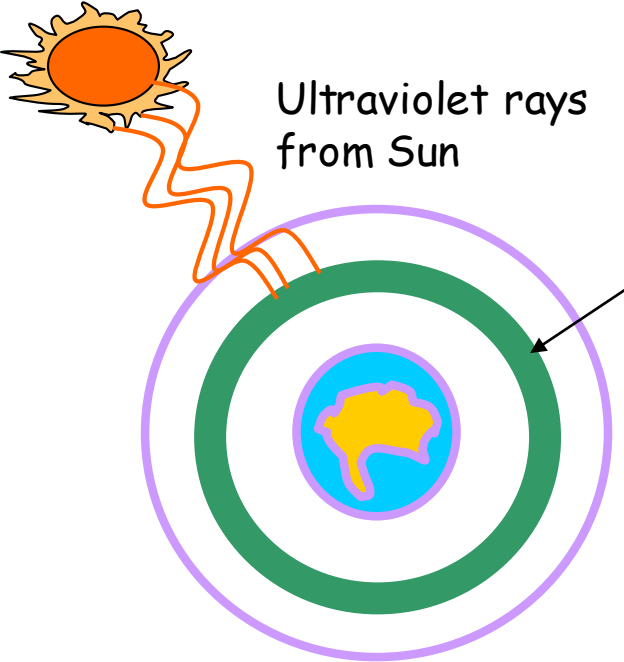


4/18
Naturally Moderated Green House Effect

15 of 82

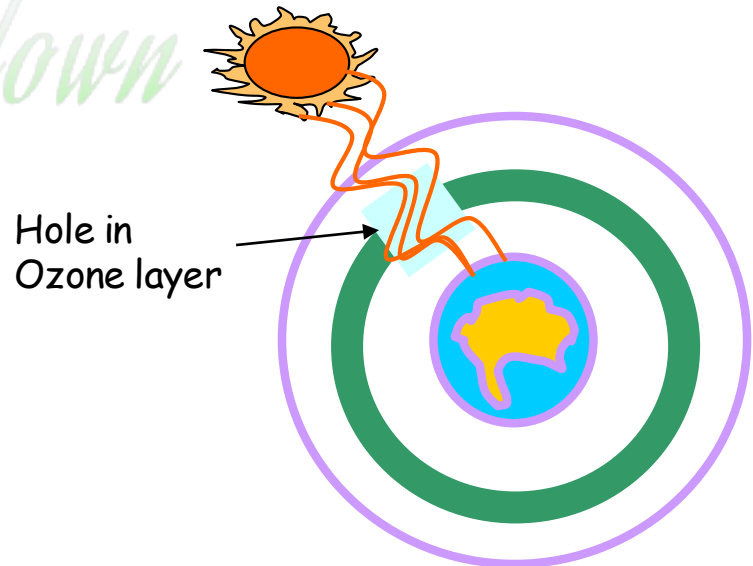
Unbalanced Green House Effect

Ozone layer depletion



The chlorine released from CFCs break down the ozone molecule.

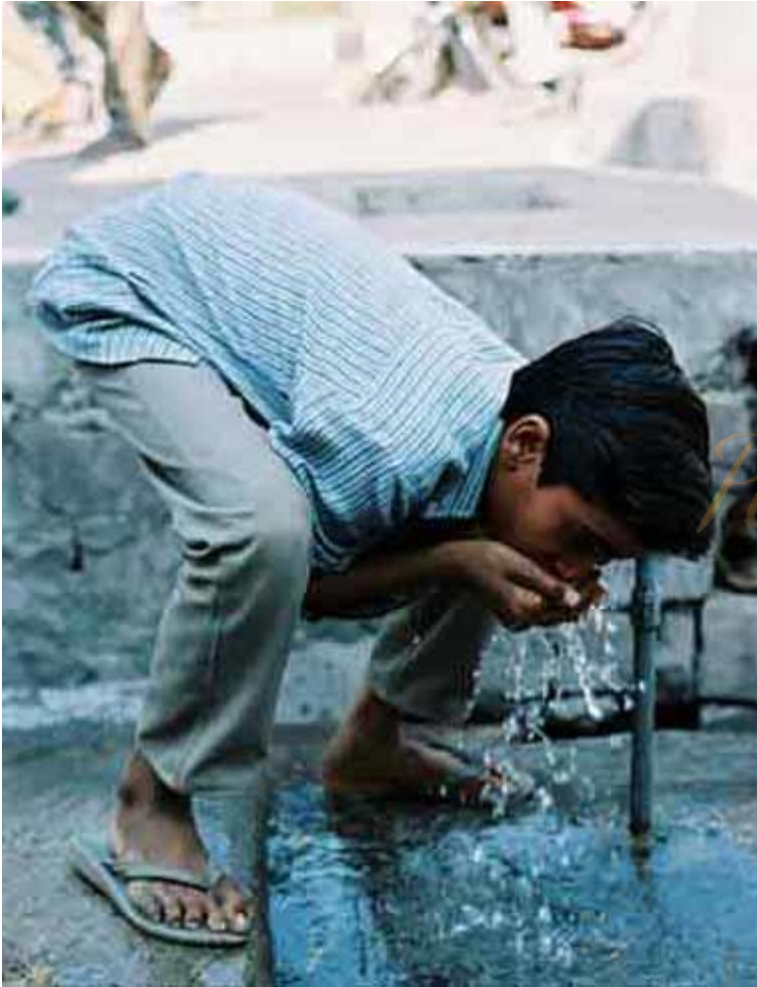
4/18



More ultraviolet radiations are reaching in to earths surface as there is a Hole in ozone layer.

17 of 82

What is water pollution?



WHO:

- 3.4 million premature deaths each year from waterborne diseases
- 1.9 million from diarrhea

Sources of Water Pollution

- Major sources are divided into Natural and Man made

- **Natural Sources:**

Eutrophication process

Floods

- **Man made sources:**

Sewage and domestic wastes

Toxic metals

Industrial effluents

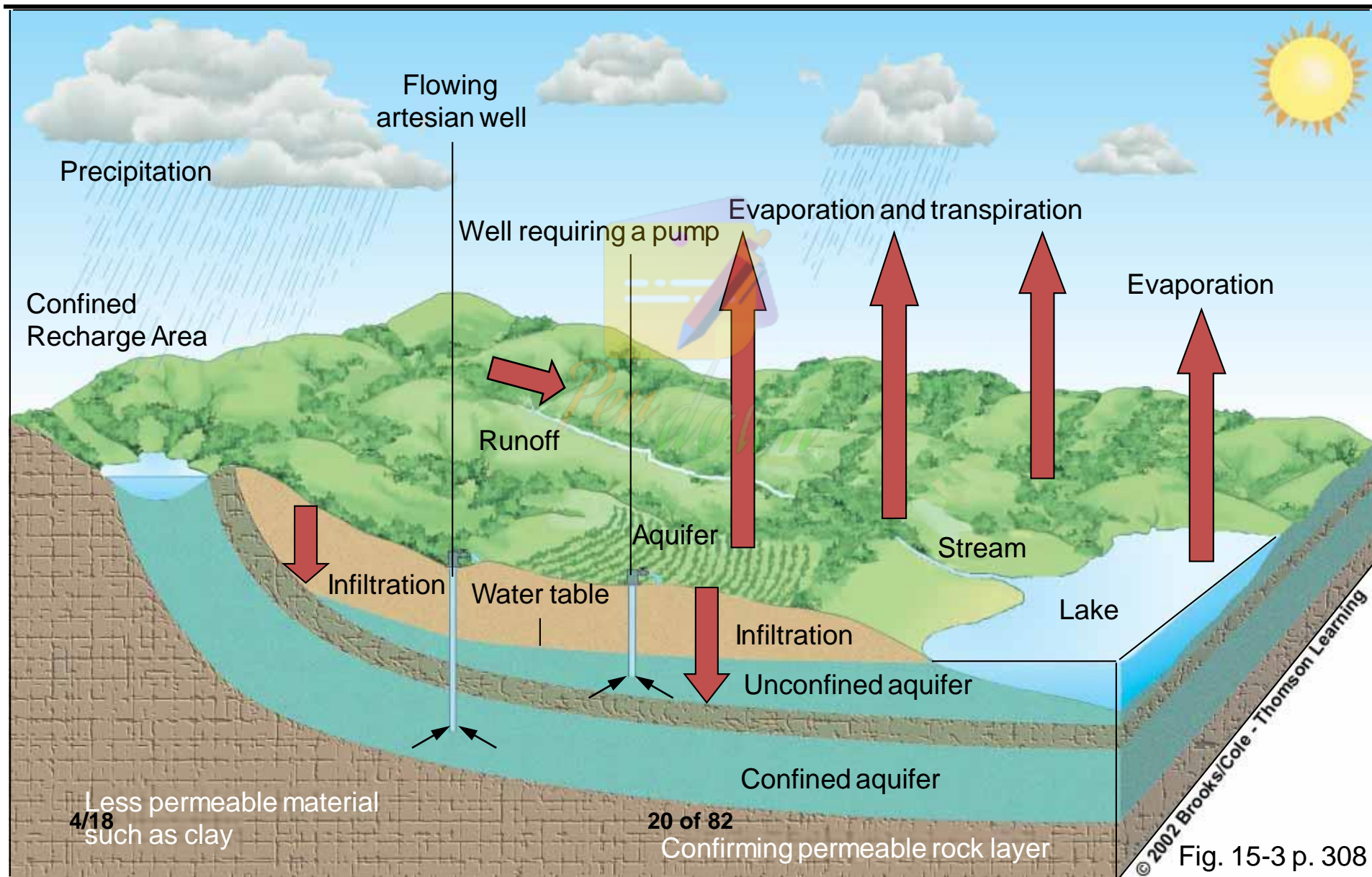
Agricultural discharges

Detergents, pesticides

Siltation process

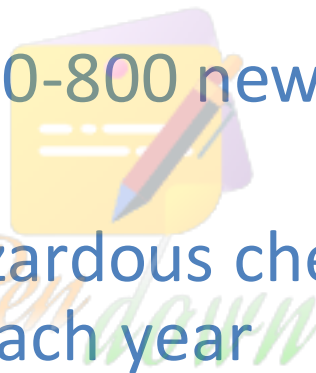


Ground Water



Groundwater Pollution

- >70,000 chemicals are used; effects of many are not known
- Each year another 700-800 new chemicals are produced
- 55 million tons of hazardous chemical wastes are produced in the US each year
- The 20 most abundant compounds in groundwater at industrial waste disposal sites include TCE, benzene, vinyl chloride...all are carcinogens, and also affect liver, brain, and nervous system



Kinds of Water Pollution

- Inorganic Pollutants
- Organic Pollutants
- Biologic Pollutants



Examples:

Pb in gasoline

Radionuclides (radon, radium, uranium,
gross alpha, and beta and photon emitters.)

Phosphorus, nitrogen (Great Lakes)

Other heavy metals

Inorganic Pollutants

- 3 groups
 - 1) Produce no health effects until a threshold concentration is exceeded—e.g., NO_3 —Ok at , 50mg/liter; at higher levels: methaemoglobinaemia
 - 2) No threshold—e.g.—genotoxic substances: some natural and synthetic organic compounds, microorganic compounds, some pesticides, arsenic
 - 3) Essential to diets: F, I, Se—absence causes problems, but too much also causes problems

Inorganic Trace Contaminants

- Mercury—methyl Hg and dimethyl Hg in fish—probably most significant path to humans—Minamata Bay, Japan, 1950's
- Rhine River drains 185,000 sq km—heavily polluted by 1970's
- Lead—toxicity has been known for a long time

Monitoring water quality

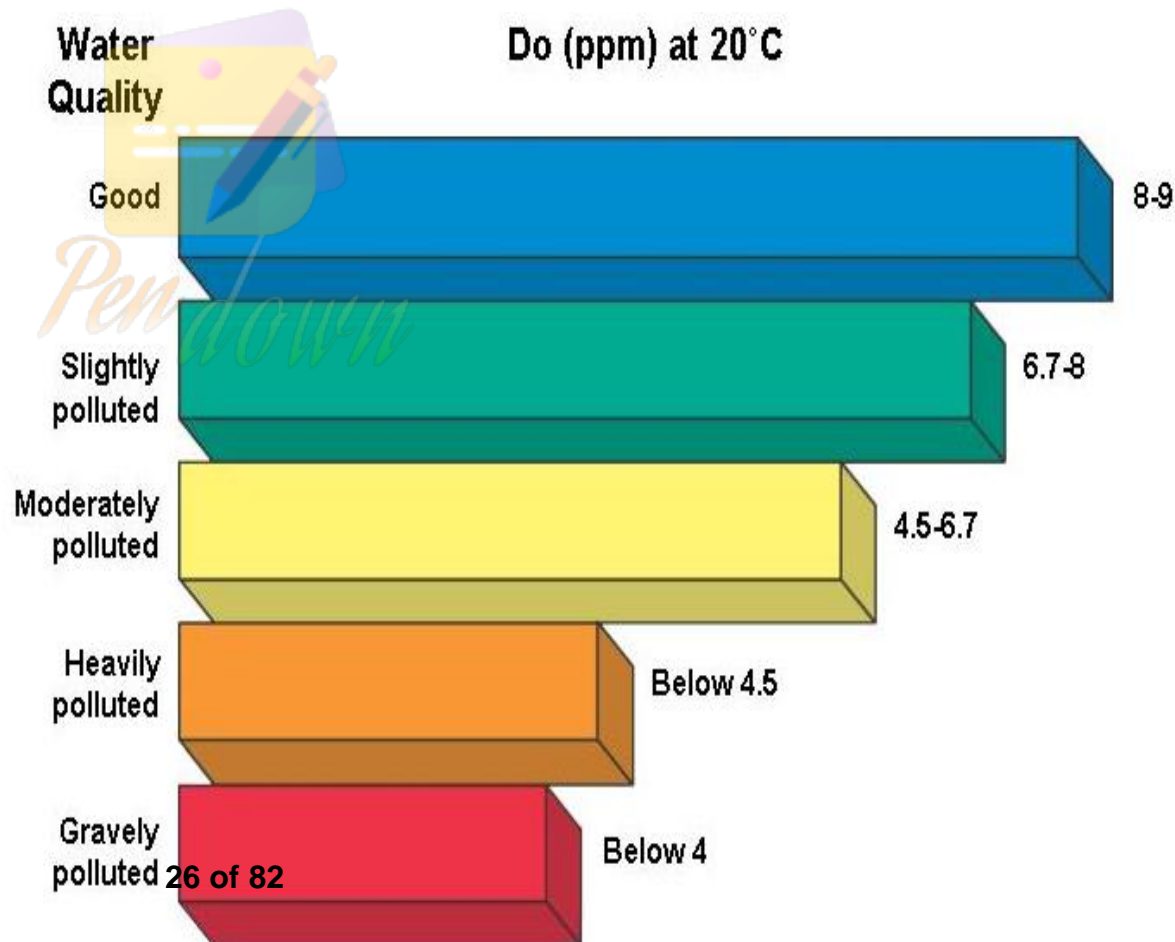
- Number of colonies of fecal coliform bacteria
- Bacterial source tracking (BST)
- Measure Biological oxygen demand (BOD) & Dissolved oxygen (DO)
- Chemical analysis

Types, Effects and Sources of Water Pollution

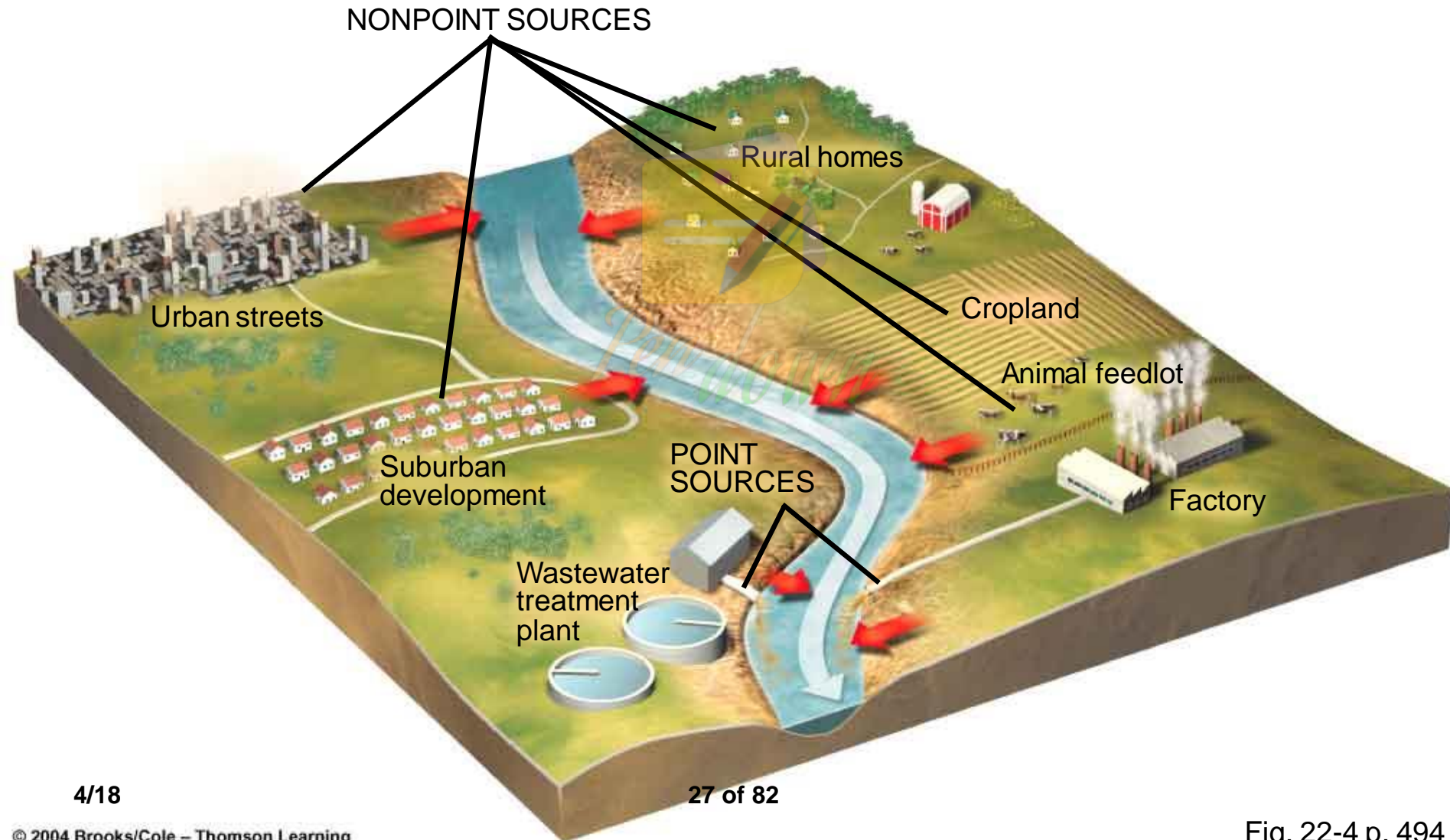
➤ **Point sources**

➤ **Nonpoint sources**

➤ **Water quality**

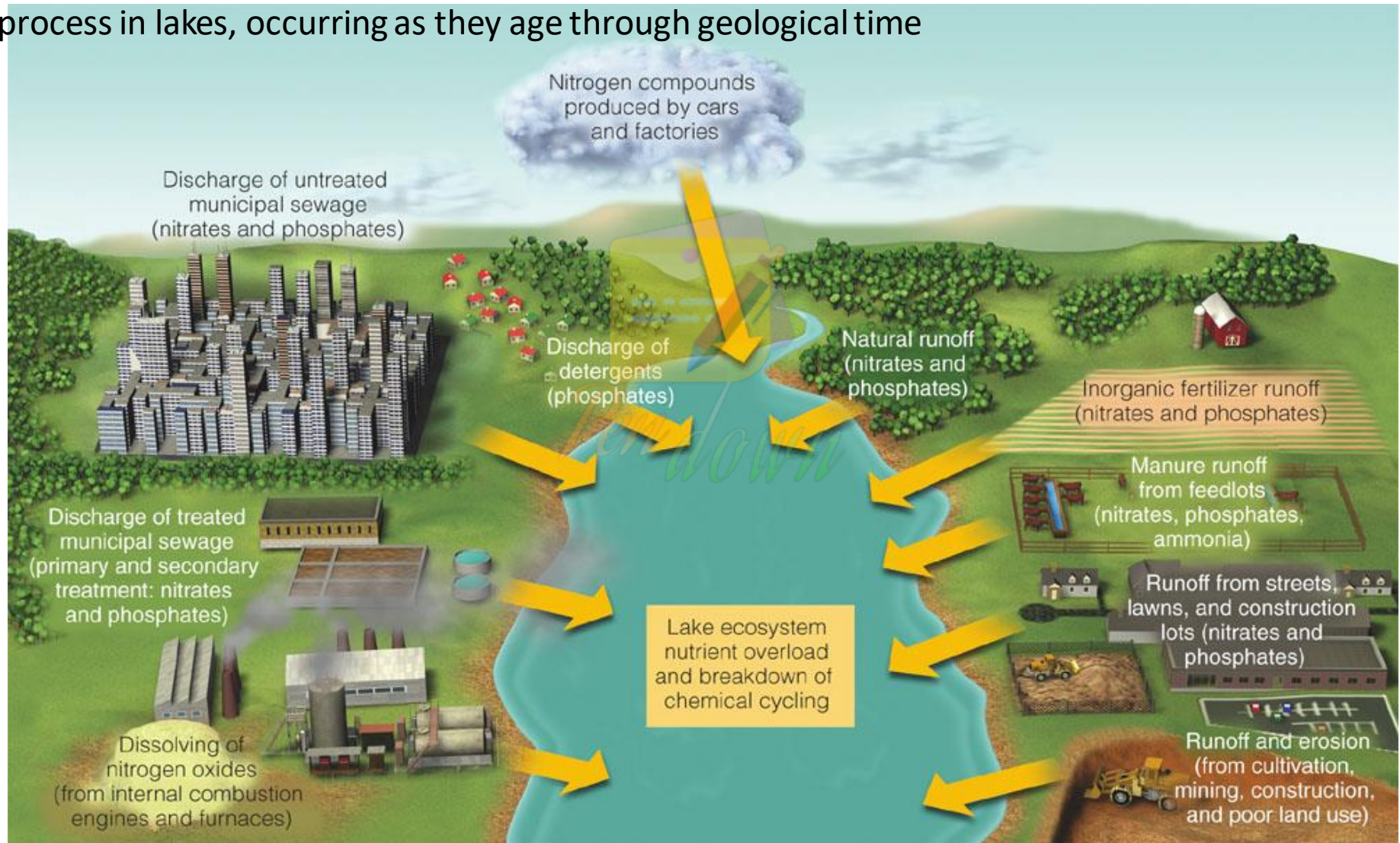


Point and Nonpoint Sources



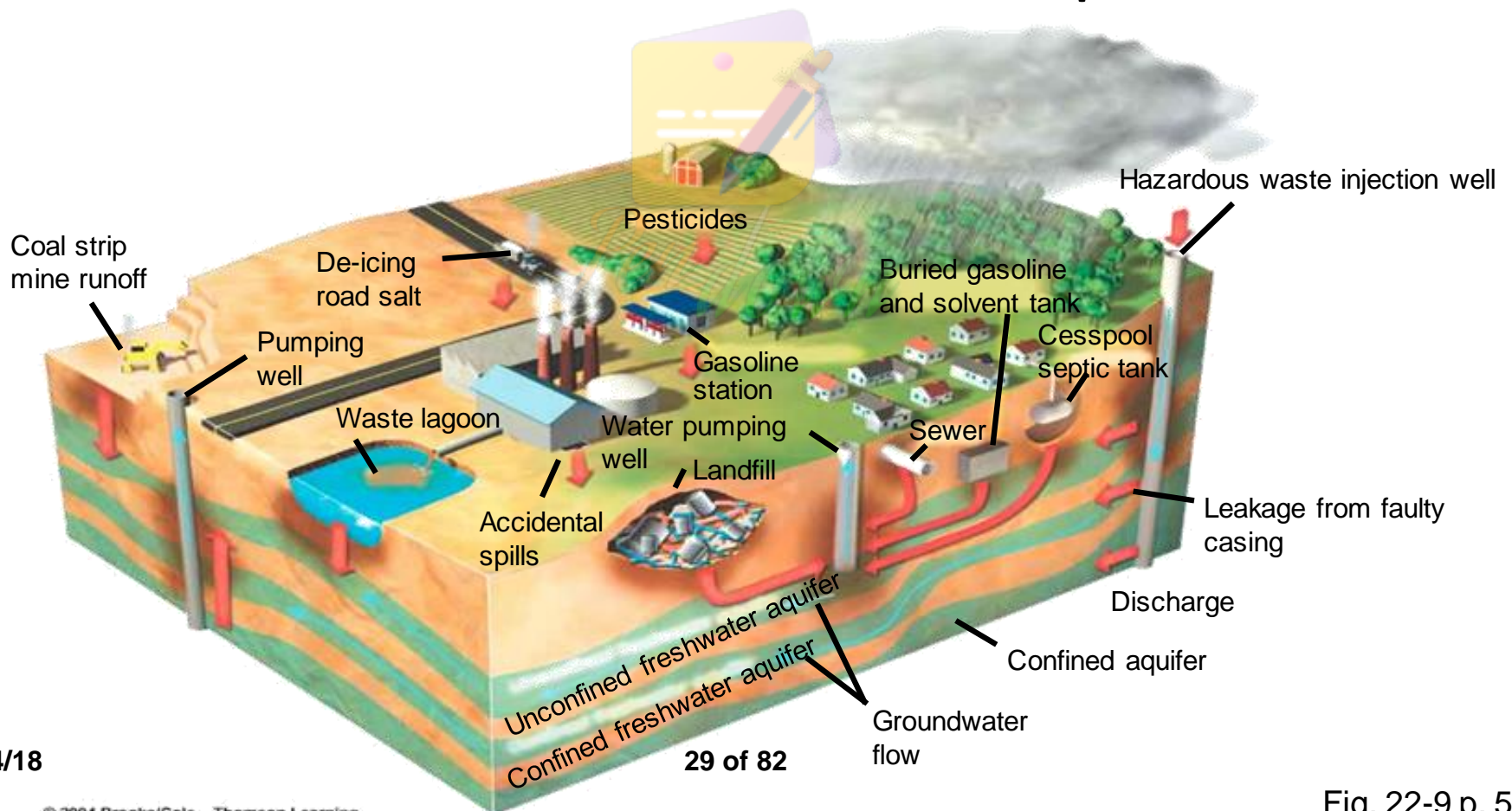
Pollution of Lakes

Eutrophication is the enrichment of an ecosystem with chemical nutrients, typically compounds containing nitrogen, phosphorus, or both. **Eutrophication** can be a natural process in lakes, occurring as they age through geological time



Groundwater Pollution: Causes

- Low flow rates
- Low oxygen
- Few bacteria
- Cold temperatures



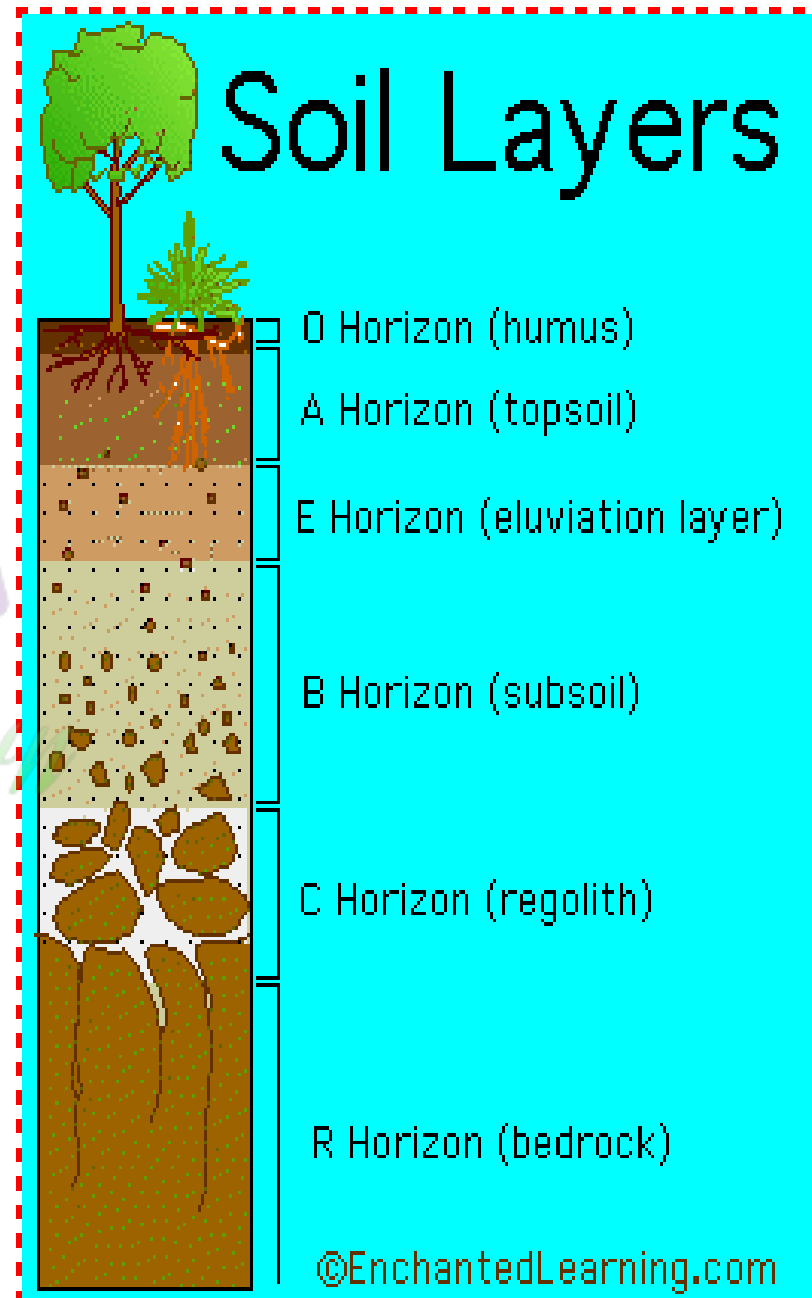
Effects of Water Pollution

- Sewage and domestic wastes effect human health resulting diseases such as **cholera, typhoid, dysentery**
- Industrial discharges contain **Lead, arsenic, Mercury, Cadmium** etc., which pose deleterious impacts in life systems
 - Lead – damages liver and kidney
 - Arsenic – lung cancer, ulcers in gastro intestinal tract
 - Cadmium – diarrhea, kidney cysts, bone deformation etc
 - Mercury – Neurological disorders
- Agricultural discharges include fertilizers, pesticides which are toxic to both aquatic and human life.

Soil, marine ,noise and thermal pollution

Pen down

- **O-horizon:** freshly-fallen & partially-decomposed leaves, twigs, animal waste, fungi & organic materials. Colour: brown or black.
- **A-horizon:** humus/partially decomposed organic matter & some inorganic mineral particles. darker & looser than the deeper layers.
- **O & A-horizon:** contain a large amount of bacteria, fungi, earthworms, small insects, forms complex food web in soil, recycles soil nutrients, & contribute to soil fertility.
- **B-horizon /(subsoil):** less organic material & fewer organisms than A- horizon.
- **C-horizon:** consists of broken-up bedrock, does not contain any organic materials. Chemical composition helps to **determine pH** of soil & also influences soil's rate of water **absorption & retention**.
- **R-horizon:** The unweathered rock (bedrock) layer that is beneath all the other layers



Soil Pollution

✓ **Soil pollution** is caused by the presence of chemicals or other alteration in the natural soil environment.

✓ Resulting in a change of the soil quality

✓ likely to affect the normal use of the soil or endangering public health and the living environment.



CAUSES OF SOIL DEGRADATION

- Soil erosion/degradation is the loss of top soil erodes fertility of soil & reduces its water-holding capacity.
- Excessive farming, construction, overgrazing, burning of grass cover and deforestation.
- Excess salts and water (Salinization).
- Excessive use of fertilizers & pesticides.
- Solid waste

First effect of pollutants

- **Washed away:** might accumulates somewhere
- **Evaporate:** can be a source of air pollution
- **Infiltrate** through the unsaturated soil to the groundwater
- **DDT:**(dichloro-diphenyl-trichloroethane) fat soluble, stored in fatty tissues
 - Interferes with calcium metabolism
 - Results in thin egg shells in birds
- **Agent orange:** code name for one of the herbicides and defoliants (results in leaf fall) used by the U.S. military as part of its herbicidal warfare program, During the Vietnam War, between 1962 and 1971, the United States military sprayed 20,000,000 US gallons (80,000,000 L) of chemical herbicides and defoliants in Vietnam
 - anti fertility, skin problems, cancer

Control of soil pollution

- Use of pesticides and fertilizers should be minimized.
- Cropping techniques should be improved to prevent growth of weeds.
- Special pits should be selected for dumping wastes.
- Controlled grazing and forest management.
- Wind breaks and wind shield in areas exposed to wind erosion
- Afforestation and reforestation.
- **3 Rs: reduce, reuse, recycle**

Treat Soil Pollution

Information needed

- ✓ **Kind of material**-organic or inorganic- is the material biodegradable/ dangerous to animals & humans
- ✓ **How much material** was added to the soil, will it overload the organisms in the soil
- ✓ **C:N ratio of the pollutant material**
- ✓ **Nature of soil:** will the soil be able to handle the material before groundwater is contaminated
- ✓ **Growing conditions for the soil organisms:** - is it too cold, too wet etc.
- ✓ **How long the material has been on site:** is there evidence of environmental problems, is it undergoing decomposition.
- ✓ **Immediate danger to people & environment:** Urgency of the situation.

WHAT IS NOISE POLLUTION?



- Sound that is unwanted or disrupts one's quality of life is called as noise. When there is lot of noise in the environment, it is termed as noise pollution.



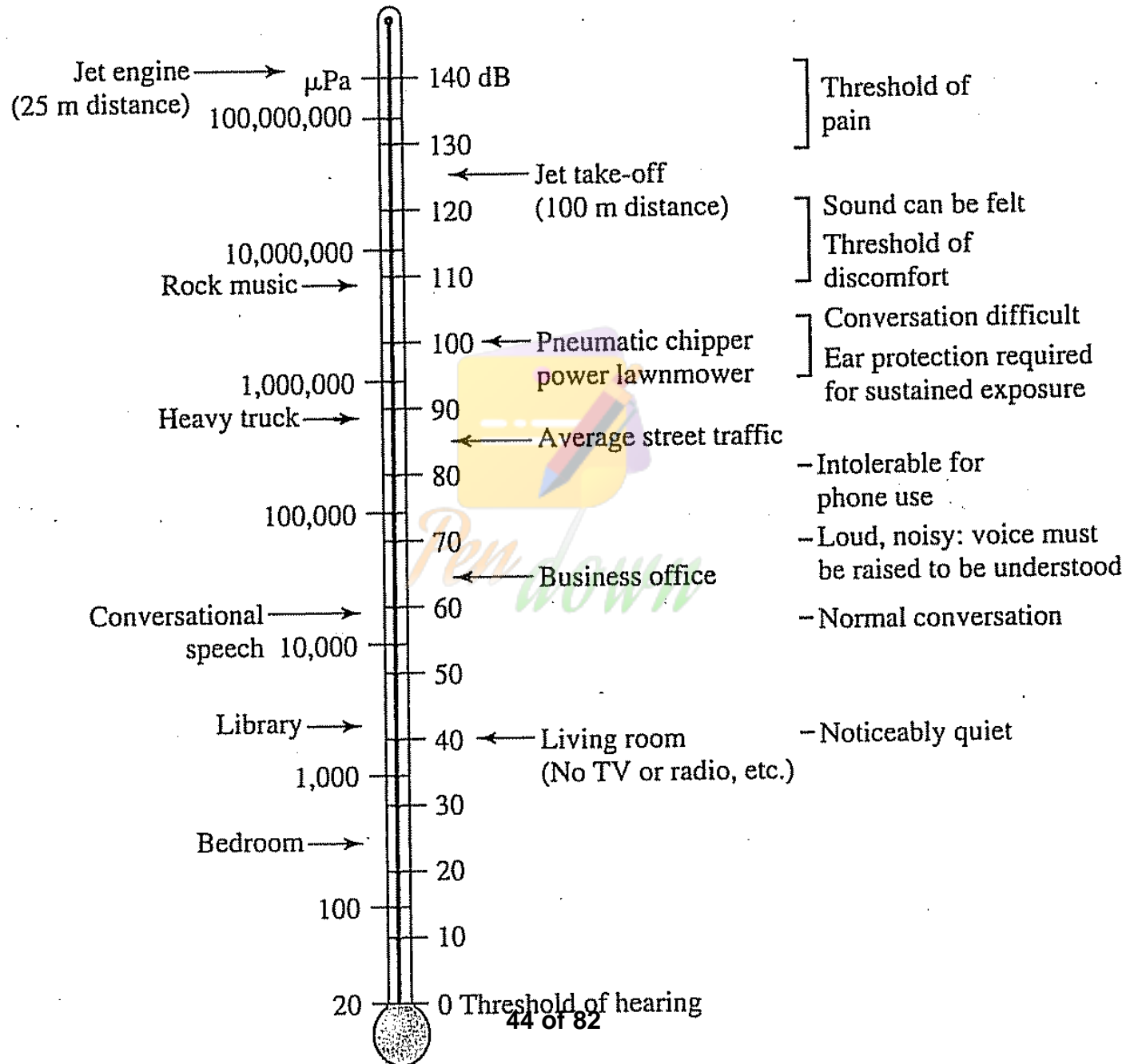
- Sound becomes undesirable when it disturbs the normal activities such as working, sleeping, and during conversations.

- It is an underrated environmental problem because of the fact that we can't see, smell, or taste it.

- World Health Organization stated that "Noise must be recognized as a major threat to human well-being"

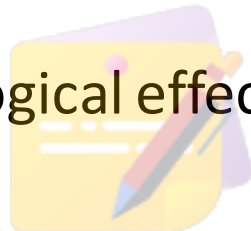
Sound Pressure

Sound Pressure Level



Effects

- Lack of sleep, irritability, heartburn, indigestion, ulcers, high blood pressure, & possibly heart disease
- Hearing loss
- Non-auditory physiological effects
 - Annoyance
 - Communication interference



Health Effects

- At 45 decibels of noise, average person cannot sleep,
- At 85 decibels hearing damage, & at 120 decibels ear experiences pain.
- According to the USEPA (US Environmental Protection Agency), there are direct links between noise and health. Also, noise pollution adversely affects the lives of millions of people.
- Noise pollution can damage physiological and psychological health.
- High blood pressure, stress related illness, sleep disruption, hearing loss, and productivity loss are the problems related to noise pollution.

Sources of Noise Pollution

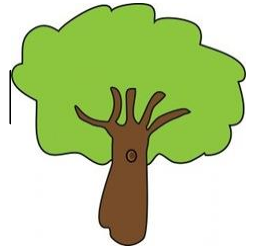


- Transportation systems are the main source of noise pollution in urban areas.
- Construction of buildings, highways, and streets cause a lot of noise, due to the usage of air compressors, bulldozers, loaders, dump trucks, and pavement breakers.
- Industrial noise also adds to the already unfavorable state of noise pollution.
- Loud speakers, plumbing, boilers, generators, air conditioners, fans, and vacuum cleaners add to the existing noise pollution.



Noise Pollution
- Loudspeakers

Solutions for Noise Pollution



- Planting bushes and trees in and around sound generating sources is an effective solution for noise pollution.
- Regular servicing and tuning of automobiles can effectively reduce the noise pollution.
- Buildings can be designed with suitable noise absorbing material for the walls, windows, and ceilings.
- Workers should be provided with equipments such as ear plugs and earmuffs for hearing protection.

Solutions for Noise Pollution

- Similar to automobiles, lubrication of the machinery and servicing should be done to minimize noise generation.
- Soundproof doors and windows can be installed to block unwanted noise from outside.
- Regulations should be imposed to restrict the usage of play loudspeakers in crowded areas and public places.
- Factories and industries should be located far from the residential areas.

Solutions for Noise Pollution

- **Community development or urban management** should be done with long-term planning, along with an aim to reduce noise pollution.
- **Social awareness programs** should be taken up to educate the public about the causes and effects of noise pollution.

Noise Pollution Control

Source path receiver concept: Can be controlled either by reducing the noise **at the source** or **by preventing its transmission** or **by protecting the receiver**

- **At the source:** lubrication of machines, tightening the loose units, reducing the eccentricity
- **In the path:** keeping the noisy machine covered, construction of noise barriers, sound-proofing of the building
- **Receiver:** No use of horns other than in emergency, vehicle engines and appliances in good Condition, purchase the least noisy air conditioner or vacuum cleaner/quieter appliances, rest areas away from noise, turn down volume of Stereos.

UNIT 6. Environmental Laws

Environmental Laws/Acts, EPA act 1986,
water Act.



India is a “soft State”

It has excellent environmental laws, but politics and/or corruption prevent their effective implementation.



The result has been disastrous for our environment and hence for the economy too, as we are now seeing.

India's environmental laws span more than a century

- 1865** British take forest lands from princes
- 1927** Forest Act, amended 1980
- 1974** Water Act
- 1981** Air Act
- 1986** Environment Protection Act
- 1991** Coastal Regulation Zones

New Laws are moving from the general to Specifics

**This has been made possible under the
1986 Environment Protection Act**

- 1989 Hazardous Waste Rules**
- 1998 Biomedical Waste Rules**
- 1999 Rules for Recycled Plastics,
Fly Ash Notification**
- 2000 Municipal Solid Waste Rules**
- 2000 Battery Mgt & Handling Rules**

Pollution Prevention and Waste Minimisation Rules will be next

A major weakness of the Environment Protection Act is its lack of “teeth”

**So new directions may arise either as judgments : CNG for Delhi vehicles,
or State or City Rules : Plastic carry-bags banned in Sikkim, parts of West Bengal, Nilgiris Mt, Shimla, all of Bangla Desh**

Economic Instruments will be the next phase

Karnataka's Green Tax on 15-year-old vehicles is the first of such moves.

World-wide, these are the most effective, e.g. for take-back of PET bottles and beer cans.

Such moves should be welcomed, creatively used and suggested by industry, e.g to prevent water pollution.

Law for Environmental Protection (Cont)

- Role of India
 - Constitution-Indian constitution is perhaps one of the rare constitutions of the world which contains specific provisions relating to Environmental protection
 - India is a signatory to many Environmental treaties

Law for Environmental Protection (Cont)

- Indian constitution Article 51 (c) provides that India shall respect International treaties
- Devolves duty on the citizen also to preserve the nature
- Article 48-A puts duty on the state regarding the protection of Environment



Law for Environmental Protection (Cont)

- All signatories to translate the Summit decisions into action-implementation
- India under obligation to implement Environmental protection
- Article 253 of the constitution provides for power of parliament to make law for implementing any treaty

Law for Environmental Protection (Cont)

- Under this provisions, parliament enacted many laws for protection of Environment, prevention of pollution
- International law, unless otherwise contrary can be construed as binding.

Law for Environmental Protection (cont)

- Important legislations:
 - The Water (prevention and control of pollution) Act, 1974
 - The Air (prevention and control of pollution) Act, 1981
 - The Environment (Protection) Act, 1986
 - The National Environment Appellate Authority Act, 1997
 - The National Environment Tribunal Act, 1995

Law for Environmental Protection (cont)

- Salient features of the Act (Water Act)- objectives
- To prevent and control water pollution
- To maintain wholesomeness of water
- To establish control on State Boards for prevention and control of pollution
- To empower the Boards for prevention/control of pollution
- To provide penalties for contravention of the provisions of the Act
- To establish control on state water testing laboratories.

Law for Environmental Protection (cont)

- Central/State pollution control Boards
- Both the Boards have the objective of pollution control
- Main functions of the Central pollution control Board
 - a) Advise the Central Govt. for control of pollution of water
 - b) Co-ordinate the activities of the State Boards

Law for Environmental Protection (cont)

- c) Provide technical assistance and guidance to State Boards
- d) Plan and organise training
- e) Media program organising
- f) To perform functions of the State Board in case of default
- g) Collect and public technical data
- h) Lay down standards for stream/well
- i) Plan and organize pollution control programs
- j) Establish laboratories for testing

Law for Environmental Protection (cont)

- Functions of State Boards
 - Plan and control/abate pollution of water
 - Advise State Govt. on matters of water pollution
 - To collect and spread information
 - To investigate and conduct research in matters of pollution
 - To work in tune with CPCB

Law for Environmental Protection (cont)

- To inspect sewerage or trade effluents
- To lay down standards of sewerage/trade effluents etc.



Law for Environmental Protection (cont)

- To create methods of effluent disposal/sewerage disposal

- in land
- in water
- in stream etc.

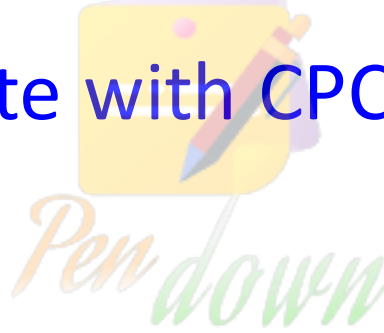


To prevent discharge of waste into water

To advise Govt. with respect to location of
polluting industries

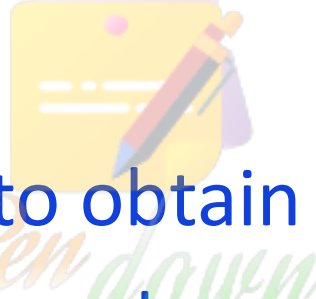
Law for Environmental Protection (cont)

- To establish laboratories
- To Co-ordinate with CPCB



Prevention and Control of Water Pollution

- Under this act, State Government has power to restrict the application of the Act to certain areas
- It has also power to obtain information
- PCBs have power to take samples of effluents.
- Report of analysis



Cont...

- PCBs have power to enter any factory and inspect
- It can prohibit use of stream or well for disposal of polluting matter
- It can regulate new outlets and new discharges

Cont...

- PCBs to undertake emergency measures in case of pollution of stream or well
- PCBs can also approach for restraining apprehended pollution of water in streams or wells
- It can give directions

Cont...

- Water Act – Chapter VII
- Under this chapter penalties can be levied for certain acts
 - Destruction of notices of PCBs
 - Obstructing PCB persons from doing their duty
 - damaging property of PCBs
 - non furnishing of information



Cont...

- Failure to intimate accident
- for willful omission of information
- or making false statement etc.
- punishment including imprisonment with
penalty – Rs.10,000 - 3 months

Cont...

- Under this act Central water laboratory, State water Laboratories are set up
- Analysts appointed for analyzing the samples
- Reports are published by analysts
- PCBs to take the help from local bodies also

The Air(Prevention and Control of Pollution) Act, 1981

- Under this act the CPB plays a major role in control/abatement of pollution
- It has to advise Central Government for improvement of Air quality
- It has to prevent air pollution
- Co-ordinate the activity of state pollution control boards

The Air(Prevention and Control of Pollution) Act, 1981(Cont..)

- Chapter VI of the air act relates to prevention and control of air pollution
- The state governments in consultation with the Board declare air pollution control areas
- Alter air pollution control areas
- Declare new air pollution control areas

The Air(Prevention and Control of Pollution) Act, 1981(Cont..)

- The act provides for control of emission from automobiles
- It also restricts certain industries on the basis of air pollution
- It declares the level of air pollutants as per standards
- It applies to the courts to restrain persons from polluting
- Just like water act it gives power to PCBs to enter and inspect the factory.

Cont...

- The wildlife(Protection) Act, 1972
- The National environment tribunal Act, 1995
- The Environmental Protection Act, 1986
- The Bio-Diversity Act, 2002
- Are the other related environmental legislations.