

Natural Resources

(Rendezvous with nature in Kerala)

Class : IX



GRAPHIC NOVEL



BIO GEOCHEMICAL CYCLE

POLLUTION

SOIL FORMATION

ACID RAIN

AIR & WATER AS A NATURAL
RESOURCES

GREEN HOUSE EFFECT



Maheshwari public school

Pratap Nagar, Jaipur

Affiliated to CBSE

www.mpspnjpr.com



R.

RitiRiwa

Acknowledgement

The production of this graphic novel is a team effort. Coming from the intense gratification of our visionaries whose contribution has raised the quality of this novel.

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DISCLAIMER

This book is published as a reading material to enrich the students to have a better understanding about natural resources through a “Rendezvous with nature in Kerala”.

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Preface

This graphic novel – Rendezvous with nature in Kerala is an educational journey of the children with their parents and grandparents to explore the bounties of nature. This picturesque presentation will motivate the students to reflect on their experiences during the trip. This experiential learning will improve reflective observation and abstract conceptualization of the topic. After reading the novel you may be tempted to visit Kerala – **‘The paradise of south’**.



0964CH14



To access the comic book and additional interactive content, download DIKSHA app from Google Play Store on your Android smartphone or tablet. The QR code has to be scanned through the DIKSHA app.

Learning Outcomes

The learner will be able to:

- Explain natural phenomena with their processes.
- Relate processes and phenomena with their causes and effects.
- Able to draw labeled diagrams ,flow charts, concept maps .
- Able to relates learning to hypothetical situations.
- Apply the knowledge of interdependence and interrelationship in the biotic and abiotic factors of environment to promote conservation of environment.
- Design models using resources in an eco-friendly.
- Think and take appropriate decisions in their life for saving resources gifted by mother nature.

Story Board

Green House Effect,
Ozone Layer and its depletion



Biogeochemical Cycle: Nitrogen,
Oxygen, Carbon

Soil as a Natural Resource
Soil Formation, Soil Erosion

Air as a Resource
Role of Atmosphere in Climate
Control, Wind Formation, Air
Pollution

Water as Natural Resource, Water
Cycle, Water Pollution



CHARACTERS



Mr. Virendra Singh
Grandfather-Green Panther
Age 65 years
Personality Trait-Learned,Down to earth Family lover

Mr. Varun Singh
Uncle - Engineer
Age 30 years
Personality Trait- Extravagant, Well behaved, Tall



Mrs. Neera Singh
Grandmother- Green Activist
Age 62 years
Personality Trait-Caring,Cheerful, Helpful



Mrs. Amita Singh
Aunt -Pursuing post graduation,
Age 28 years
Personality Trait-
Calm,Pleasing,Sensible



Mrs. Asha Singh
Mother- Teacher
Age 39 years
Personality Trait-Humble, Knowledgeable

Jojo- Son
(Studying in class 6)
Personality Traits- Inquisitive, Confident, Naughty



Mr. Ashok Singh
Father Government servant
Age 42 years
Personality Trait-Intelligent , Smart, Cautious,Vigilant

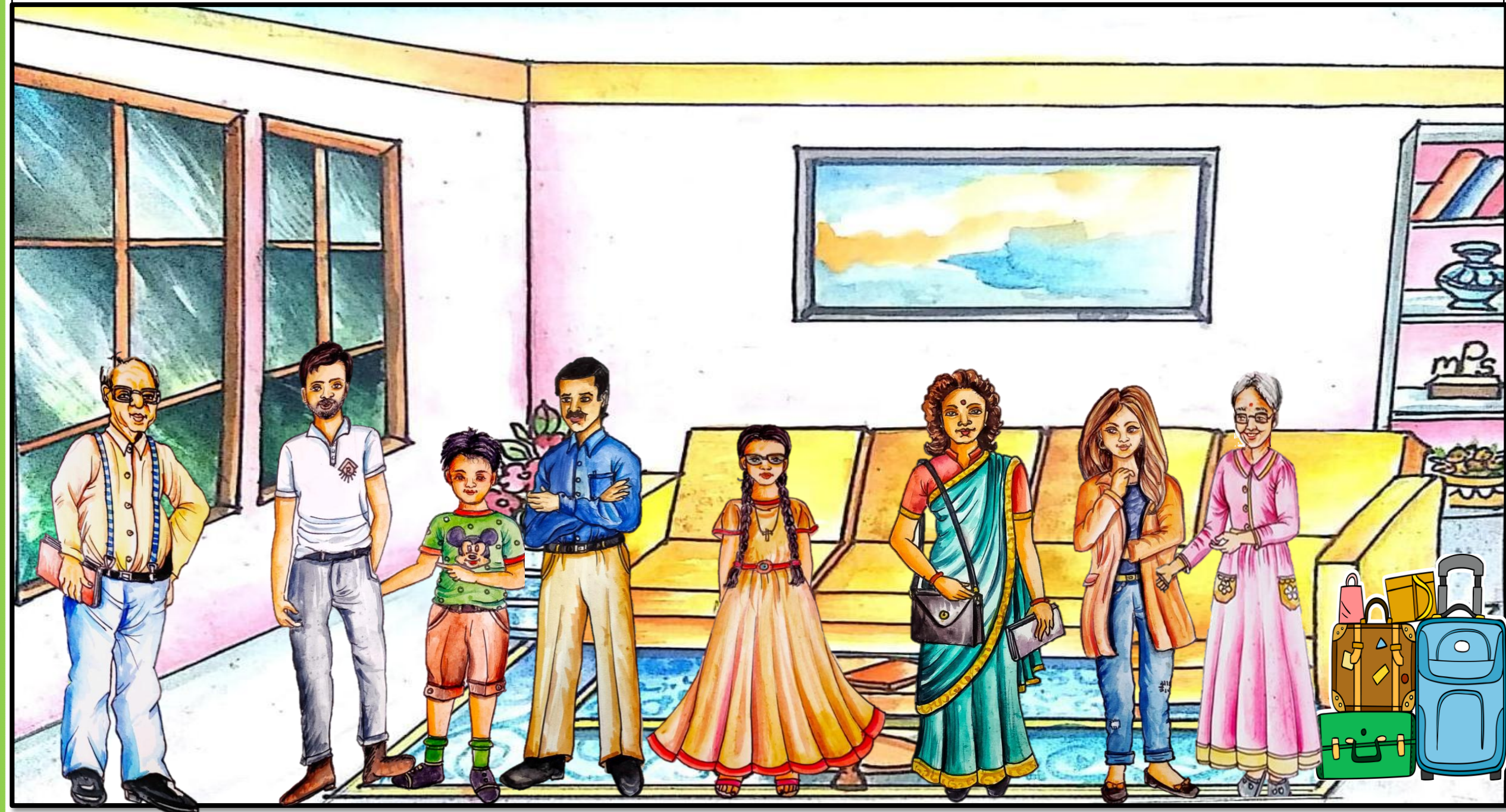


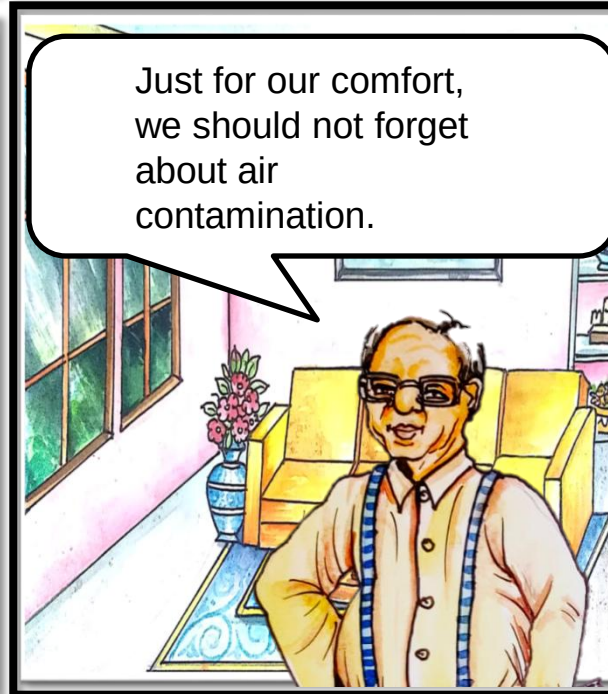
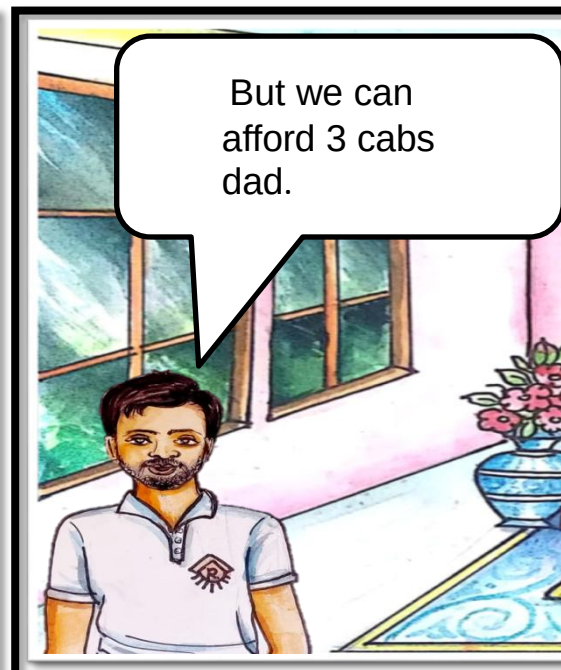
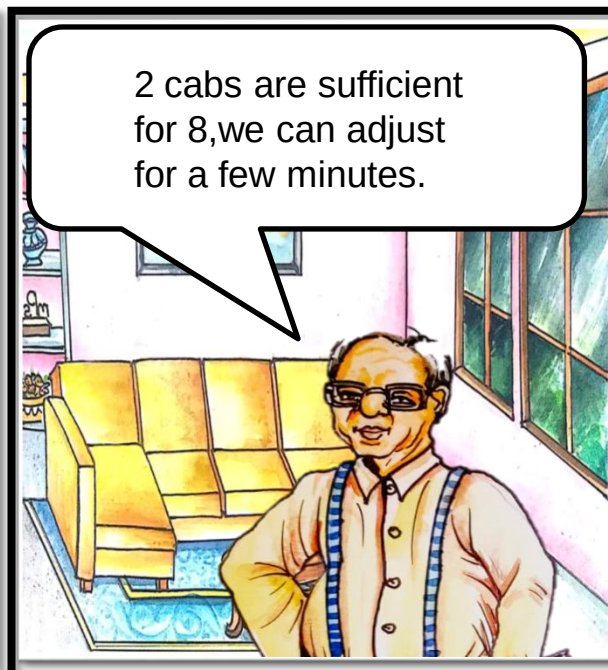
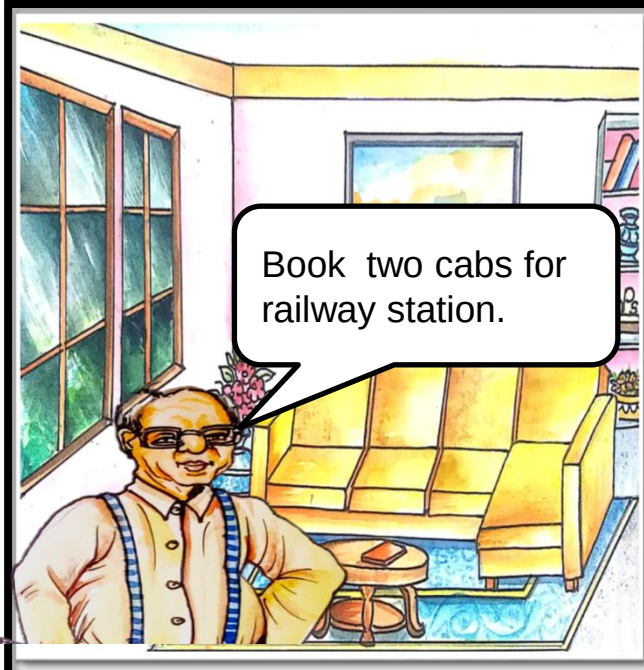
Momo - Daughter
(studying in class 9)
Personality Traits –Pragmatic, Sensible, Generous

Content/Travel Plan

S.No.	Sites	Areas covered
1.	Journey Begins.... Living Room	Air
2.	Outside home	Pollution
3.	Railway station	Environment friendly
4.	Inside Train	Water cycle ,Soil formation, Wind formation
5.	Farm House	Organic farming
6.	Dining Area Of Farm	Nitrogen cycle
7.	Garden Area	Air as a resource
8.	Lobby Area Of Farm House	Biogeochemical cycle
9.	Kovalam Beach	Sea breeze-land breeze
10	Munnar hill Station	Carbon cycle ,Acid rain
11	Roadside Hill station	Green house effect
12.	Water Fall	Water as a resource
13.	Return to Hotel Room	Ozone layer depletion

Uncle is booking a cab for station on the mobile .



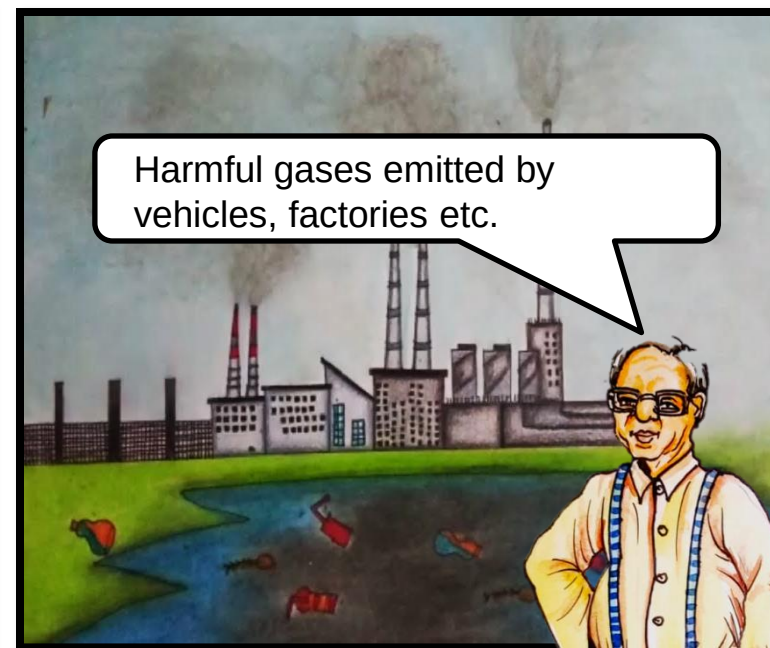


Vehicular Pollution

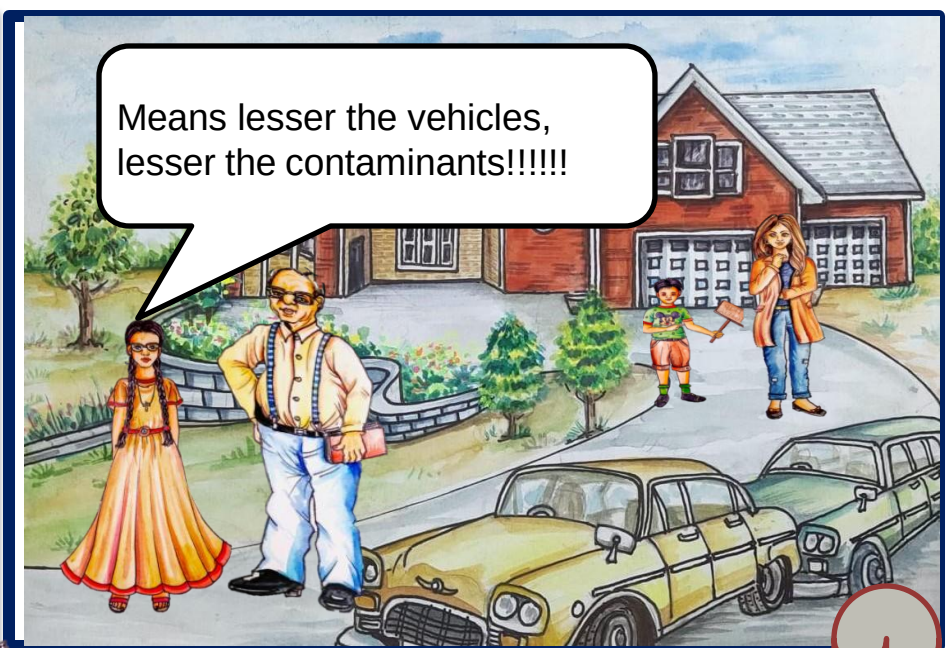




Contaminants?
What's that !

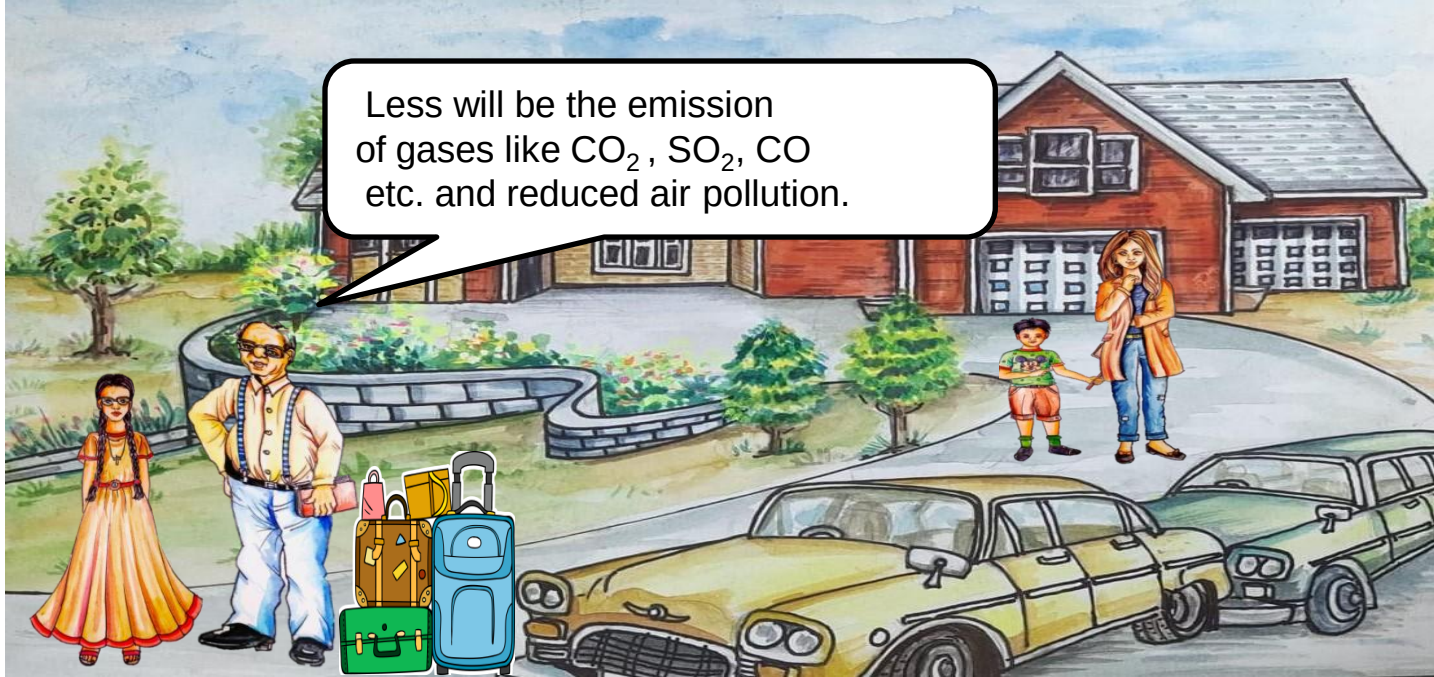


Harmful gases emitted by
vehicles, factories etc.



Means lesser the vehicles,
lesser the contaminants!!!!

Outside the House



Less will be the emission
of gases like CO₂, SO₂, CO
etc. and reduced air pollution.

Do You Know?

Smog which occurs mainly because of air pollution can also be defined as a mixture of various gases with dust and water vapor. Smog also refers to hazy air that makes breathing difficult.

Railway Platform



Oops..... the platform is so dirty....



Because few careless people litter here and there.



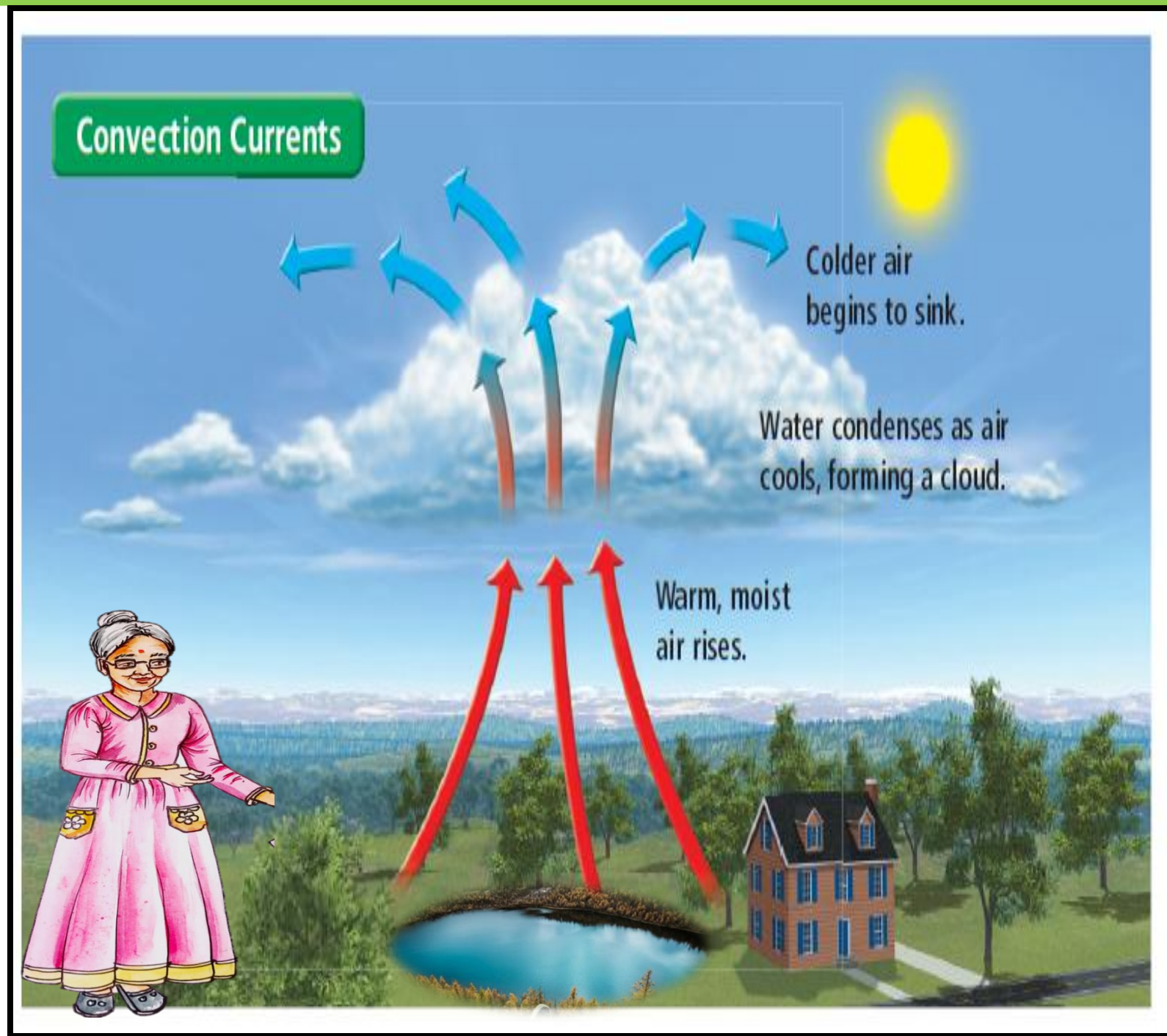
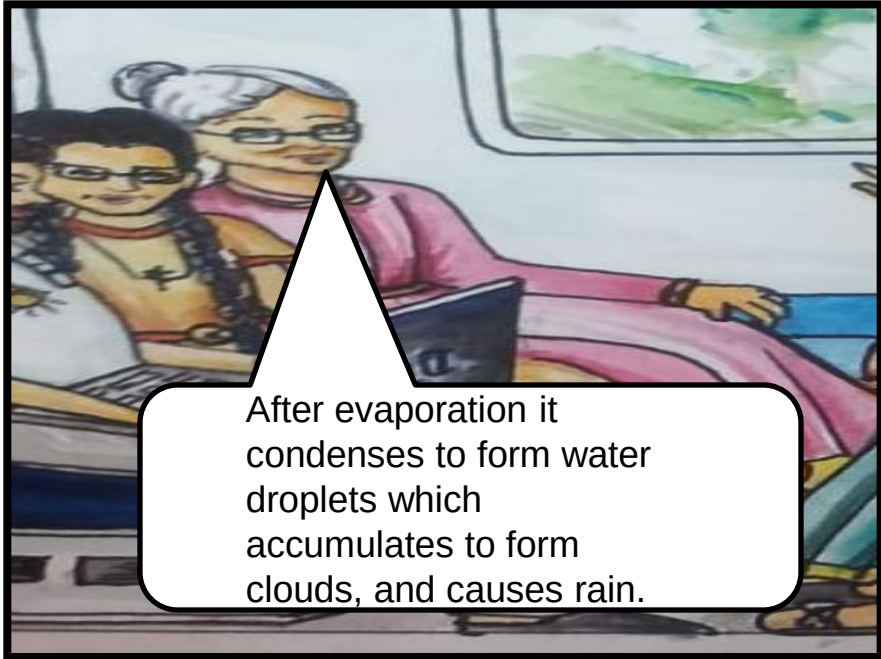
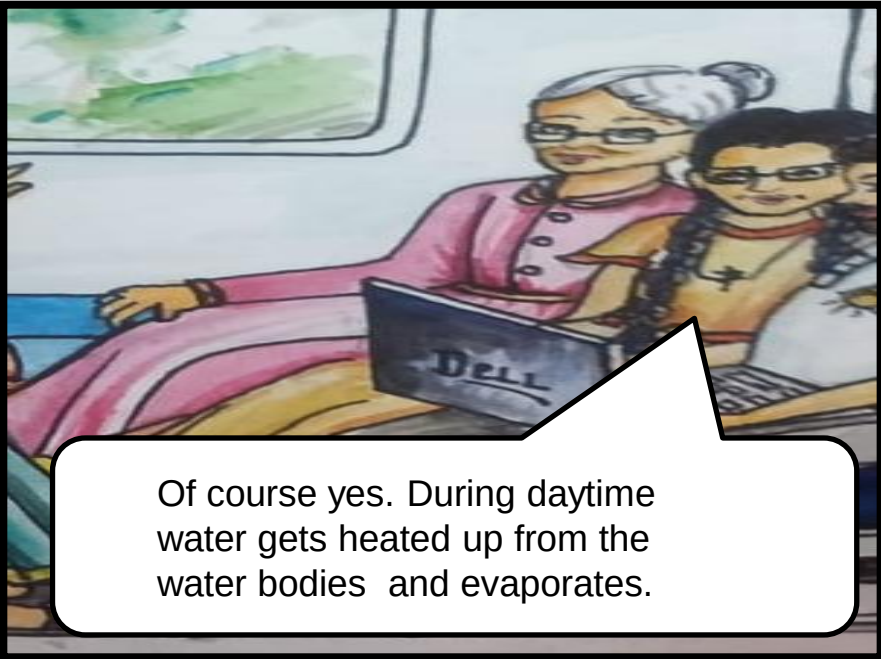
Ok.. Let's board our train.



I will take a corner seat please, to enjoy the rain.

Ok. You sit there. Do you know how the rain originates?





Dad, please close the window.. I am feeling cold.



The cold wind is blowing outside, I am also shivering with cold.



What is this wind and how does it form?



Due to uneven heating of earth's surface. On being heated, air becomes lighter and rises up creating difference in air pressure and this causes winds.



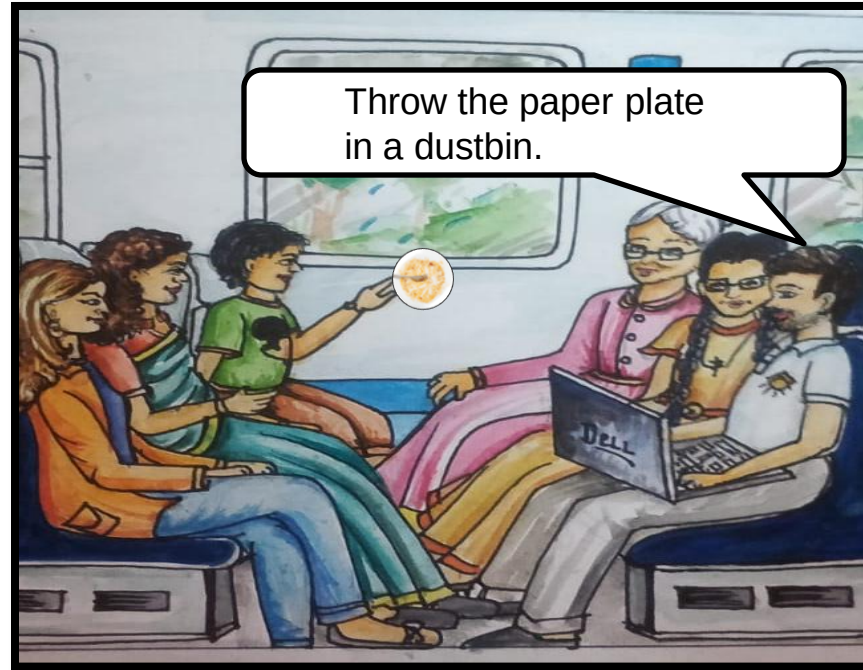
Test Your Knowledge

1What is the basic process that causes movement of air due to cool breeze?

- (a) Pressure difference between the air of two regions
- (b) Moving leaves of the plants
- (c) Temperature difference between the two regions
- (d) Striking of air with the mountains

Answer: (c)

Jojo after having his breakfast was throwing the paper plate at the corner of the seat. Uncle notices him. Uncle advises him not to litter around.



Test Your Knowledge

2 Which among the following is an eco-friendly activity?

- (a) Making use of automobiles
- (b) Making use of poly bags for shopping
- (c) Making use of dyes for colouring the clothes
- (d) Making windmill to generate power for irrigation.

Answer: (d)



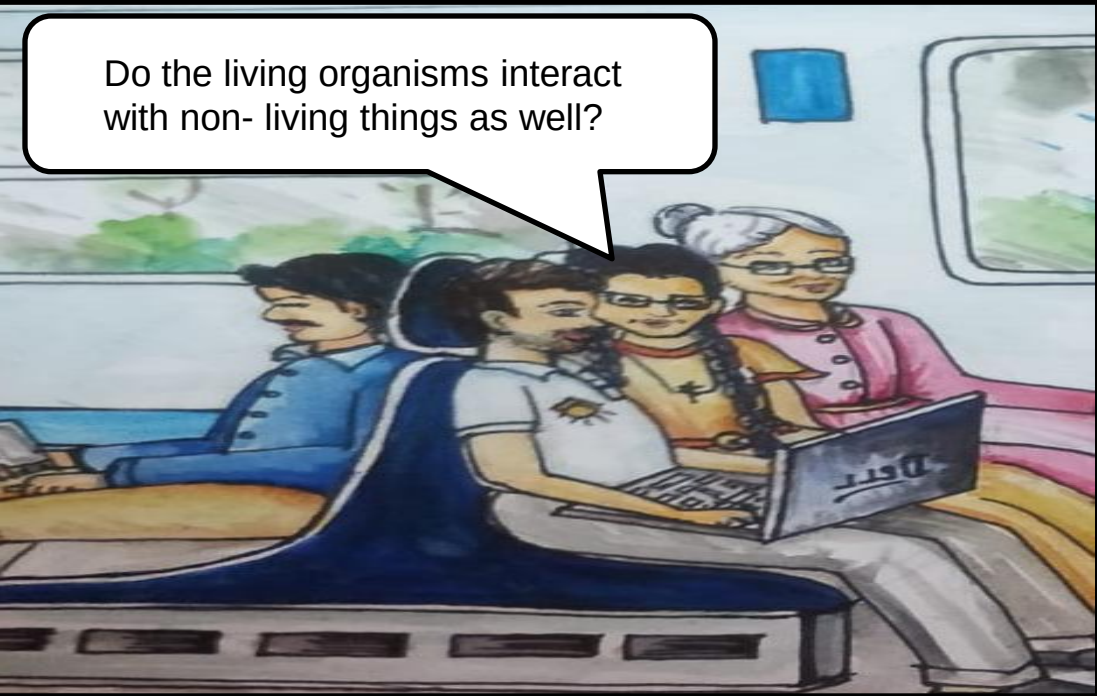
A comic panel showing three people (two women and one man) sitting in the back of a vehicle, looking out a window. The man, wearing a green t-shirt, is pointing towards the landscape outside. The woman next to him is wearing a blue sari, and the woman in the foreground is wearing an orange sari.

Flora and fauna???

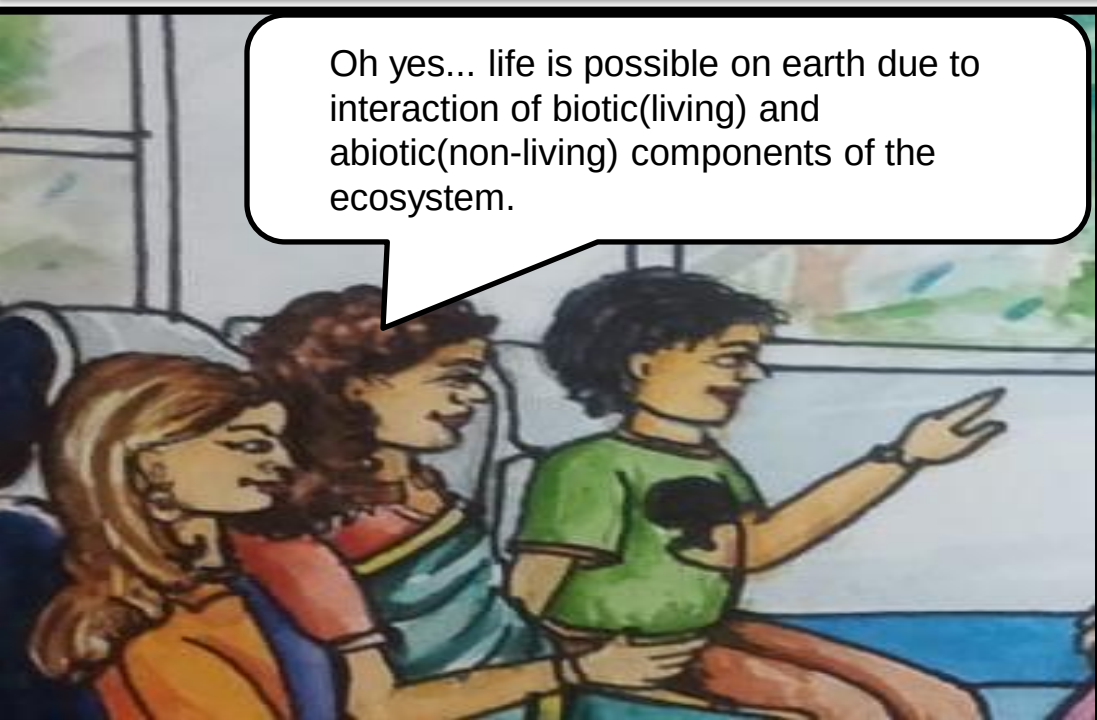
A comic panel showing three people (two women and one man) sitting in the back of a vehicle, looking out a window. The man, wearing a green t-shirt, is pointing towards the landscape outside. The woman next to him is wearing a blue sari, and the woman in the foreground is wearing an orange sari.

Flora means plants and fauna means animals... and do you know, they too depend on each other.

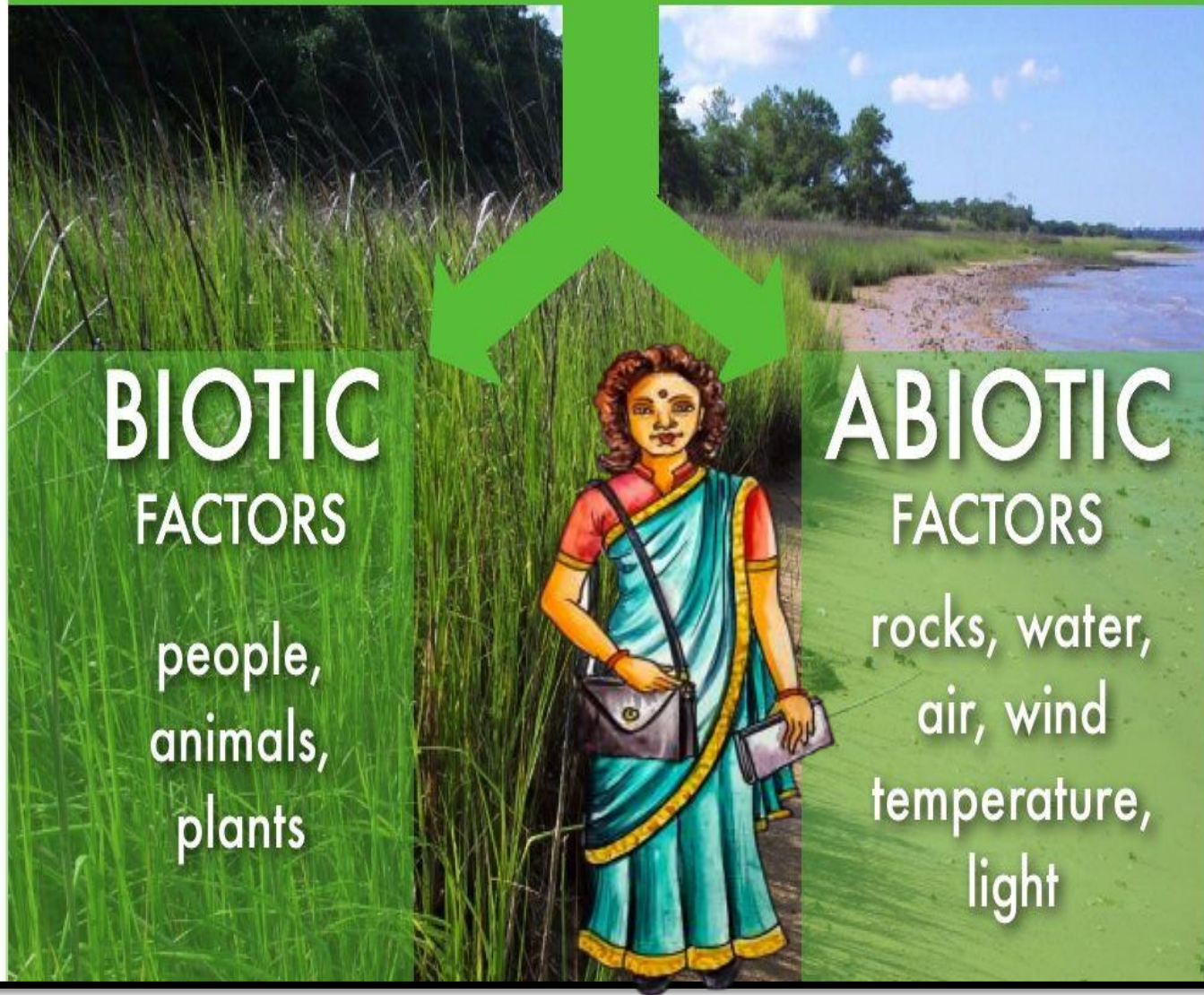
Do the living organisms interact with non- living things as well?



Oh yes... life is possible on earth due to interaction of biotic(living) and abiotic(non-living) components of the ecosystem.



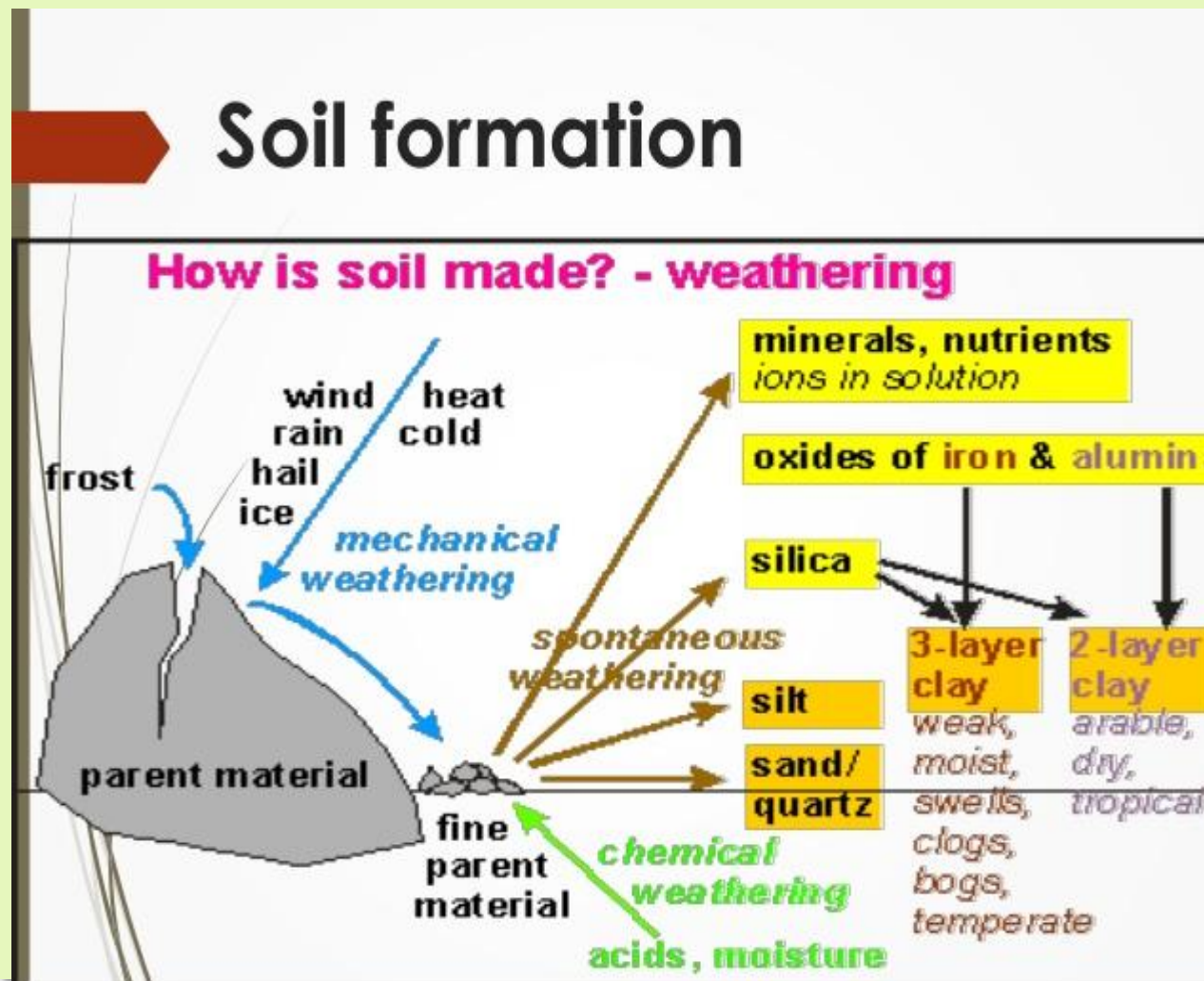
DIVIDING THE ENVIRONMENT



Wow ! such beautiful rocks....

Yes. Rain is one of the causes of weathering of rocks which breaks these rocks into fine particles This results in formation of soil.

Could you please tell if the rain affects these rocks too?



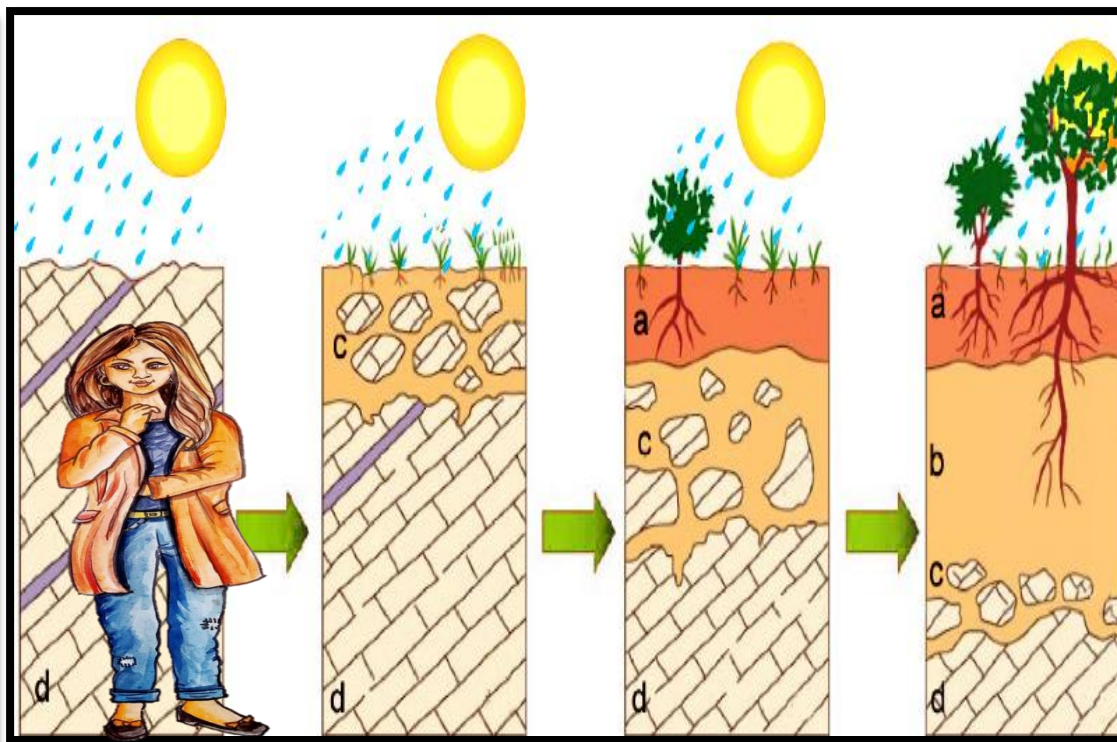
Soil horizons

a - Top soil

b - Sub soil

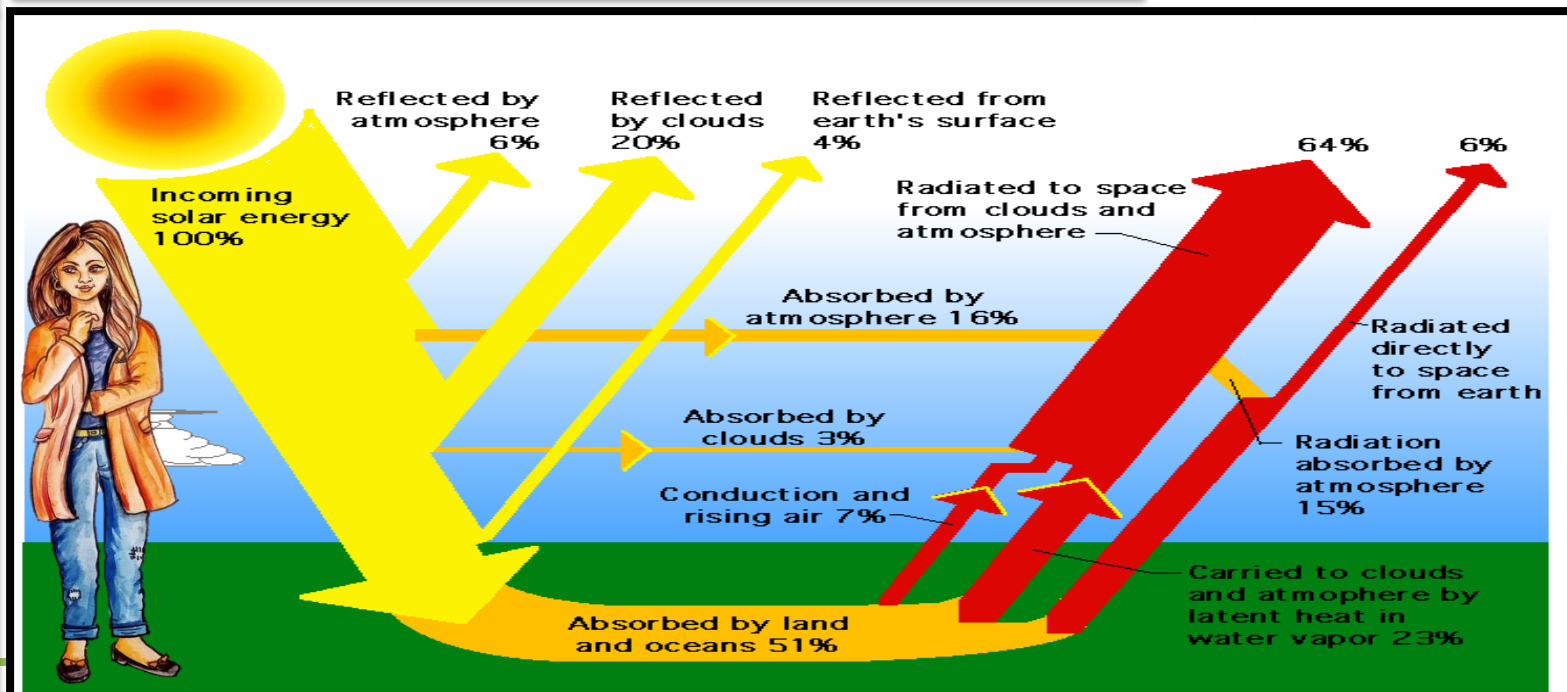
c - Parent rocks

d - Bed rocks



Any other factors that causes the soil formation?

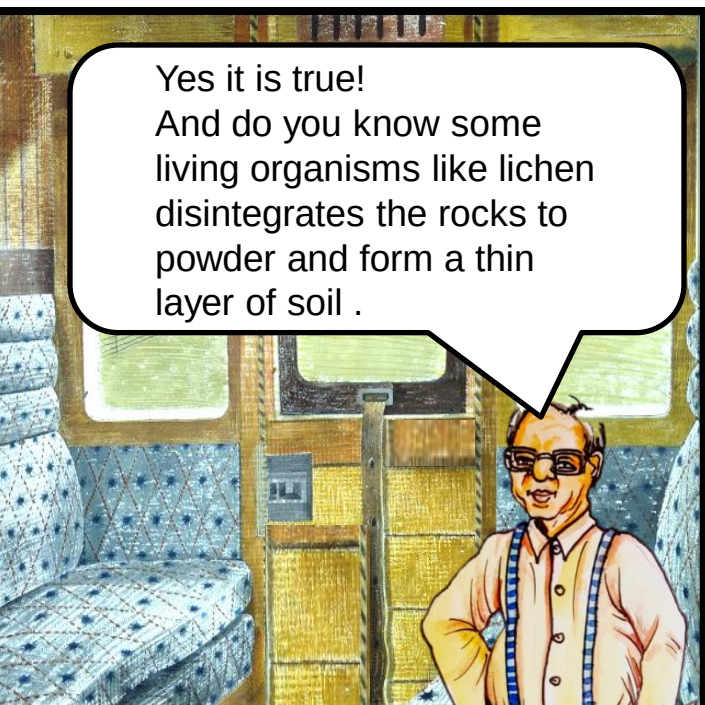
Yes..... the Sun also does that.



But Grandpa I have read that wind also helps in eroding the rocks.



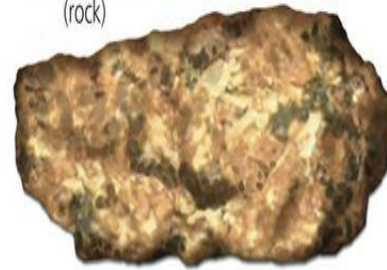
Yes it is true!
And do you know some living organisms like lichen disintegrates the rocks to powder and form a thin layer of soil .



Soil Formation

- Soils form from parent material
- Parent material (rock) is slowly broken down into smaller particles by biological, chemical, and physical weathering.
- It takes a long time to form soil.
 - Example: To form 2.5 cm (1 in.) it may take from 200-1000 years.

Parent material
(rock)



Biological
weathering
(tree roots
and lichens)

Chemical
weathering
(water, acids,
and gases)

Physical
weathering
(wind, rain,
thermal expansion
and contraction,
water freezing)



Particles of parent material

© Brooks/Cole, Cengage Learning

Test Your Knowledge

3 Overgrazing is responsible for causing

- A) soil depletion
- B) floods
- C) earthquake
- D) landslide

Answer: (a)

4 The moisture of soil can be retained by the process of

- A) Counter Barriers
- B) Mulching
- C) Rock Dams
- D) Planting grass

Answer: (b)

5 As the exposed rock break off and start decaying due to temperature change, this process is called

- A) Deforestation
- B) Landslide
- C) Soil erosion
- D) Weathering

Answer: (d)

The family members are looking at the beauty around.

I am yearning to visit the
landscapes of Kerala. Let's
go.



In the garden

In this farm, they practice Organic farming - they do not use chemicals and fertilizers.

Then how will the soil obtain nutrients.

Manure prepared in the field is used to enrich the fertility of soil.

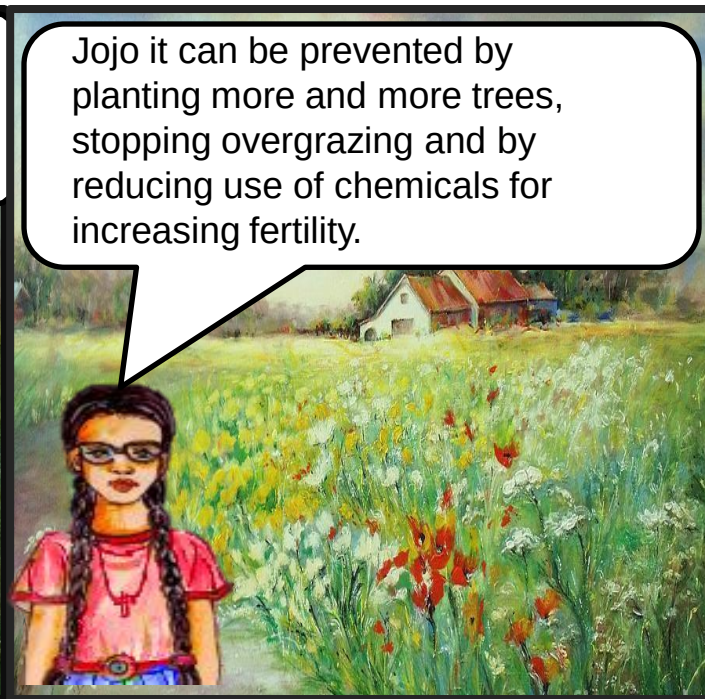
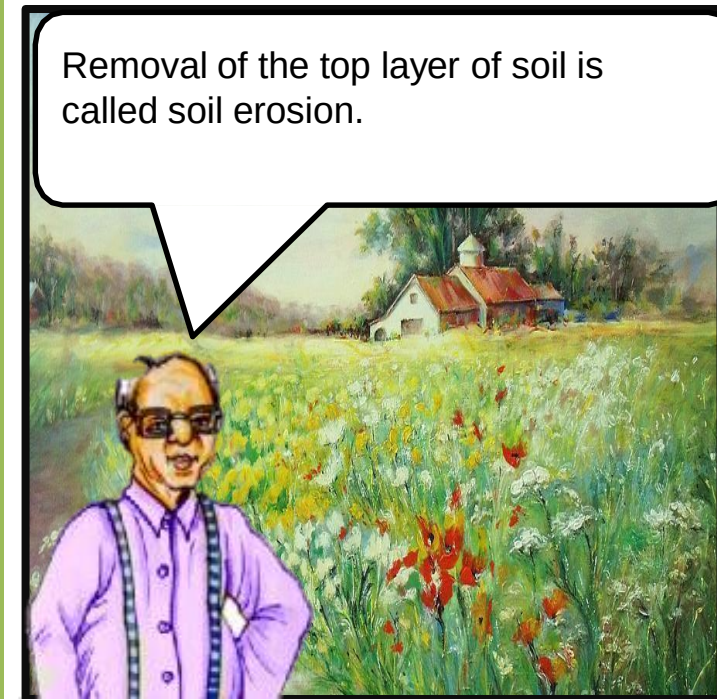
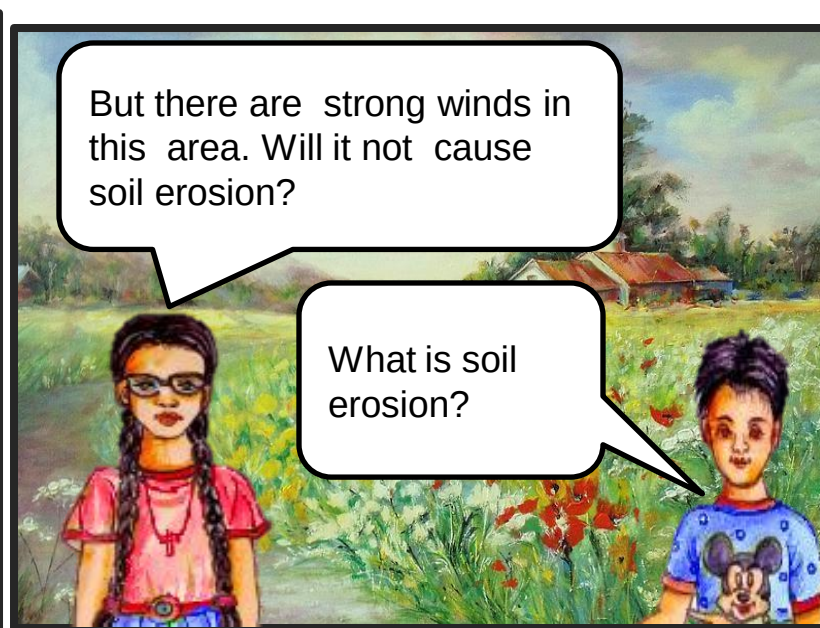
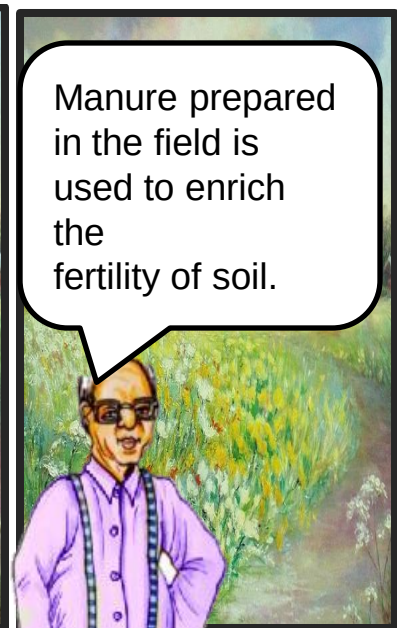
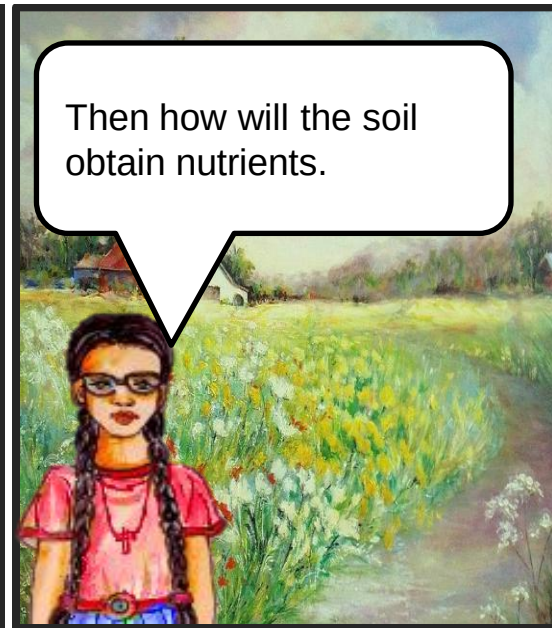
But there are strong winds in this area. Will it not cause soil erosion?

What is soil erosion?

Removal of the top layer of soil is called soil erosion.

Jojo it can be prevented by planting more and more trees, stopping overgrazing and by reducing use of chemicals for increasing fertility.

I am starving.



Today you will be served organic food in your diet as, all food items in the meal are obtained from the field.



You have had a tiring day and must be exhausted. Take a catnap. We have lots of exciting places to visit.

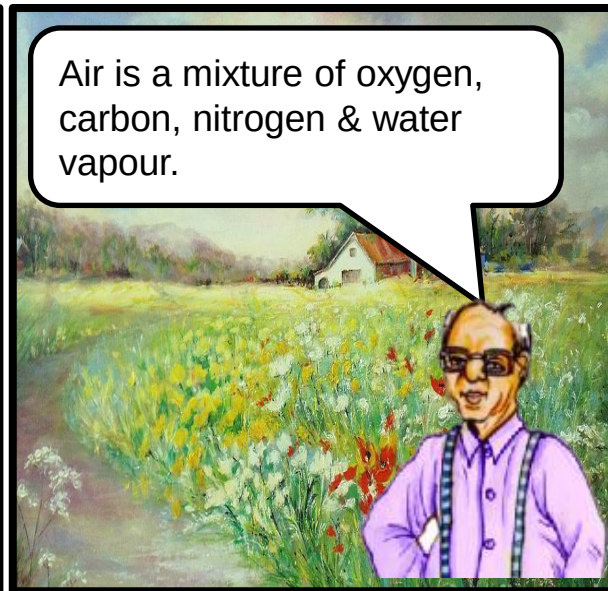


Grandfather is playing with kids and enjoying the moments. Jojo is looking up at the sky.

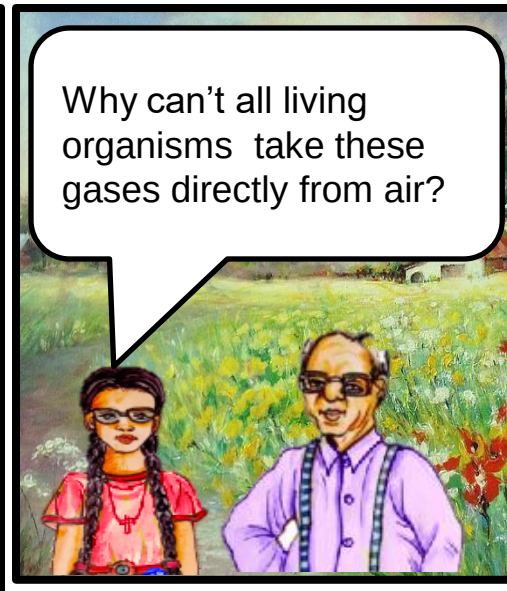
What is air made up of?



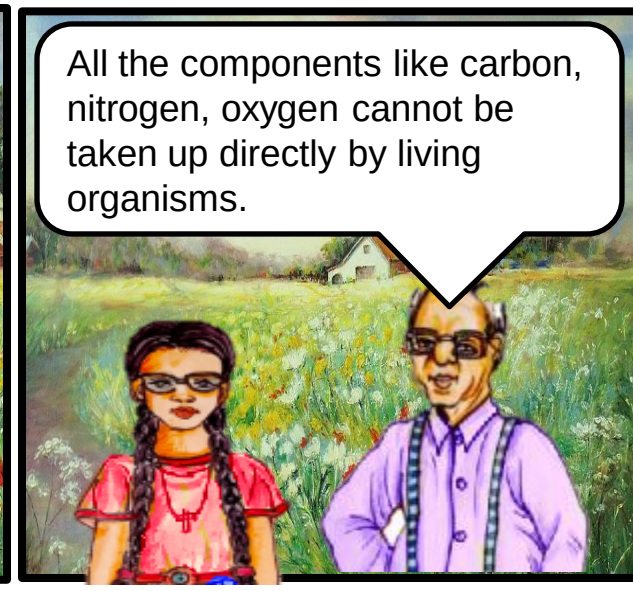
Air is a mixture of oxygen, carbon, nitrogen & water vapour.



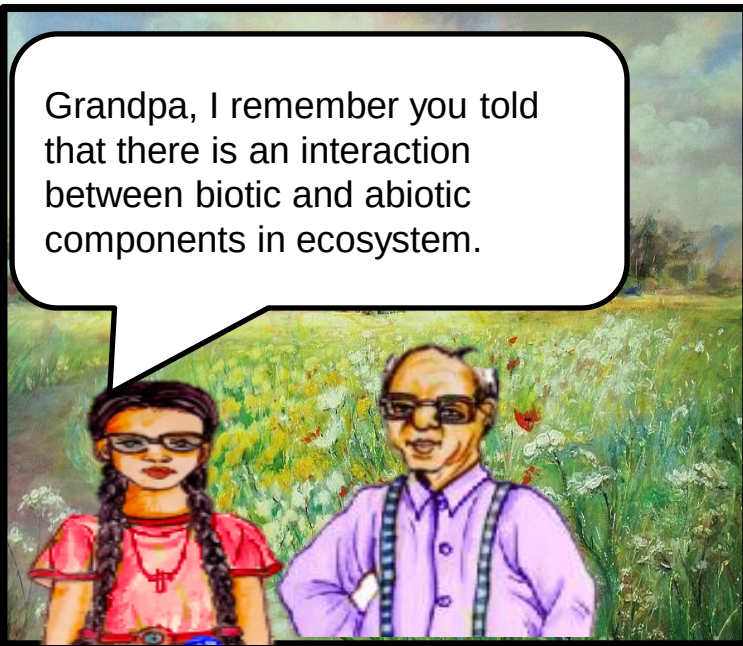
Why can't all living organisms take these gases directly from air?



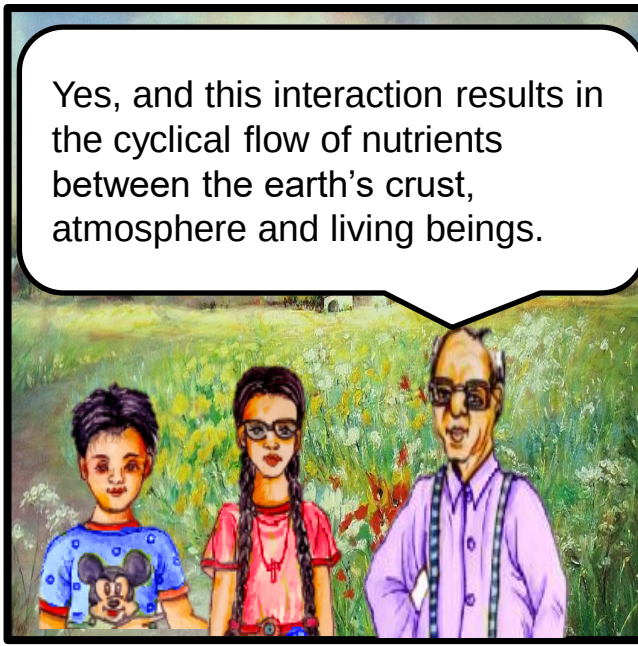
All the components like carbon, nitrogen, oxygen cannot be taken up directly by living organisms.



Grandpa, I remember you told that there is an interaction between biotic and abiotic components in ecosystem.



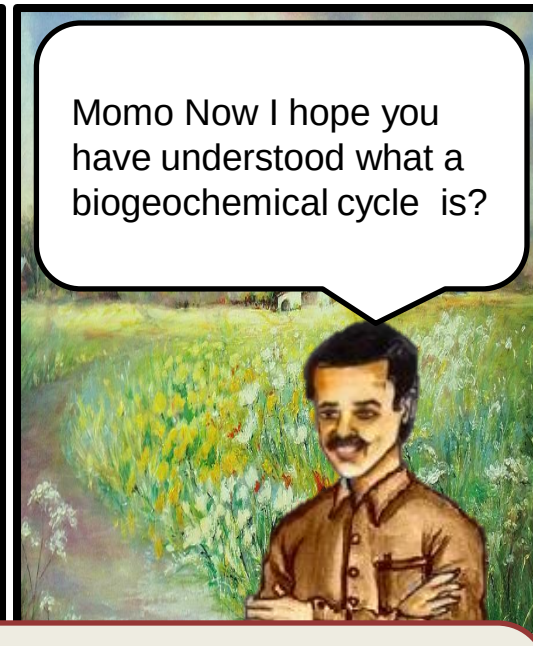
Yes, and this interaction results in the cyclical flow of nutrients between the earth's crust, atmosphere and living beings.



Like we have so many cycles operating in environment, same way these components also keep interchanging.



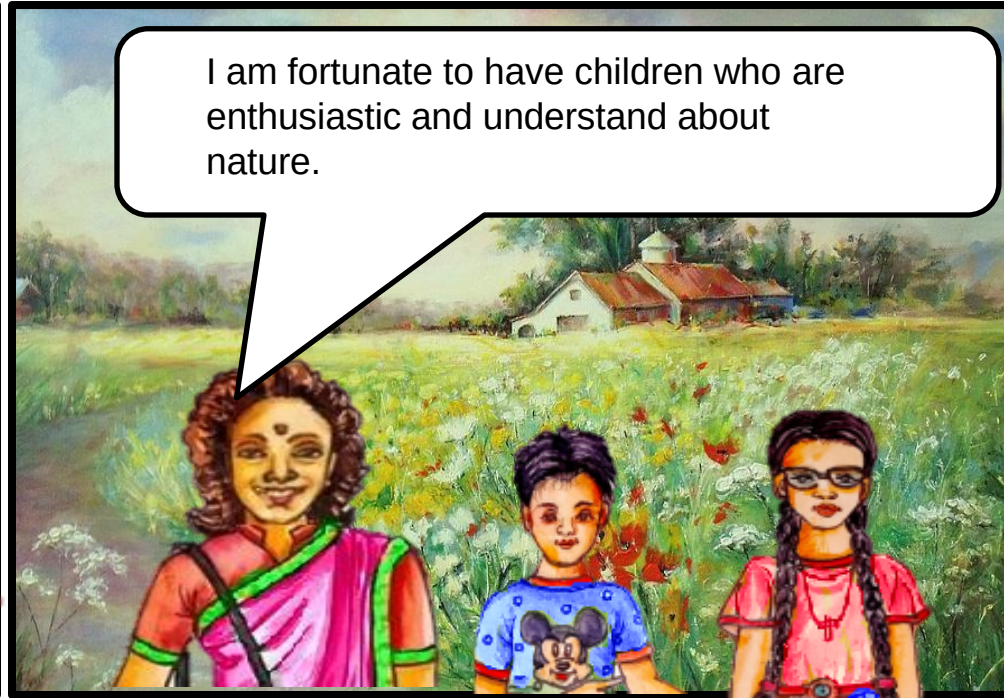
Momo Now I hope you have understood what a biogeochemical cycle is?



Yes dad. I have understood that there is cyclic flow of nutrients between living and non living components of environment.



I am fortunate to have children who are enthusiastic and understand about nature.

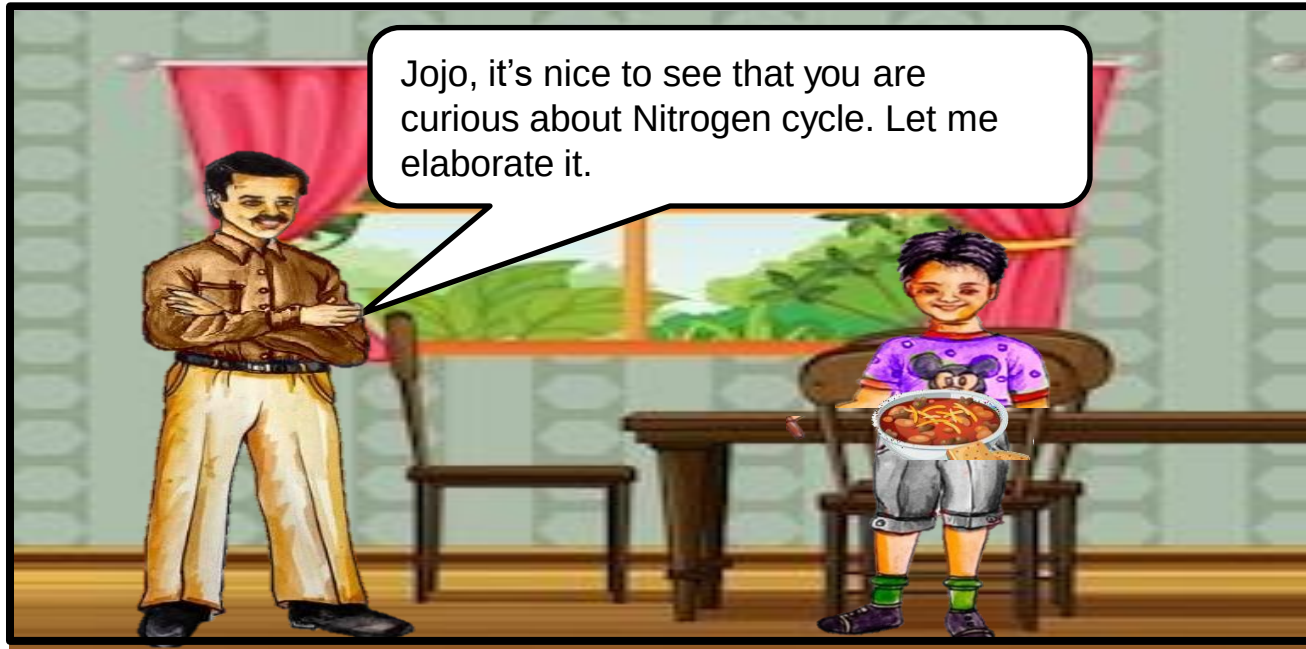
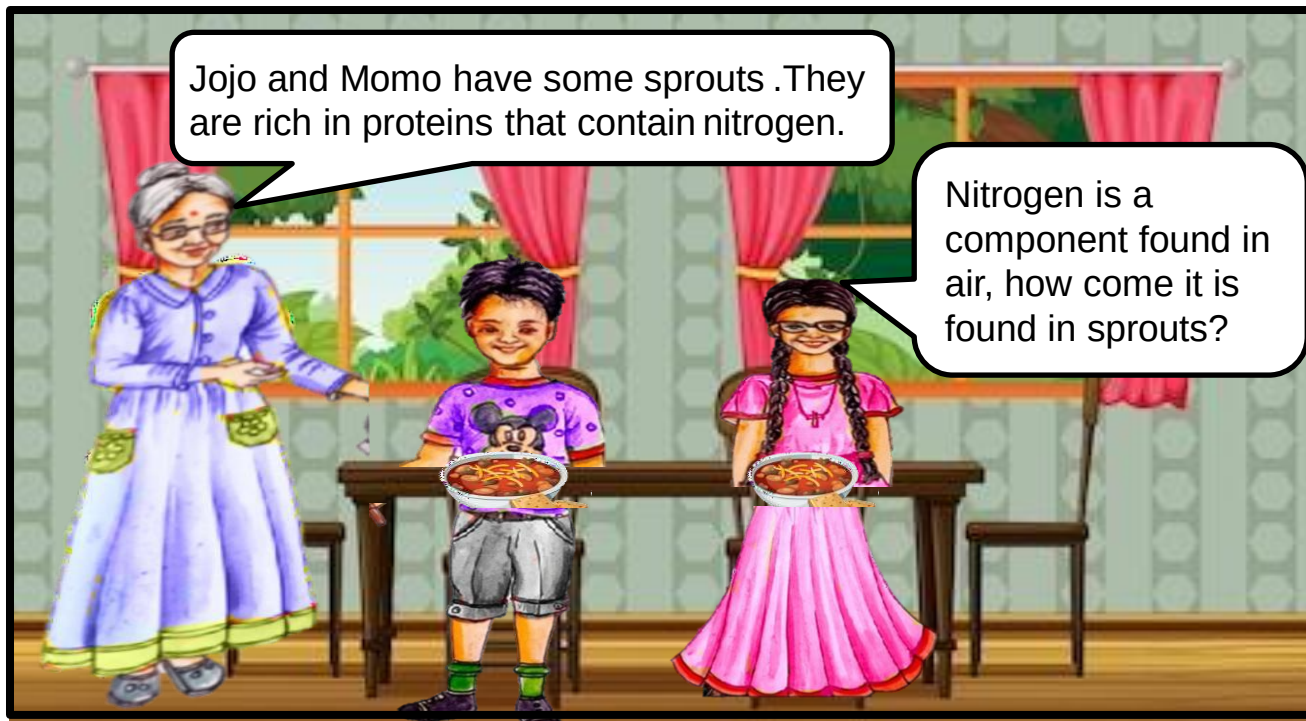


Test Your Knowledge

6 Top soil is the best for the vegetation. The main components of this productive top layer are:

- (a) Humus and living organisms only
- (b) Humus and soil particles only
- (c) Humus, living organisms and plants
- (d) Humus, living organisms and soil particles.

Answer: (a)



There are different ways by which it enters living organisms.

How does it enter our body then?

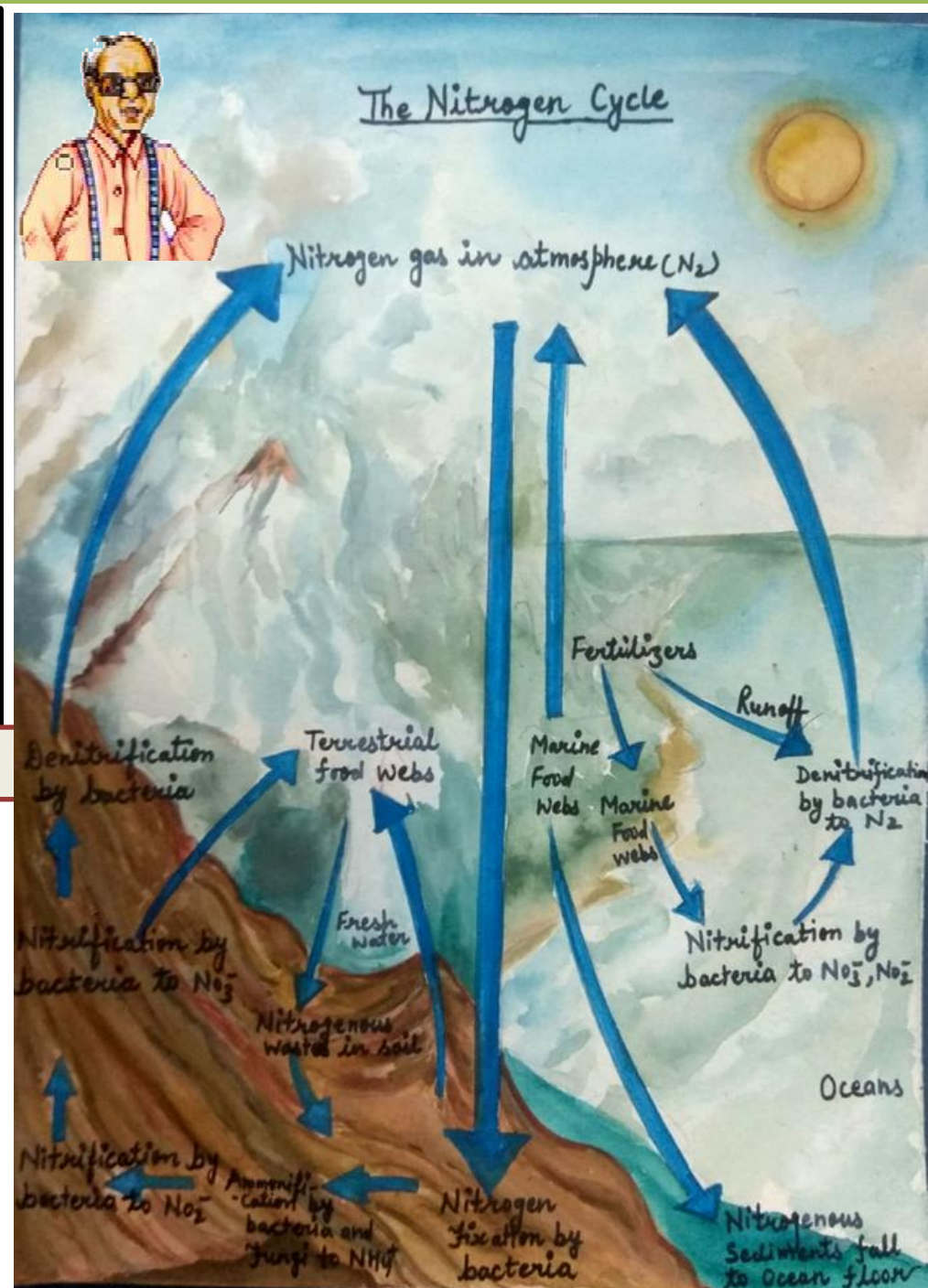
Yes my dear it is present in the plants. When we eat plant products, nitrogen requirement of our body is fulfilled.

What are the ways and means By which living organisms can intake nitrogen?

Test Your Knowledge

7. Nitrogen-fixing bacteria are found in the roots of in special structures called root nodules.

Answer: Legumes

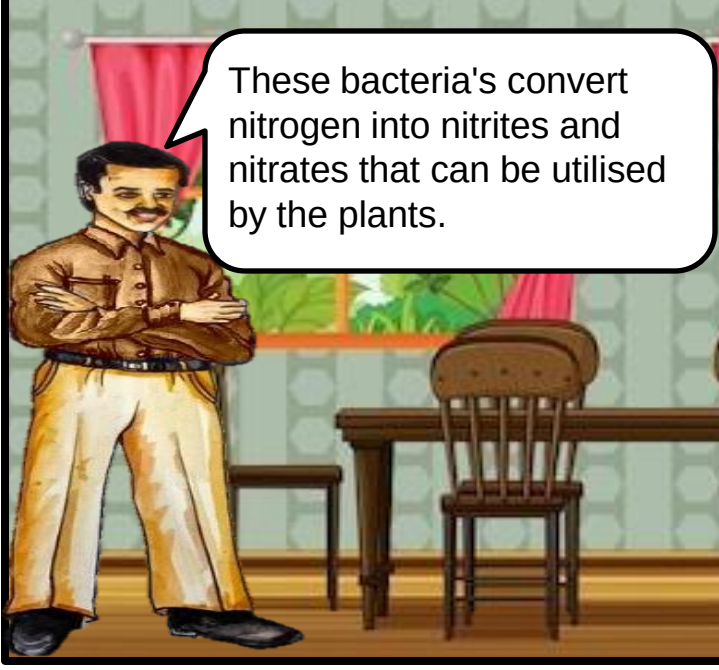




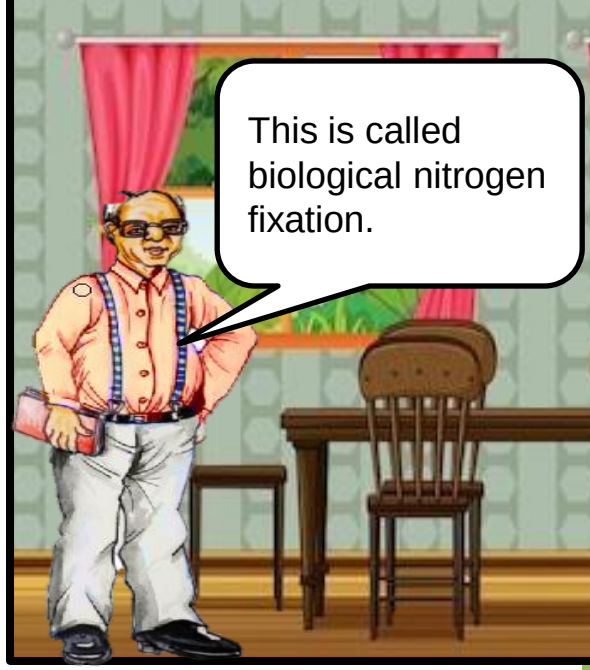
Nitrogen has some micro-friends in soil known as nitrogen fixing bacteria.



But how are these bacteria helpful?



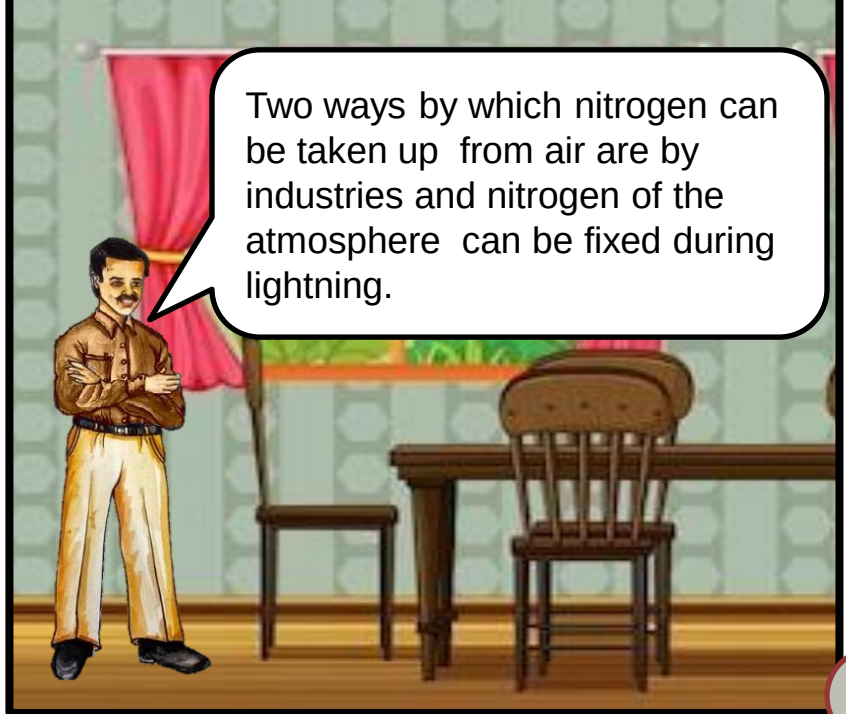
These bacteria's convert nitrogen into nitrites and nitrates that can be utilised by the plants.



This is called biological nitrogen fixation.



Ok! But what are the other methods by which Nitrogen can be taken from the atmosphere?



Two ways by which nitrogen can be taken up from air are by industries and nitrogen of the atmosphere can be fixed during lightning.

Test Your Knowledge

8 The amount of nitrogen in the atmosphere is maintained by a biological cycle which involves two processes, first is to withdraw nitrogen from the atmosphere and secondly to add the same to atmosphere.

Can you guess the names of these two respective processes.

- (a) Nitrogen fixation and nitrification
- (b) Nitrogen fixation and denitrification.

Answer: (b)

Momo when plants, animals and humans die, they are decomposed by bacteria in soil and nitrogen returns to the atmosphere.

Is nitrogen recycled?



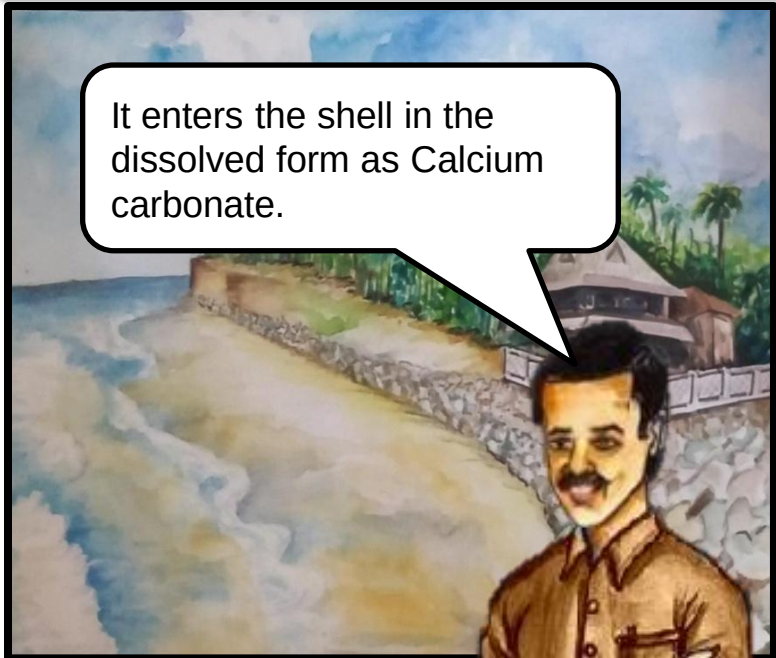
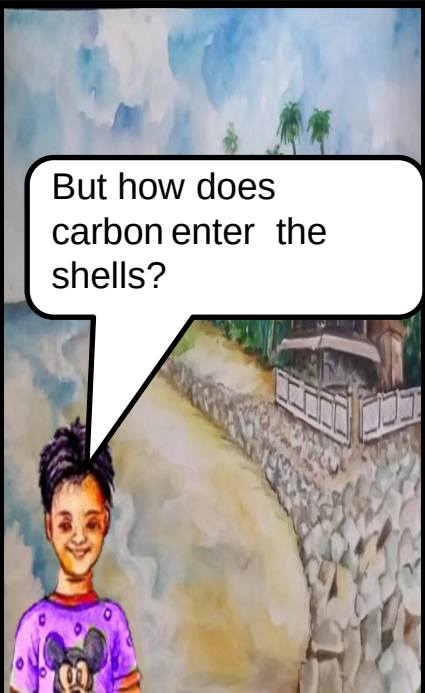
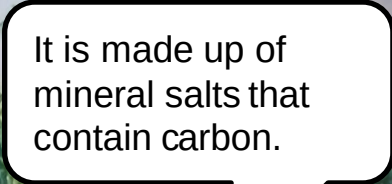
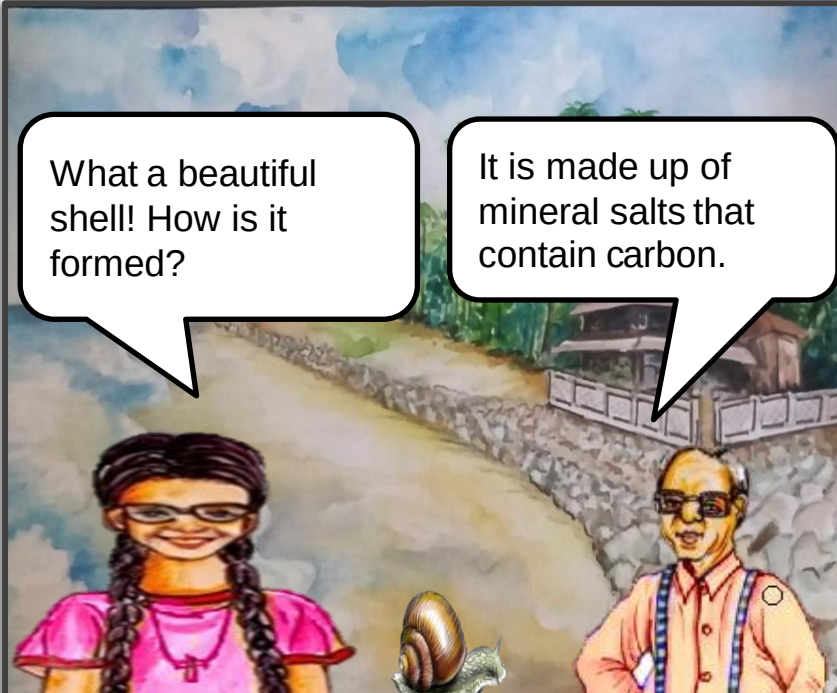
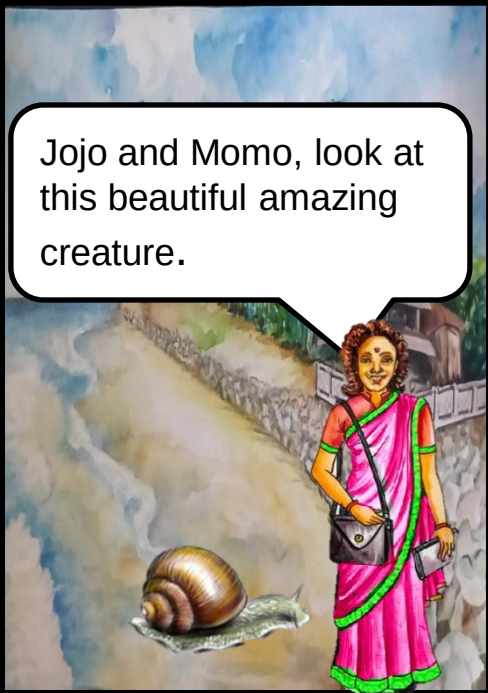
Everybody please hurry up we have to leave for the Kovalam beach.



Let me make the arrangements for lunch. I will take some bread and biscuits.



Kovalam Beach



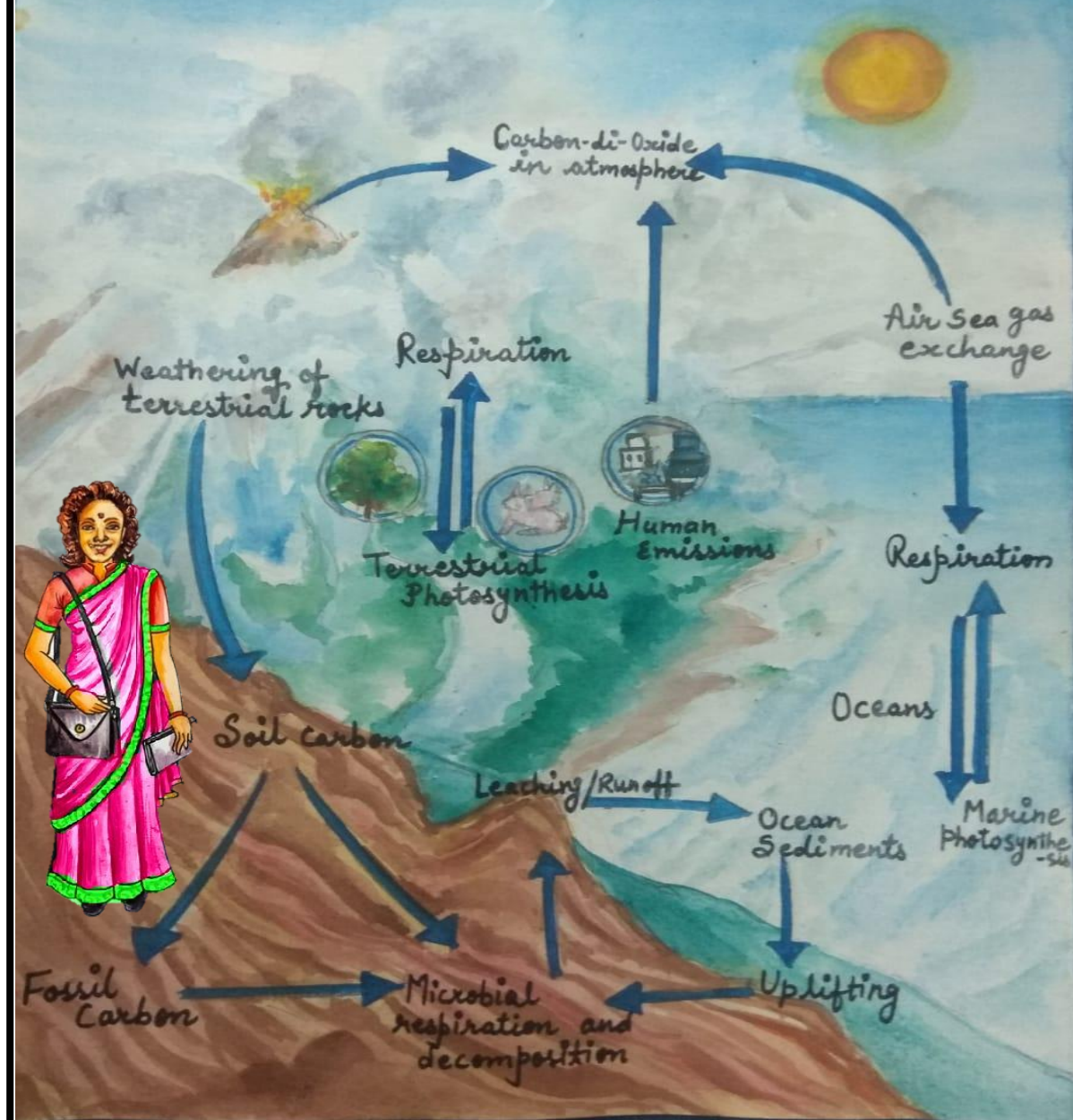
When we exhale, carbon dioxide is released back into the atmosphere.



Carbon dioxide is also released when we burn things like fuel for cooking, transportation etc.



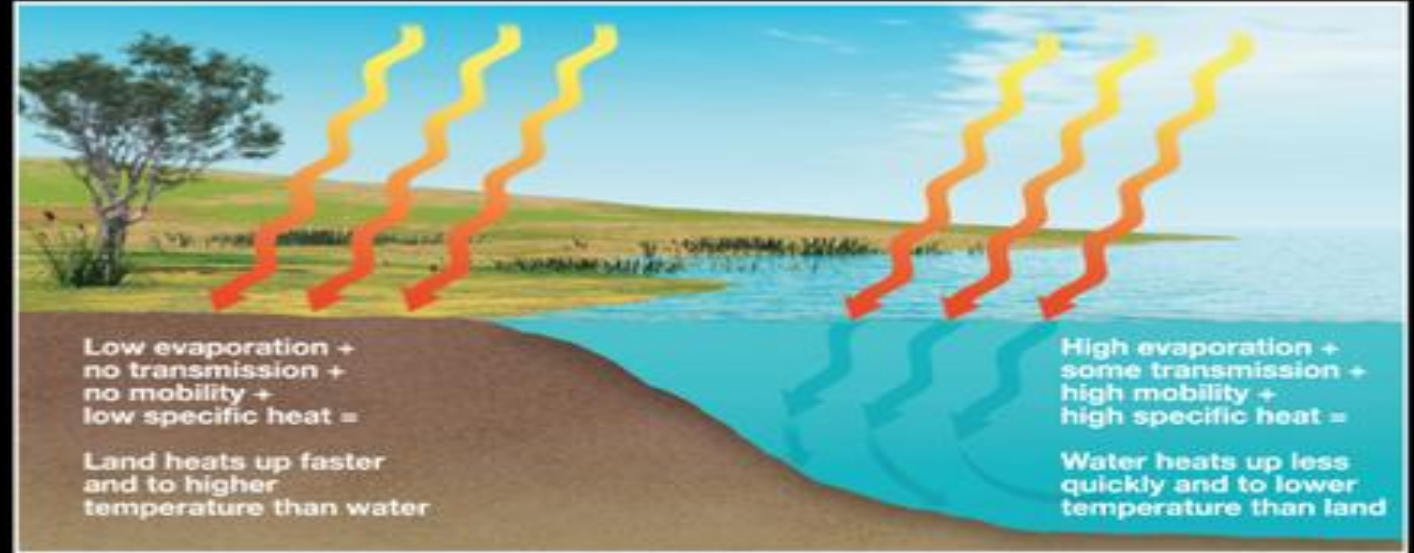
The Carbon Cycle



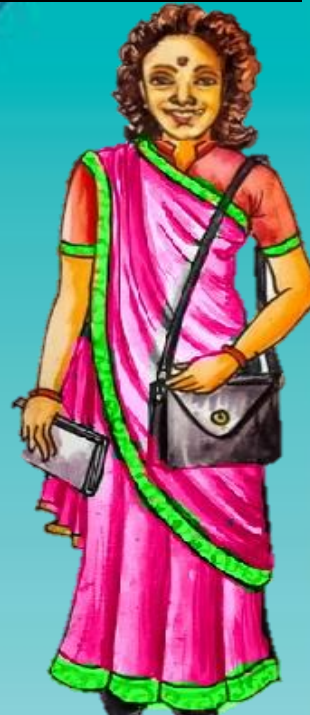
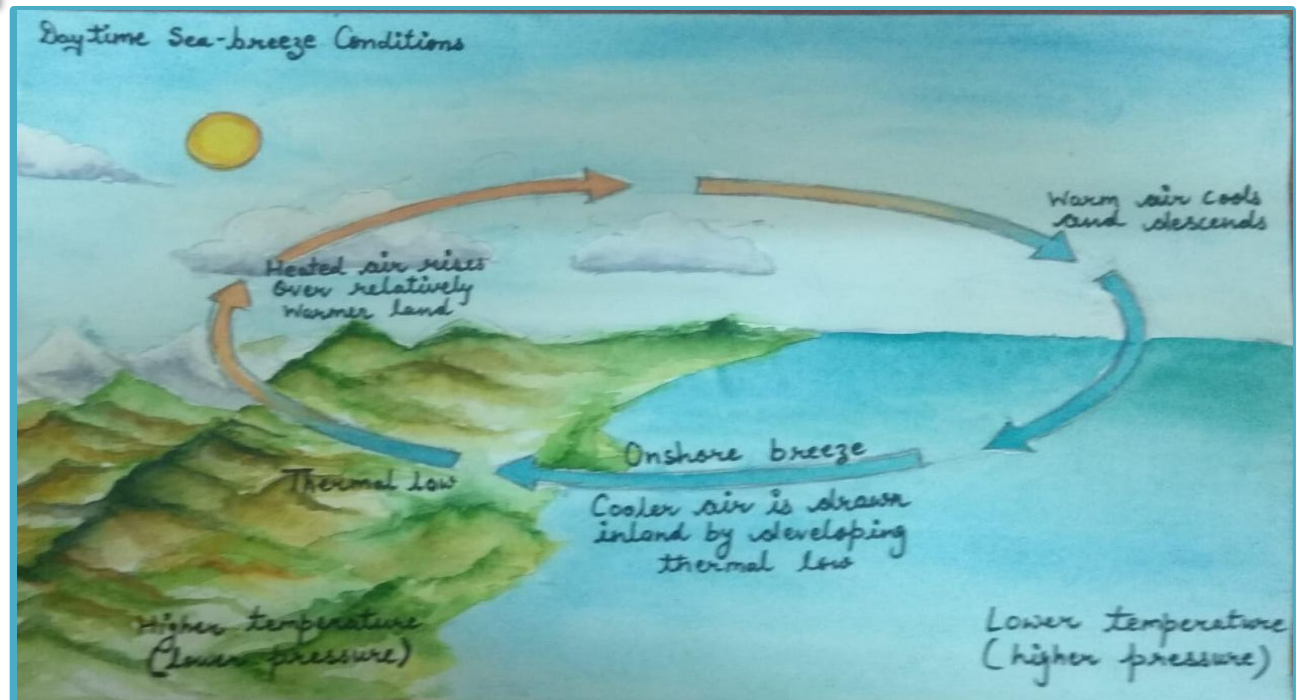
Can you both feel the cool breeze . It is called sea breeze.



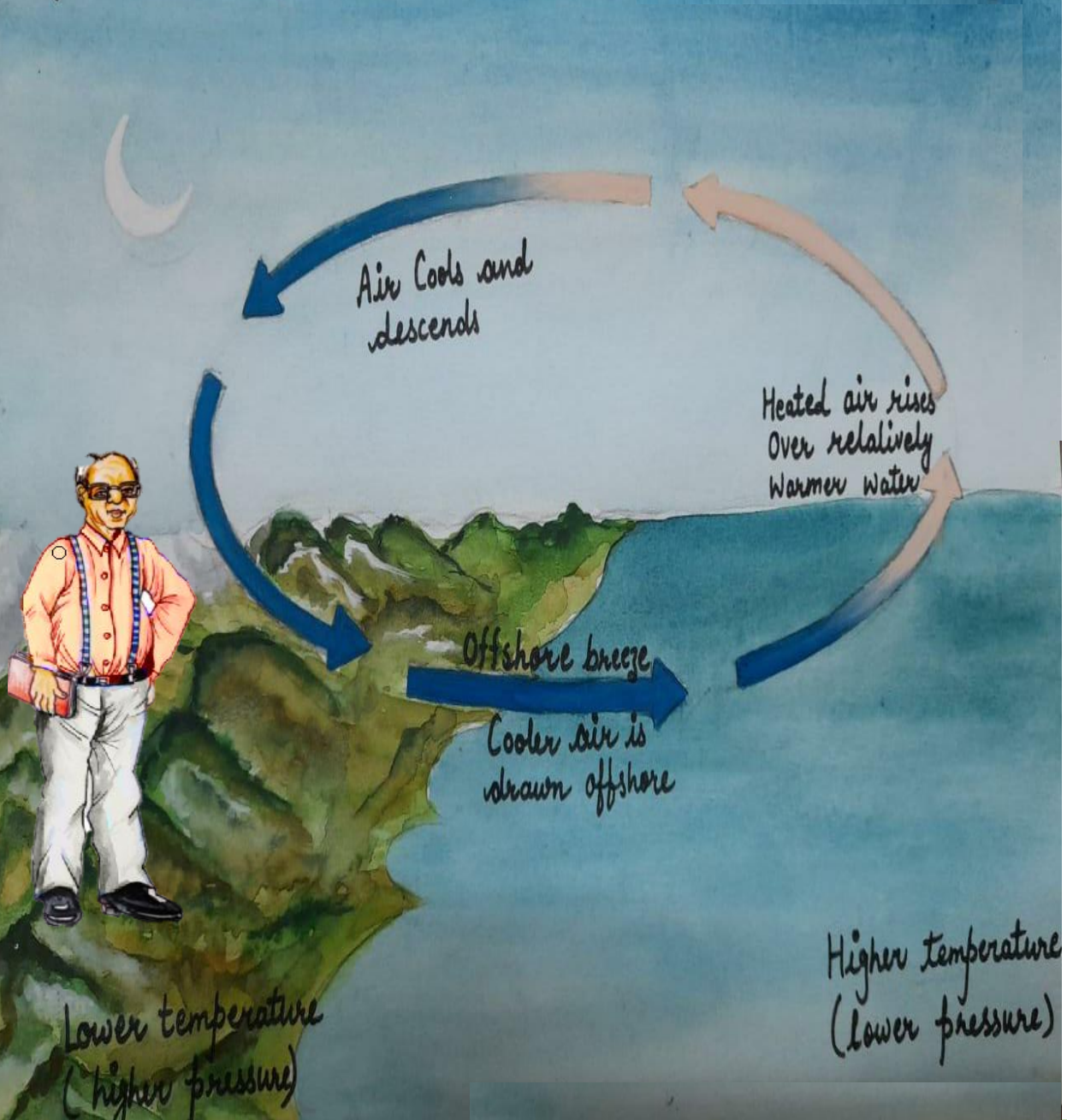
Land/Water Heating Differences



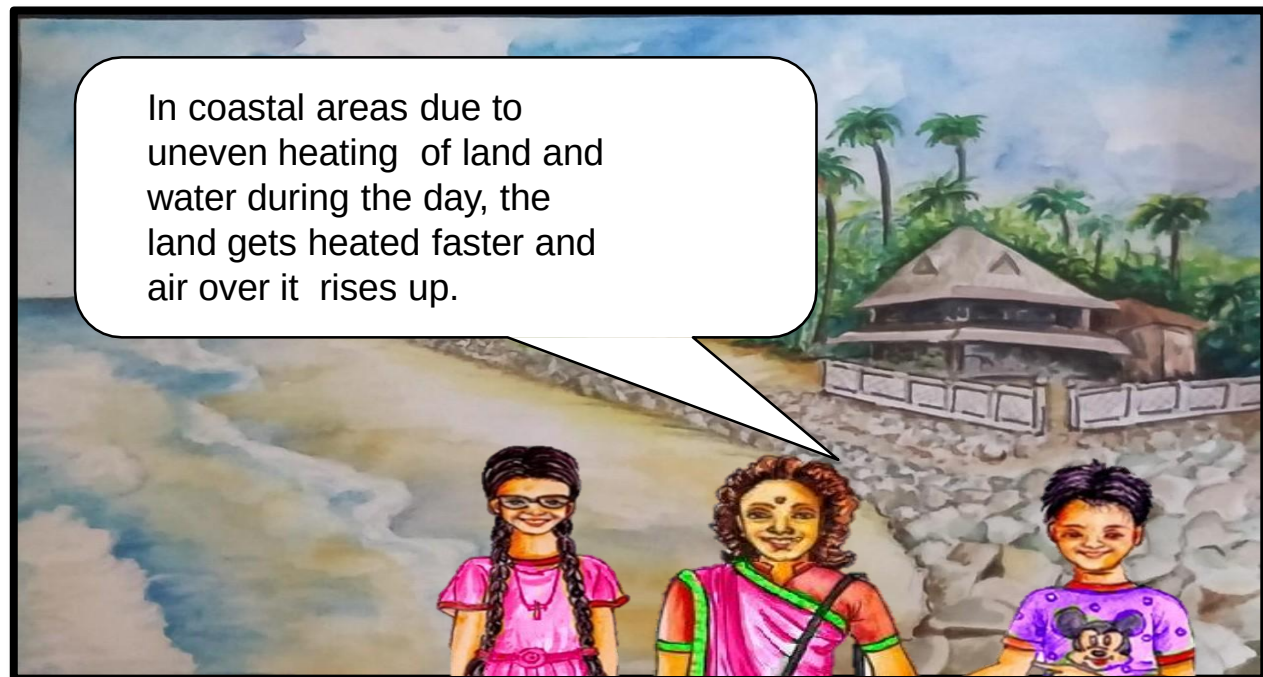
What is sea breeze? How is it caused?



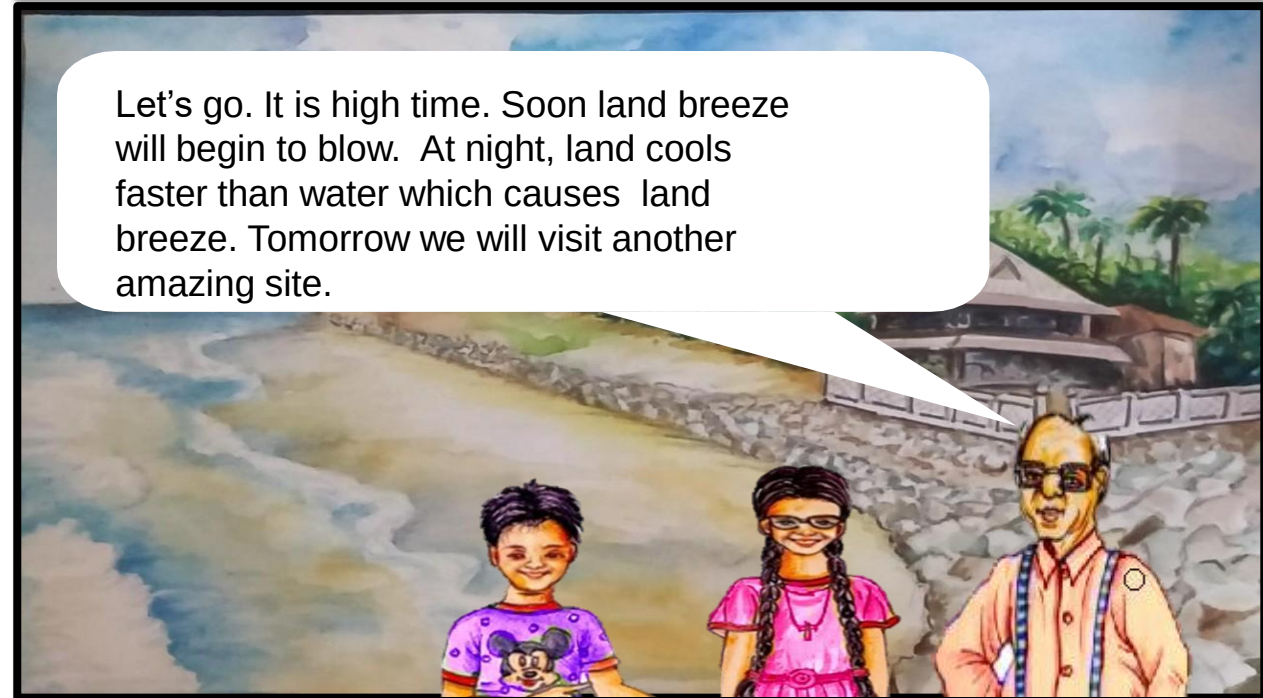
Night time land-breeze Conditions



In coastal areas due to uneven heating of land and water during the day, the land gets heated faster and air over it rises up.



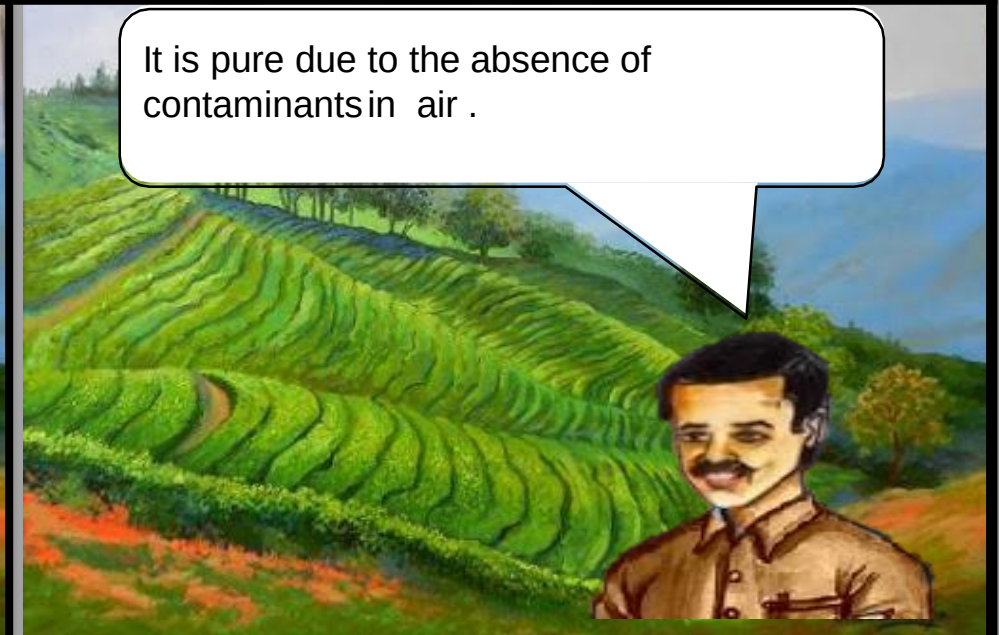
Let's go. It is high time. Soon land breeze will begin to blow. At night, land cools faster than water which causes land breeze. Tomorrow we will visit another amazing site.



Family members reached the next beautiful destination of the trip, the Munnar hills. Children are excited and amazed to visit the place.



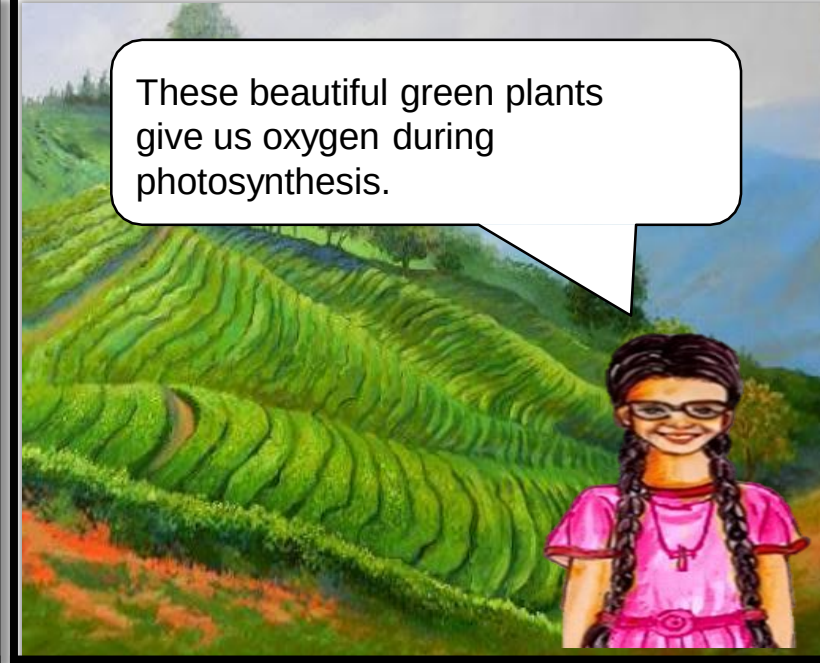
Amazing site. I have never seen such a beautiful place earlier .Lot of greenery around.
Why is air so pure here?



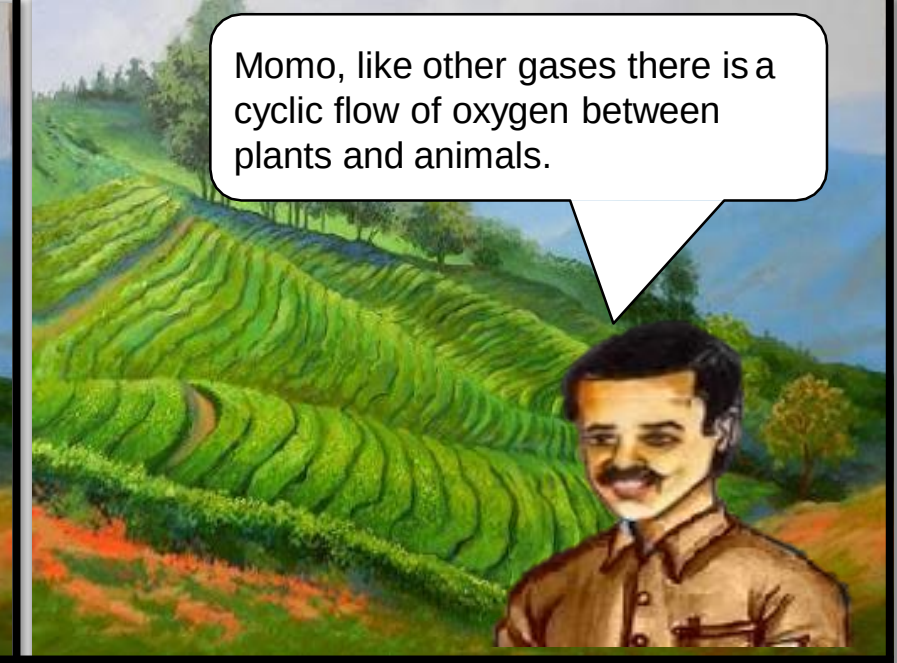
It is pure due to the absence of contaminants in air .



Where does the Oxygen come from?



These beautiful green plants give us oxygen during photosynthesis.



Momo, like other gases there is a cyclic flow of oxygen between plants and animals.

Yes papa, we use oxygen for respiration and it is also required for burning things.



Any other use of oxygen?



Oxygen is also used during decomposition by bacteria and fungi.



And it is this oxygen gas only that makes life possible on earth.



Let's take air from Munnar hills to Delhi .



The air helps in maintaining the temperature of the earth.

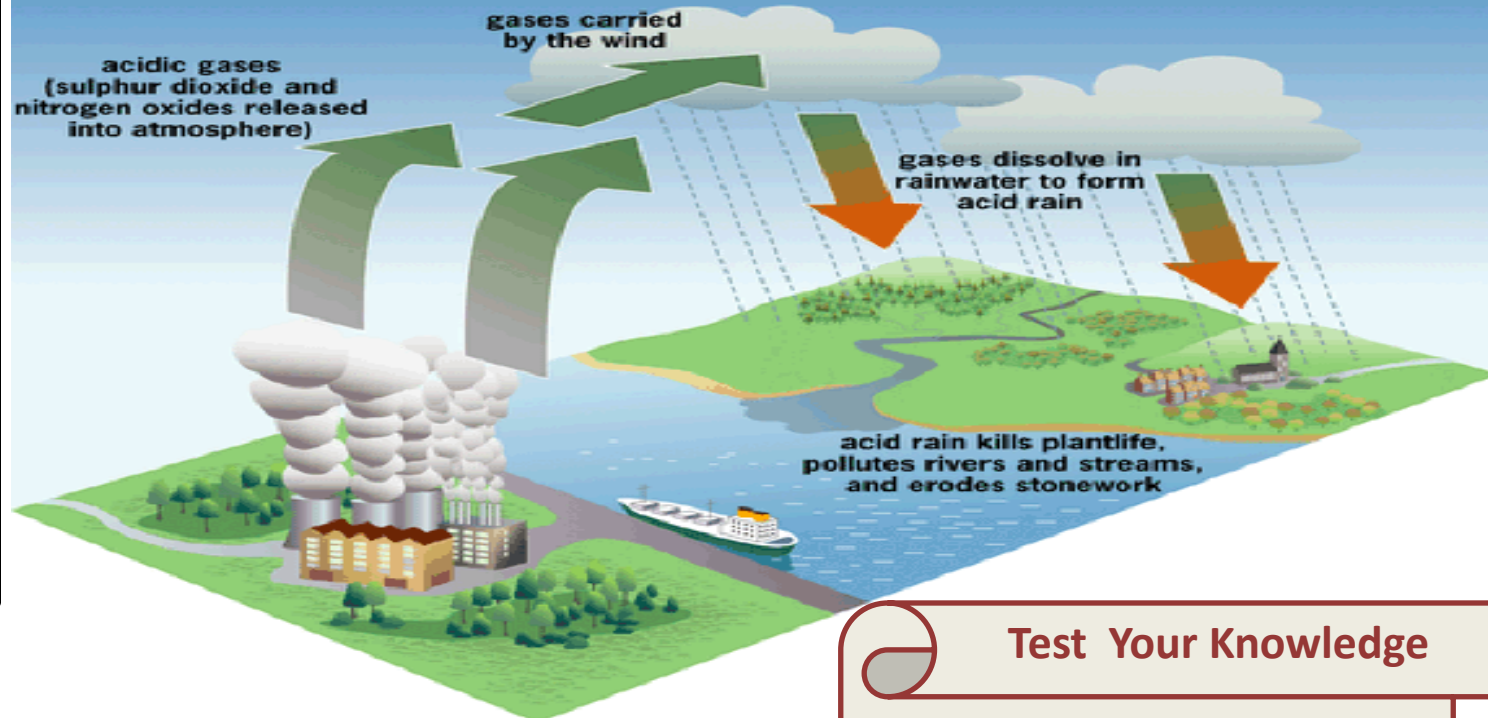


In Metropolitan cities, there is lot of pollution that make the air toxic.



The harmful gases are Sulphur dioxide, Methane, Carbon monoxide etc.

When these gases react with water vapours present in the air it causes acid rain which is very harmful for crops.



Roadside Hill Station

Population has increased. There are number of vehicles on the road leading to more fuel consumption causing air pollution.

All these factors have contributed to increase the level of carbon dioxide in the atmosphere.

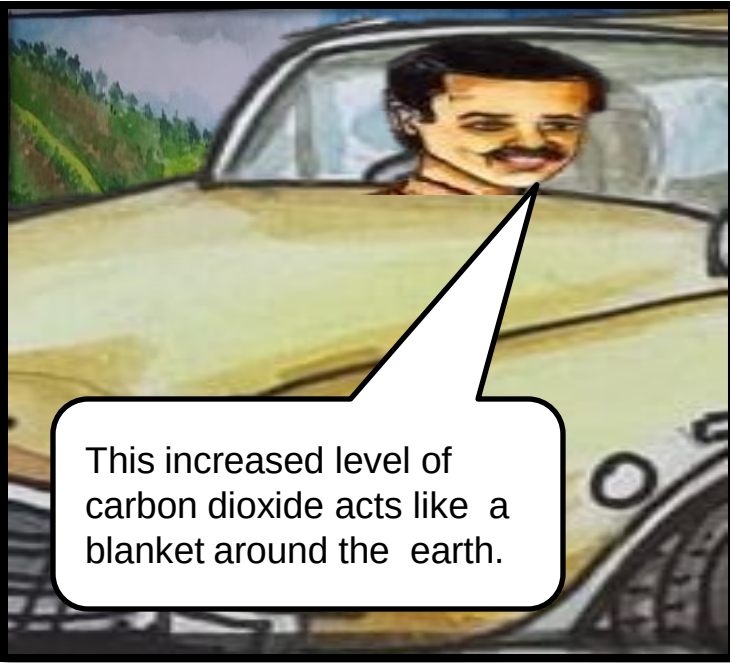
Test Your Knowledge

9. Most of the pollution in the atmosphere (air) comes from
- a. Pollen
 - b. Forest fires
 - c. Volcanic eruptions
 - d. Burning fossil fuels

Answer:(d)

10. The suspended particles released on burning fossil fuels could be unburnt carbon particles or substances called

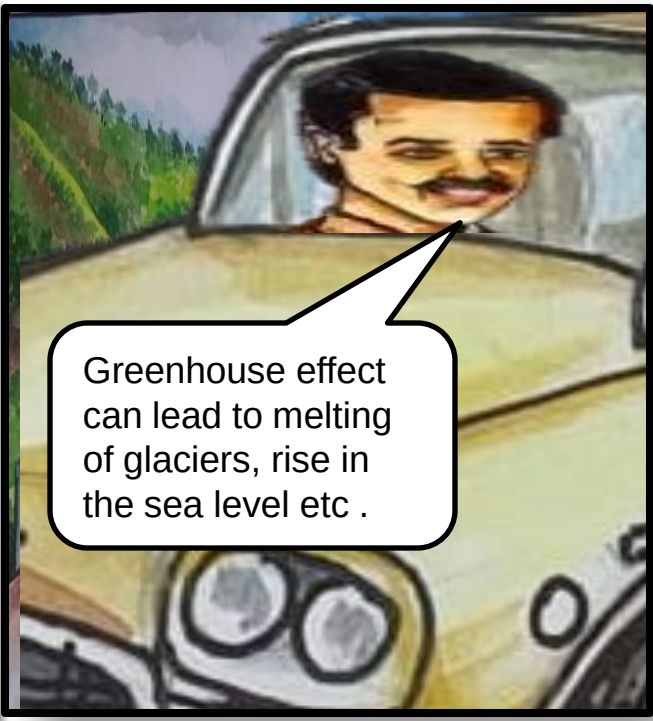
Answer: Hydrocarbons



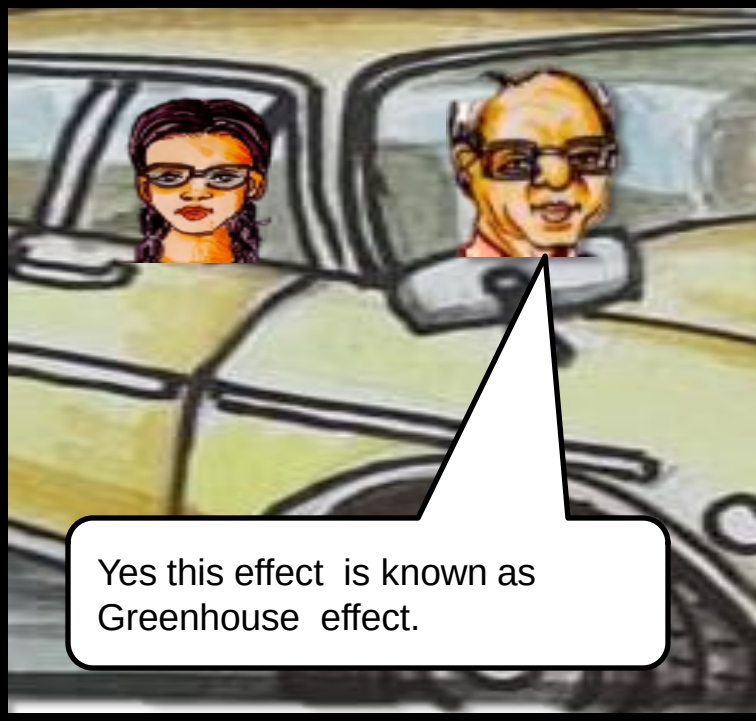
This increased level of carbon dioxide acts like a blanket around the earth.



And it traps the heat and the temperature rises.

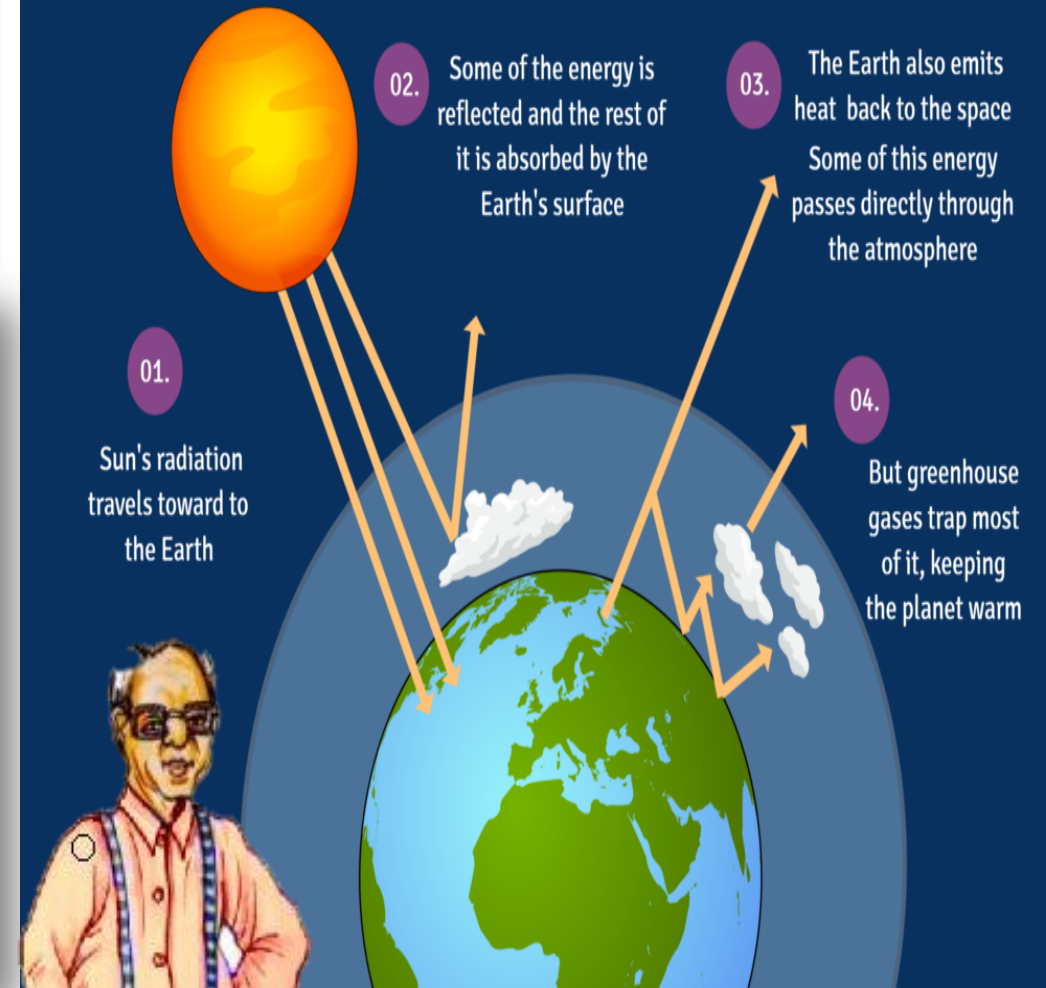


Greenhouse effect can lead to melting of glaciers, rise in the sea level etc .

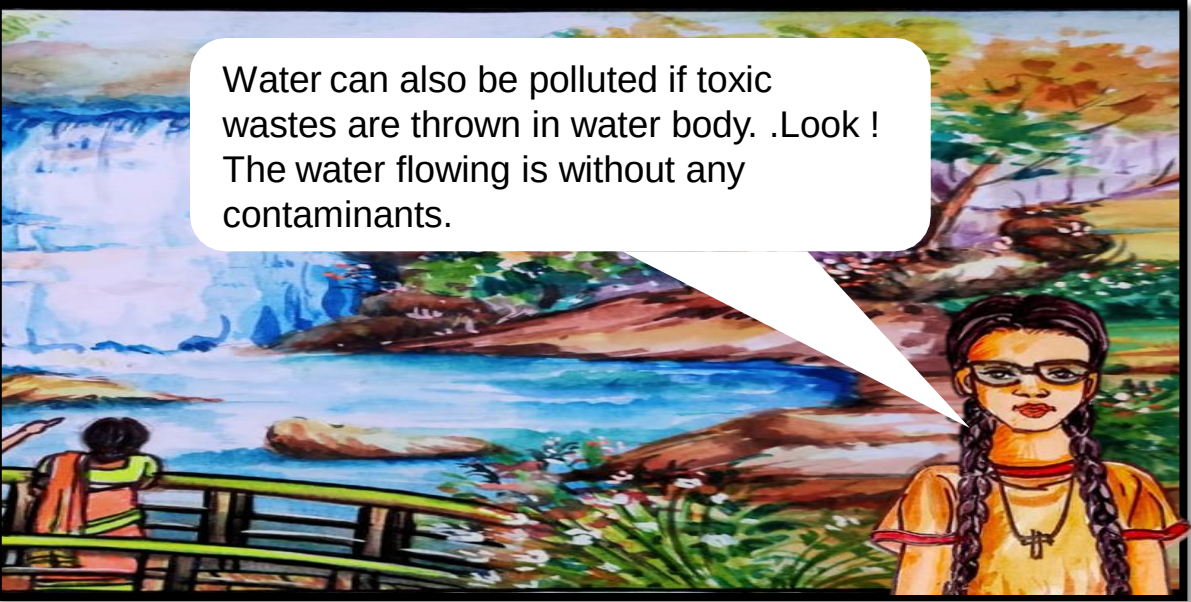


Yes this effect is known as Greenhouse effect.

The greenhouse effect



Lakkham Water fall



Water can also be polluted if toxic wastes are thrown in water body. .Look ! The water flowing is without any contaminants.



Yes Momo, people and Govt are taking measures to keep it clean.

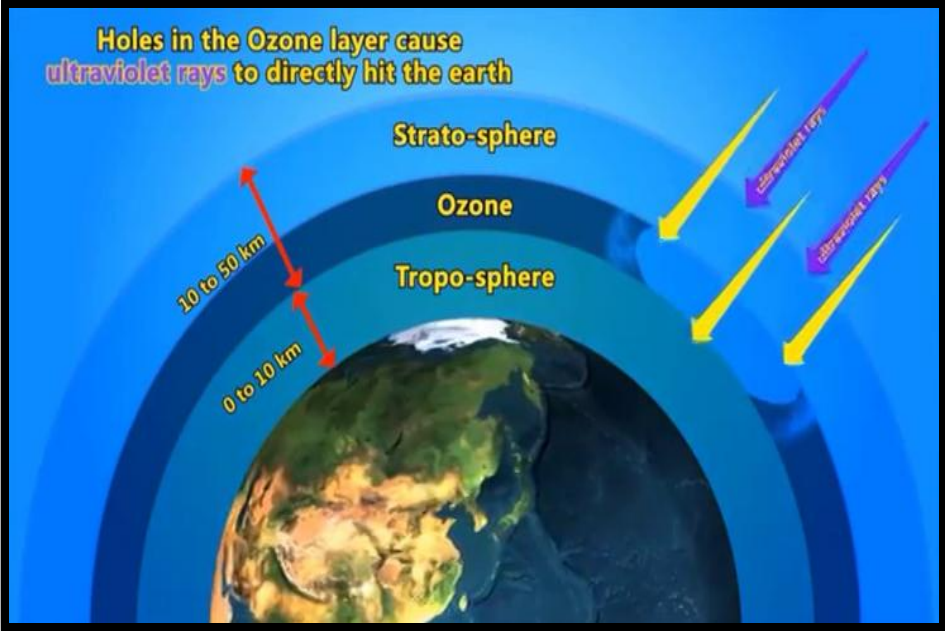
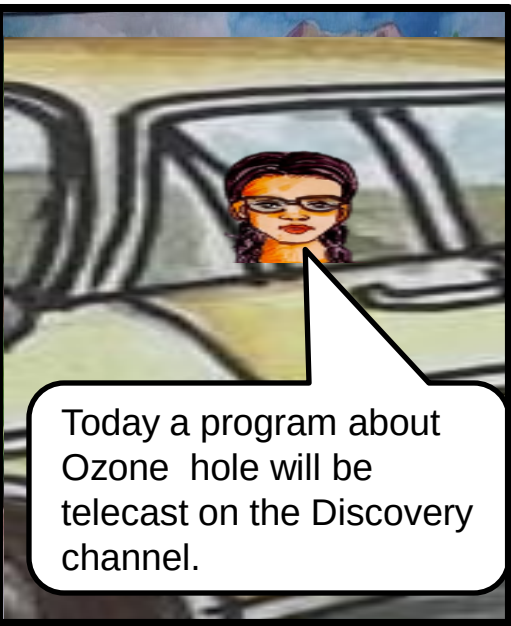
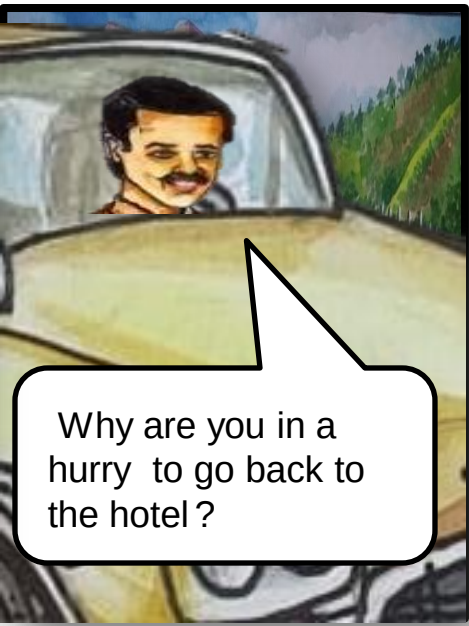


Don't throw the waste/ garbage in the water body.

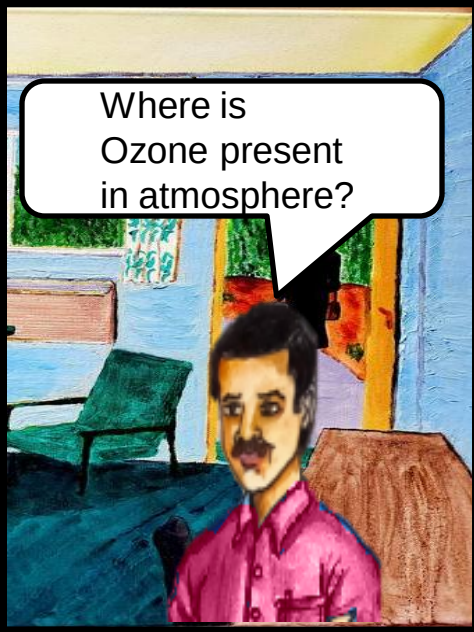
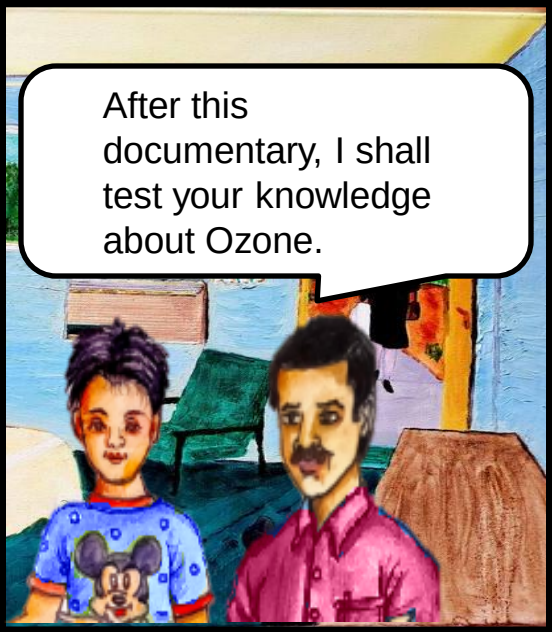
Look at the banner there. It is written : Don't throw the waste materials in the water body. Use bin.



After returning from the waterfall, Jojo and Momo are sitting along with their parents in a cab eager to watch a documentary.



All family members are sitting together to watch the documentary.



It acts like a shield and protects us from the harmful UV rays.



Why do we need protection against UV rays?



Jojo, UV rays can cause cancer & cataract and they can also slow down the growth of plants.



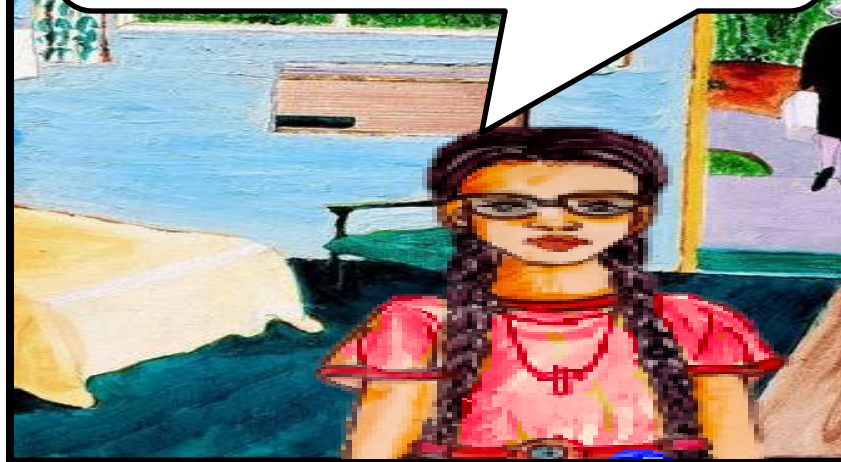
But how do these rays enter our atmosphere?



A hole has developed in the Ozone Layer which has resulted in the entering of these UV radiations.



Use of more and more Chlorofluorocarbons in ACs, refrigerators etc is the main reason for the hole in ozone.

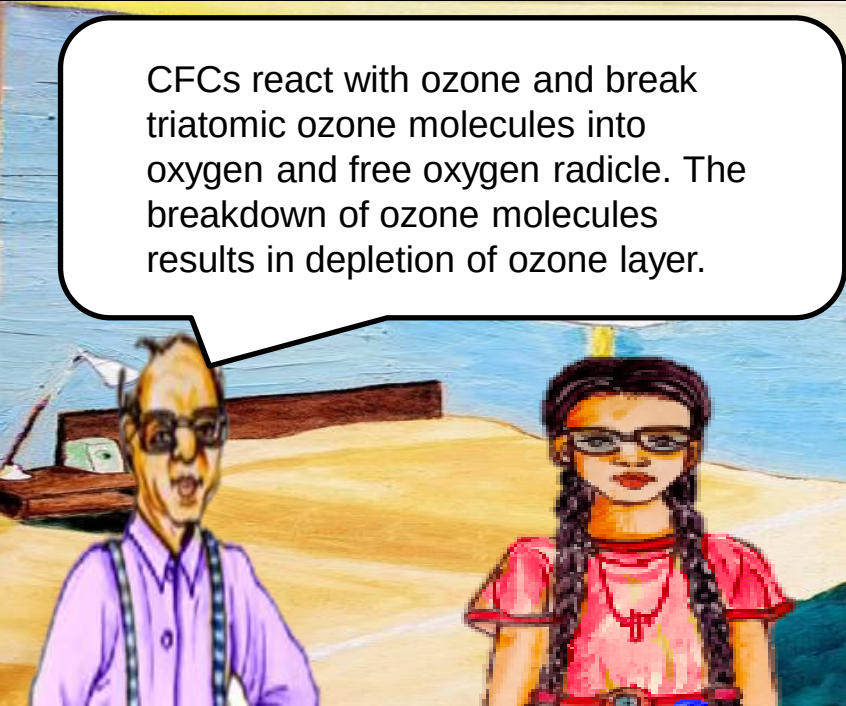


But how do CFC's cause the Ozone Layer hole?



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4. <https://youtu.be/BpxVSZbM>
5. <https://youtu.be/dmzIc7h6yc>
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7. Google platform and Kerala images
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10. Wikipedia



CFCs react with ozone and break triatomic ozone molecules into oxygen and free oxygen radicle. The breakdown of ozone molecules results in depletion of ozone layer.



But what can we do to stop this Ozone layer's depletion?



Government has now banned the use of CFCs and Ozone hole is now healing these days. We are now on our way to save ourselves from harmful UV rays.



Let us all sleep now. Tomorrow we have to board the train back to Delhi.

Test Your Knowledge

11. _____ is the region of atmosphere where ozone layer is present.
12. Ozone hole was first detected over _____.
13. Synthetic material/ chemical which depleted Ozone layer is
 - a. CFCs
 - b. CFLs
 - c. CO₂
 - d. None of above

Answers:

11. Stratosphere

12. Antarctica

13.(a)

Glossary

Abiotic - Non-living chemical and physical factors of the environment

Afforestation - Planting new forests on lands that have not been recently forested.

Air pollution - The modification of the natural characteristics of the atmosphere by a chemical, particulate matter, or biological agent.

Biodiversity - The variety of life in all its forms, levels and combinations; includes ecosystem diversity, species diversity, and genetic diversity.

Biogeochemical cycle - A circuit or pathway by which a chemical element or molecule moves through both biotic ("bio-") and abiotic ("geo-") parts of an ecosystem.

Biosphere - the part of the Earth, including air, land, surface rocks, and water, within which life exists.

Biotic - living organisms in the environment.

Carbon cycle - the biogeochemical cycle by which carbon is exchanged between the biosphere, lithosphere, hydrosphere, and atmosphere of the Earth.

Carbon dioxide - a gas with the chemical formula CO₂; the most abundant greenhouse gas emitted from fossil fuels.

Decomposers - consumers, mostly microbial, that change dead organic matter into minerals and heat.

Environment - the external conditions, resources, stimuli etc. with which an organism interacts.

Erosion - displacement of solids (sediment, soil, rock and other particles) usually by the agents of currents such as, wind, water, or ice by downward or down-slope movement in response to gravity or by living organisms.

Greenhouse effect - the process in which the emission of infrared radiation by the atmosphere warms a planet's surface.

Humus - organic material in soil lending it a dark brown or black colouration.

Hydrological cycle (water cycle) - the natural cycle of water from evaporation, transpiration in the atmosphere, condensation (rain and snow), and flows back to the ocean (e.g. rivers).

Hyporheic zone is the region of sediment and porous space beneath and alongside a stream bed, where there is mixing of shallow groundwater and surface water.

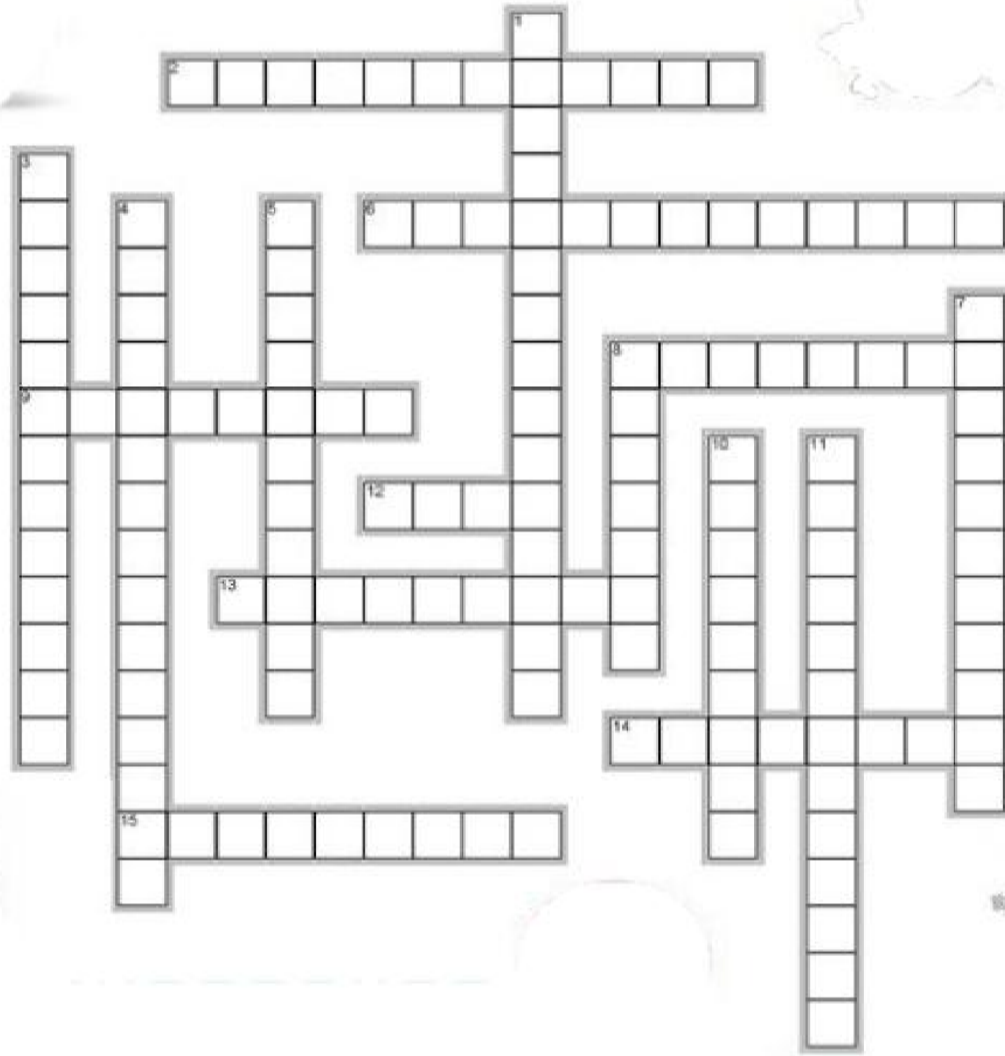
Hydrosphere - all the Earth's water; this would include water found in the sea, streams, lakes and other water bodies, the soil, groundwater.

Manure - organic matter used as fertilizer in agriculture..

Natural resources - naturally occurring substances that are considered valuable in their relatively unmodified (natural) form.

Nutrients - Chemicals required for the growth of organisms. Phosphorus, nitrogen and potassium are major plant nutrients but there are also many trace elements, elements that are needed in small quantities for the growing and developing of animal and plant life.

TEST YOUR KNOWLEDGE



Down

1. a measure of the effect that human activities have on the climate
3. a gradual warming of the earth's surface temperature reportedly caused by the emission of gases that trap the sun's heat in the earth's atmosphere
4. gases that trap the heat of the sun in the earth's atmosphere, producing the greenhouse effect
5. fuels such as oil, coal and natural gas
7. the surroundings and external conditions that affect the growth and development of living things
8. the study of the relationship of living things (plants, animals and humans) with each other and with their environment
10. contamination of the air, water, or soil with substances that can cause harm to human health or the environment
11. capable of being broken down or decomposed by natural biological processes

Across

2. protecting, maintaining or improving natural resources, to keep them safe from destruction or degradation and conserve them for future generations
6. destruction of forests to make land for agriculture
8. the release or discharge into the air of pollutant substances such as gas or smoke
9. an area designated to receive household garbage, solid waste and construction debris
12. location where garbage, rubbish or waste is taken and just dumped, without environmental controls
13. the process of minimising waste by recovering materials and transforming them into new products
14. rain mixed with sulphuric, nitric and other acids formed by gases released into the atmosphere when fossil fuels are burned
15. a community of plants, animals and other organisms living in an area which provides what they need in order to survive

Crossword answers

1. Carbon footprint
7. Environment
13. Recycling

2. Conservation
8. Emission
14. Acid Rain

3. Global warming
9. Landfill
15. Ecosystem

4. Green house Gases
10. Pollution

5. Fossil fuels
11. Biodegradable

6. Deforestation
12. Dump

Message



This illustrated graphic novel on "Rendezvous with nature in Kerala" is an outcome of honest and diligent efforts of the entire team of MPS, Pratap Nagar. When a thought that has been enduring in mind becomes a reality, it is truly interesting and exciting. This issue is intended to be published to cater to the curiosity and edification needs of the students of today. Besides this, this innovative venture will serve as a medium to arouse the interest of the inquisitive minds in complex topics. I earnestly wish that it succeeds in providing maximum benefit to readers. Happy Reading!

**Shri Pradeep Baheti
Chairman, ECMS**



It gives me a great sense of pride when I see a perceptible change in the teaching learning process .We have been doing exceedingly well and have touched the pinnacles of achievement in almost all spheres of learning. This innovative idea of graphic novel will definitely endow our kids with a sense of joyful learning. I congratulate each and everyone who relentlessly contributed to this constructive project and made this dream come true .Happy Learning!

**Shri Natwar Lal Ajmera
General Secretary Education, ECMS**

Message



Our temple of learning has always taken necessary steps to improve quality of education ,standard of teaching ,methods of assessment ,development of skills etc. Our sole objective is to cater to the inquistive minds of our new generation .In this regard ,I am truly elated to introduce this innovative idea of teaching through graphic novel. I congratulate the team associated with this noble mission and wish them a great success ahead.

**Shri Mukesh Rathi
Honorary Secretary**



I extend a hearty welcome to all the exuberant readers of Graphic Novel on ‘Rendezvous with nature in Kerala’ Nothing remains constant in this dynamic world. Graphic Novel is an ongoing feature which supports the reading of a chapter in an effective manner. Building comprehension and critical thinking skills is one amongst the myriad benefits of this innovative and unique pattern for students. The combination of dedication ,pragmatic approach and innovative thinking enabled us to fabricate this effective teaching tool . The readers will definitely find it useful in learning a complex subject matter. I would like to express sincere gratitude to Mr. Sandeep Sethi (Director Education, M.S.M.S. II, Museum Trust) without whose unconditional support and persistent guidance, this would have not been accomplished so compellingly.

I hope this aesthetic ,artistic and edifying piece of work will fulfill its purpose of making learning enjoyable and effective.

**Ms. Reeta Bhargava
Principal**

Summary

The Graphic novel ‘Rendezvous with nature in Kerala ‘ . The biggest aspect is to make the students aware and become environment sensitive. To ensure that students understand the concept of natural resources.

- **Incorporate sensitivity in the students towards environmental issues.**
- **Enhance their understanding of optimum utilization of the resources.**
- **Encourage students to understand the cyclic flow of nutrients in surroundings.**



The Education Committee of
The Maheshwari Samaj (Society), Jaipur

Legacy of ECMS

