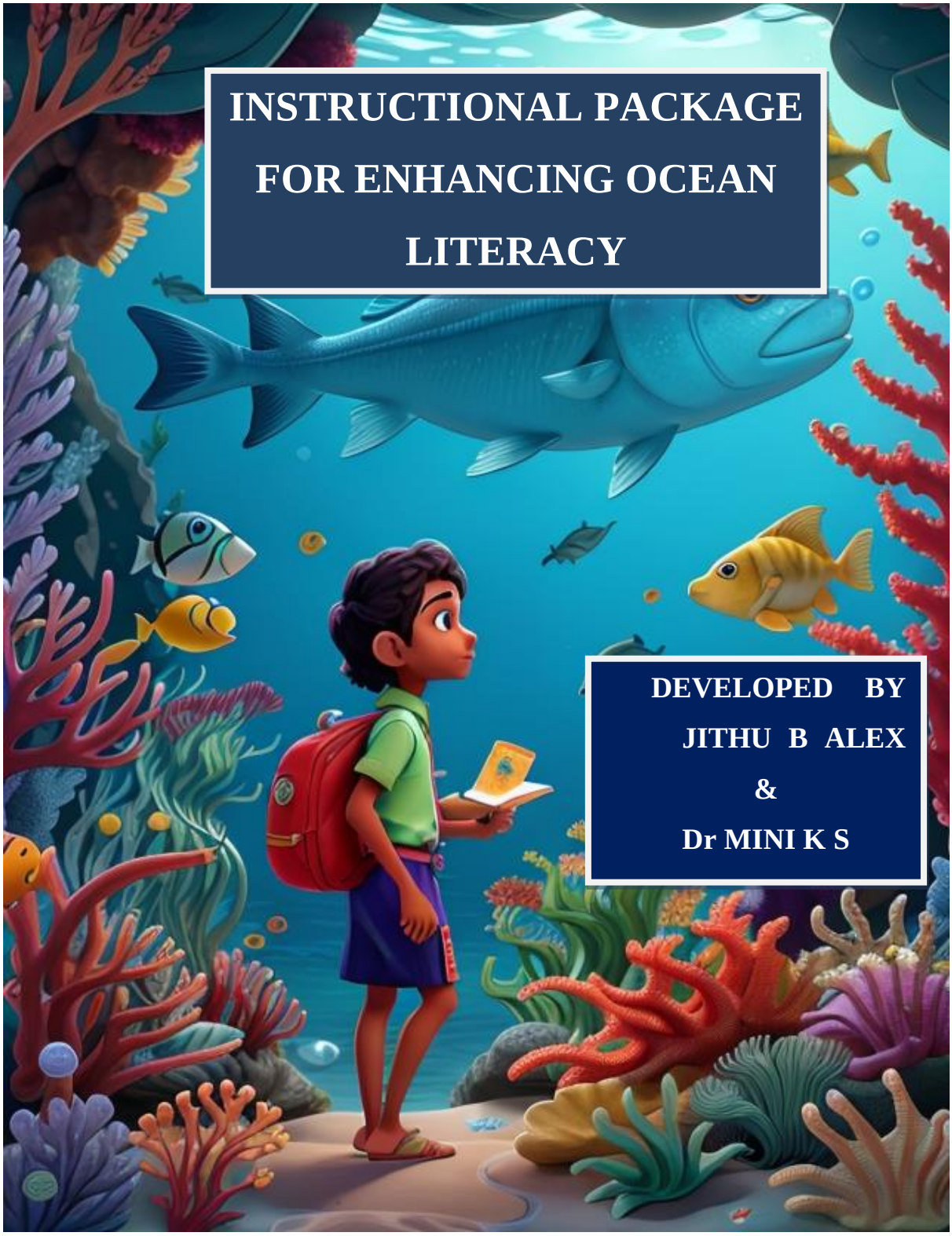


INSTRUCTIONAL PACKAGE FOR ENHANCING OCEAN LITERACY

DEVELOPED BY
JITHU B ALEX
&
Dr MINI K S

Instructional package 1:

The Earth has one big ocean with many features (part- I)

Name of The Teacher	**-**	**Jithu B Alex**
Name of The School	**-**	
Time Required	**-**	**1 hr**
Subject	**-**	**Ocean Literacy Enhancement**
Topic	**-**	**The Earth has one big ocean with many features**

Objective: To introduce the concept of the ocean as a global interconnected system and familiarise students with the different features of the ocean.

Curricular objectives :

- To develop awareness on the earth has one big ocean with many features.
- To Identify the different types of oceans such as the Pacific Ocean, Atlantic Ocean, Indian Ocean, Arctic Ocean, and Southern Ocean.
- To describe the various features of the ocean.
- To Understand the interconnectedness of oceans.
- To Understand Ocean Basins are composed of the Seafloor and of its geologoical features.
- To understand the earth's highest peaks, deepest valleys and flattest plains are all in the ocean.

Skills

- Critical Thinking, Communication Skills, Observation skills:

Instructional Materials:

- Map
- Interactive digital map of the world's oceans.
- Videos and animations illustrating ocean currents, tides, and the water cycle.
- Booklet

Strategy

ICT – Oriented

Phase 1

Orientation

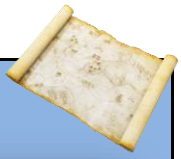
The teacher begins the class by building rapport and asks some questions about the ocean.

- What percentage of Earth's surface is covered by the ocean?
- How many ocean basins are there?
- What are some examples of geological features found on the seafloor?
- What causes the sea level to change?
- What are some unique properties of seawater?
- How is the ocean connected to major lakes, watersheds and waterways?

Students respond actively and share their knowledge about the ocean.

Phase 2

Presentation



Activity 1

The teacher displays a World Map on the projector screen, showing the names of different oceans. The teacher divides the class into 5 groups the Pacific Ocean, the Atlantic Ocean, the Indian Ocean, the Arctic Ocean, and the Southern Ocean. The teacher then distributes five world maps to each group to locate and mark the names of the oceans displayed on the computer screen on their respective maps. Instructs them to identify the areas that are blue-coloured and compare the size with other areas. instructs students to mark the ocean interconnectedness from the map, and identify those areas from the map presented in the slide.

Slides

Students identify the oceanic regions represented by the colour blue on the map. They recognise that these areas are significantly larger compared to the landmasses depicted. The students carefully locate and mark each ocean on their maps, and dents gain a visual understanding of the vastness and scale of the Earth's oceans.

Students locate areas that showcase ocean interconnectedness on the map. They mark the Panama Canal, connecting the Atlantic and Pacific Oceans, as well as the Strait of Malacca, which connects the Indian Ocean with the Pacific Ocean, the Bering Strait, situated between the Pacific Ocean and the Arctic Ocean, recognizing its importance as a passageway for water and marine life exchange. Drake Passage on their maps, noting its significance as a connection between the Atlantic Ocean and the Southern Ocean, The Mozambique Channel, which connects the Indian Ocean with the Atlantic Ocean

The teacher distributes a booklet to each group, containing in-depth information about each ocean basins and instructed the groups to thoroughly understand the features and characteristics of their assigned ‘ocean group’ and engage in a debate with the other groups.

Pacific Ocean

- **Size and Geography:** The Pacific Ocean is the largest and deepest ocean basin, covering more than one-third of the Earth's surface. It stretches from the western coasts of the Americas to the eastern coasts of Asia and Australia.
- **Ring of Fire:** The Pacific Ocean is surrounded by the "Ring of Fire," an area with intense tectonic activity, resulting in frequent earthquakes, volcanic eruptions, and tsunamis.
- **Marine Biodiversity:** The Pacific Ocean is a biodiversity hotspot, home to numerous unique and endangered species, including the iconic marine life of the Great Barrier Reef.
  - **Resource Exploitation:** The Pacific Ocean is rich in natural resources, including fish, minerals, and oil, leading to debates on sustainable resource management and conservation
  - **Climate Regulation:** The Pacific Ocean plays a crucial role in regulating global climate patterns through ocean-atmosphere interactions like El Niño and La Niña.

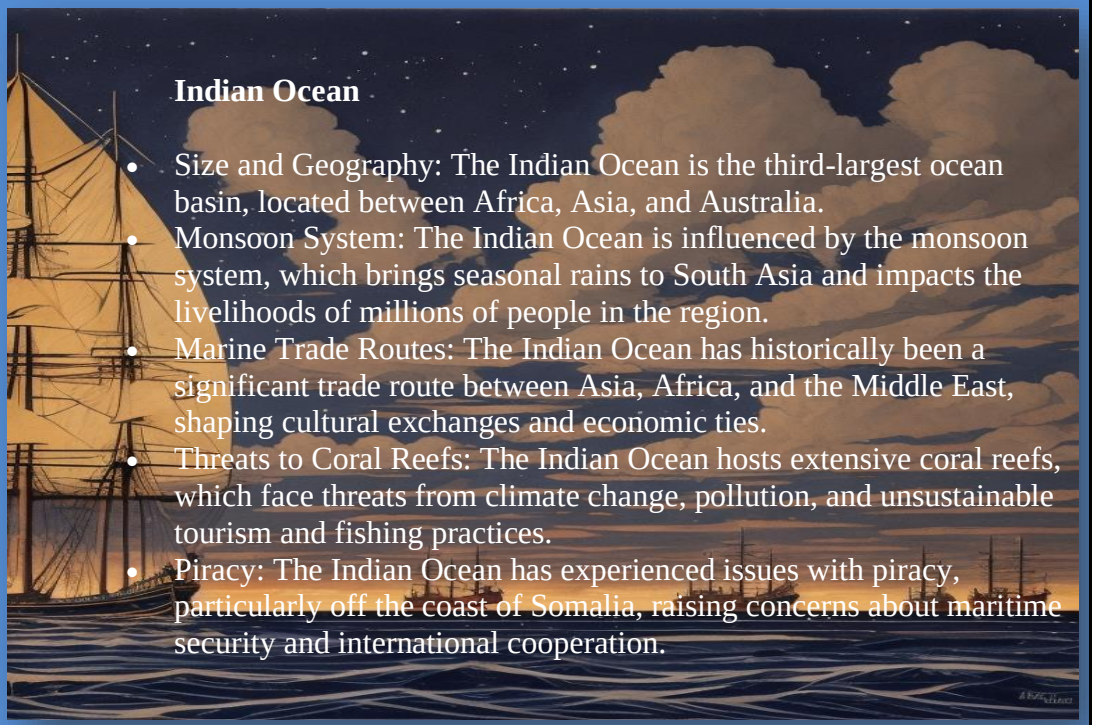
Atlantic Ocean

- Size and Geography: The Atlantic Ocean is the second-largest ocean basin, covering approximately 20% of the Earth's surface. It separates the Americas from Europe and Africa.
- Ocean Currents: The Atlantic Ocean is known for its major ocean currents, such as the Gulf Stream, which significantly influences weather patterns and climate along the eastern coasts of North America and Europe.
- Biodiversity: The Atlantic Ocean supports diverse marine ecosystems, including the Sargasso Sea, known for its unique floating seaweed habitat and the rich biodiversity it hosts.
- Economic Importance: The Atlantic Ocean plays a crucial role in global trade, providing major shipping routes that connect Europe, the Americas, and Africa.
- Environmental Concerns: Pollution and overfishing are significant challenges facing the Atlantic Ocean, threatening marine life and coastal communities.

Southern Ocean

- **Unique Circumpolar Current**: The Southern Ocean is characterized by the Antarctic Circumpolar Current, which flows eastward and is a critical driver of global ocean circulation.
- **Climate Change Impact**: The Southern Ocean plays a crucial role in regulating the Earth's climate, and its melting ice shelves contribute to rising sea levels
- **Marine Conservation**: The Southern Ocean is home to diverse marine life, including penguins, seals, and whales, leading to discussions about protecting these unique ecosystems.

- **Scientific Exploration:** The Southern Ocean is relatively less explored compared to other ocean basins, providing opportunities for scientific research and discovery.
- **International Cooperation**: The governance of the Southern Ocean requires international collaboration due to its remote and challenging conditions.



Indian Ocean

- Size and Geography: The Indian Ocean is the third-largest ocean basin, located between Africa, Asia, and Australia.
- Monsoon System: The Indian Ocean is influenced by the monsoon system, which brings seasonal rains to South Asia and impacts the livelihoods of millions of people in the region.
- Marine Trade Routes: The Indian Ocean has historically been a significant trade route between Asia, Africa, and the Middle East, shaping cultural exchanges and economic ties.
- Threats to Coral Reefs: The Indian Ocean hosts extensive coral reefs, which face threats from climate change, pollution, and unsustainable tourism and fishing practices.
- Piracy: The Indian Ocean has experienced issues with piracy, particularly off the coast of Somalia, raising concerns about maritime security and international cooperation.

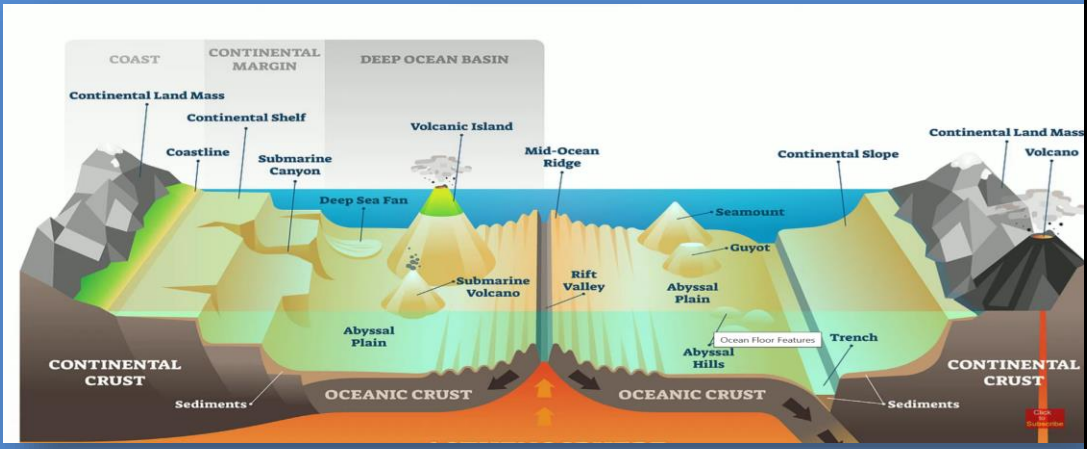
Arctic Ocean Basin:

- Climate Change and Melting Ice: The Arctic Ocean is experiencing rapid ice melt due to global warming, leading to environmental, economic, and geopolitical implications.
- Resource Exploitation: Melting ice has opened up new opportunities for resource extraction, such as oil and gas, raising debates about environmental impacts and sustainable practices.
- Indigenous Peoples and Culture: The Arctic region is home to various indigenous communities with unique cultures and traditional knowledge, necessitating discussions about preserving their way of life.
- Maritime Routes: The receding ice has also opened up the possibility of new shipping routes, which can significantly reduce transit times between Europe and Asia but pose environmental risks.
- International Law and Governance: The Arctic's changing conditions bring up questions about sovereignty, resource rights, and the need for international cooperation in the region.

Students thoroughly explore the rich information about their assigned ocean. They immerse themselves in understanding the distinct features, characteristics, and fascinating details specific to their ocean. Equipped with an in-depth understanding of their assigned ocean, students engage in a spirited debate with other groups. They passionately present their findings, highlighting the unique aspects of their ocean and defending their viewpoints against counterarguments.

The teacher consolidates the whole content about each ocean to the class.

The teacher shows an image that contains basic information about ocean basins that are Ocean basins are composed of the seafloor and all of its geological features (such as islands, trenches, mid-ocean ridges, and rift valleys) and vary in size, shape and features due to the movement of Earth's crust (lithosphere).



Students understand ocean basins are composed of the seafloor and all of its geological features (such as islands, trenches, mid-ocean ridges, and rift valleys) and vary in size, shape and features due to the movement of Earth's crust. (lithosphere).

- The teacher shows different slides to comparison of Earth's highest peak mountain Everest and the sea mount Mauna Kea. Teacher asks students to find out their observations from the comparison.
- Teacher shows two slides with an image and description of the deepest part of the earth Mariana Trench and the earth's flattest abyssal plain.

Slide

Mauna Kea
Located on the Big Island of Hawaii, USA. Its peak stands at 13,796 feet (4,205 meters) above sea level. If measured from its base on the ocean floor, Mauna Kea rises about 33,500 feet (10,210 meters), making its total height even greater than that of Mount Everest.

Mount Everest
The tallest mountain in the world, situated in the Himalayas and straddles the border between Nepal and the Tibet region of China. It rises 29,032 feet (8,849 meters) above sea level. If measured from sea level, it's the highest point on Earth.

Slide

Location

The Mariana Trench is located in the western Pacific Ocean, east of the Philippines. It is the deepest part of the world's oceans, with a maximum depth of 36,070 feet.

Slide

An abyssal plain is an underwater plain on the deep ocean floor, usually found at depths between 3,000 and 6,000 metres (9,800 and 19,700 ft). Lying generally between the foot of a continental rise and a mid-ocean ridge, abyssal plains cover more than 50% of the Earth's surface.They are among the flattest, smoothest, and least explored regions on Earth

Students understand Earth’s highest peak is Mauna Kea when it is measured from the ocean floor, the deepest valleys are the Mariana Trench and the flattest plain is the Abyssal Plain. These all are found in the ocean

Phase 3

Application

The teacher asks students to find out which Counties have coasts with the Indian Ocean from the map given.

Students identify the counties that have coast with the Indian Ocean.

Phase 4

Consolidation

The ocean is the defining physical feature on our planet Earth, covering approximately 70% of the surface. While there is one vast ocean, it encompasses various ocean basins including the North Pacific, South Pacific, North Atlantic, South Atlantic, Indian, Southern, and Arctic. These ocean basins are made up of the seafloor and its geological features such as islands, trenches, mid-ocean ridges, and rift valleys. The movement of Earth's crust, or lithosphere, causes these basins to vary in size, shape, and features. In fact, Earth's highest peaks, deepest valleys, and flattest plains are all found within the ocean.

Phase 5

Assessment and Extension Activities

Find out all island countries from the map given.

Instructional package 2: The Earth has one big ocean with many features (part- II)

Name of The Teacher	**- Jithu B Alex**
Name of The School	**-**
Time Required	**- 1 hr**
Subject	**- Ocean Literacy Enhancement**
Topic	**- The Earth has one big ocean with many features**

Objective: To introduce the concept of the ocean as a global interconnected system and familiarise students with the different features of the ocean.

Curricular Objectives :

- To understand the interconnectedness of oceans.
- To demonstrate how ocean currents circulate.
- To observe the effects of sea-level changes through an interactive experiment involving ice cubes and water.
- To visualise the “global ocean conveyor belt” concept.
- To explain the role of the ocean in shaping the Earth's climate and weather pattern
- To demonstrate the relationship between tectonic plate movement and localized sea level variations.
- To demonstrate to students the implications of ice cap melting on global sea level rise.

Skills

- Critical Thinking, Communication Skills, and Observation skills.

Instructional Materials:

- Interactive digital map of the world's ocean, highlighting its various features.
- Videos and animations illustrating ocean current flow.

Strategy

- Demonstration, ICT – Oriented

Phase 1
Orientation

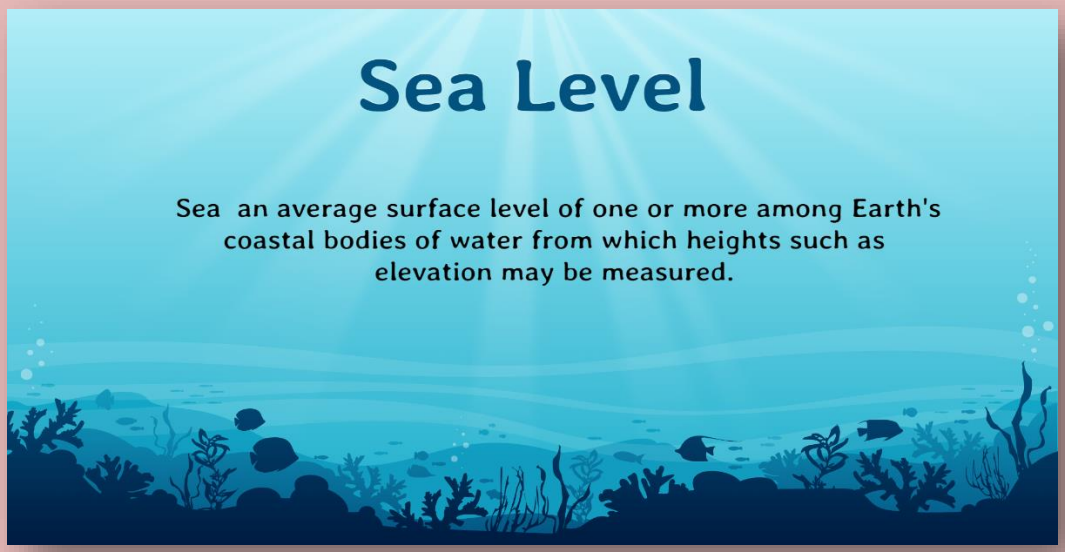
The teacher begins the class by building rapport and asking students about sea level and evaporation.

Students respond with their ideas about sea level and evaporation.

Phase2
Presentation

The teacher introduces the concept of Sea Level in the class by using a slide and demonstrates an experiment that shows the sea level rise by melting ice in polar regions.

Slide -



Demonstration

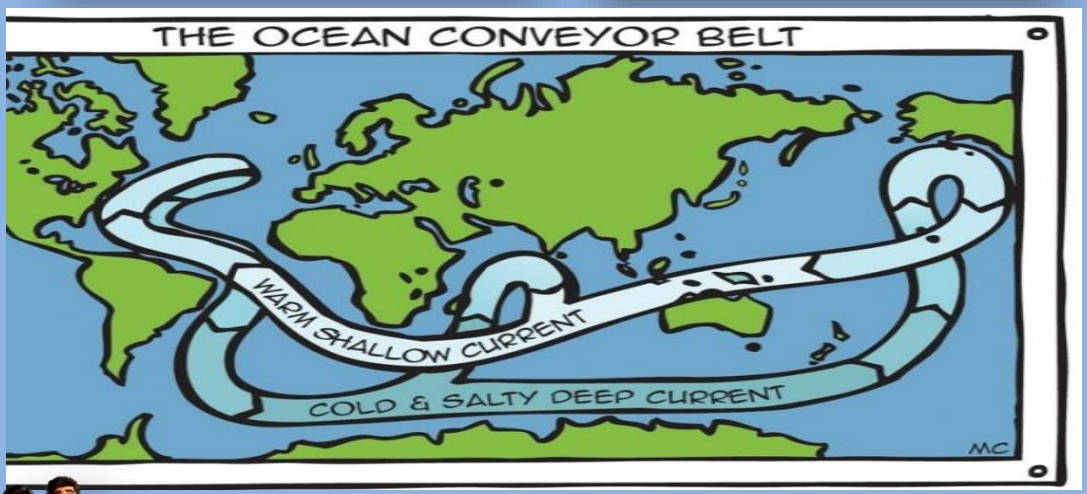
The teacher Sets a rectangular glass tank on a stable surface. The teacher fills the tank with water, leaving some space at the top. The teacher marks the initial water level on the tank using a marker or tape to represent the current sea level. Places the small land area (representing a landmass) at one end of the tank, ensuring it is submerged and touches the bottom of the tank. Asks the students to observe and mark the water level. Introduce the concept of tectonic plate movement and explain that the land area represents a region affected by these movements. Carefully and slowly shift the land area towards the other end of the tank to simulate tectonic plate movement. As the land area moves, the students should notice that the water level rises at the opposite end of the tank, indicating an increase in sea level.
Measures and records the final water level, indicating the sea level rise caused by the movement of the landmass due to shifting tectonic plates.

Then teacher removes the land area from the tank and return the water level to the initial marked level. Explain that another factor affecting sea level is the melting of ice caps. Place ice cubes or an ice block into the water, representing melting ice caps and their contribution to sea level rise. Allow the ice to melt and ask students to observe and record any changes in the water level. Measure and record the final water level after the ice has completely melted. Summarises the experiments and emphasises that both tectonic plate movement and melting ice caps can cause an increase in sea level. Encourage students to reflect on the potential consequences of rising sea levels, such as coastal flooding, erosion, and habitat loss. Teacher reminds students that these experiments are simplified representations and that the actual processes involved are more complex and occur over longer timeframes.

Students understand concept that both tectonic plate movement and melting ice caps can lead to an increase in sea level. They comprehend the impact of these factors on the Earth's coastal areas.

Demonstration

The teacher uses a rectangular tank to demonstrate ocean currents. warm water, dyed with food colouring, is placed at one end and ice cubes at the other. As warm water has more kinetic energy and is less dense, it moves towards the cooler end, displacing the colder, denser water which flows back to the warmer end. This circulation in the tank mirrors how water current function. Warm water from the equator moves towards the poles in the ocean, and cold water from the poles flows to the equator, creating the "ocean conveyor belt" which distributes heat and influences climate. After demo teacher shows an animated images of ocean current flow.



Students get enough idea about ocean current flow and realise that how heat differences and density differences influence ocean current flow. Students understand the concept of the ocean conveyor belt.

The teacher shows a picture of a natural pond in a slide and explains that ponds are connected to the ocean, exchanging water through certain pathways. Determine how the ocean is connected to ponds.

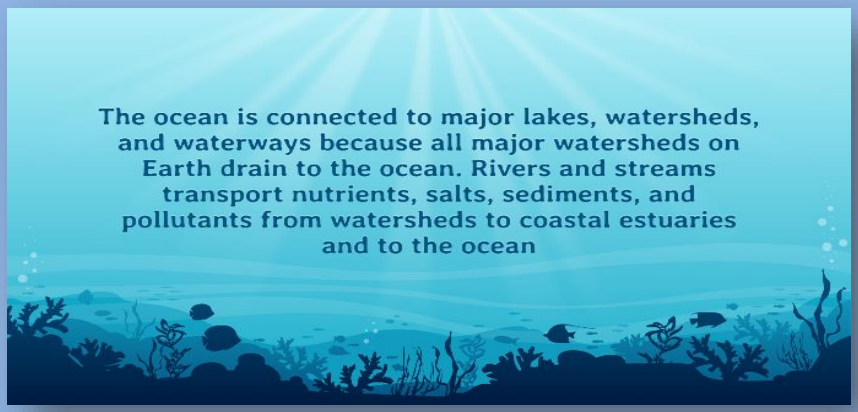
Slide

With or without the teacher's help, students discovered that the ocean is connected to ponds through the process of evaporation. Through evaporation, water circulates all over the world and returns as rain.

The teacher consolidates the idea with a slide.

Teacher shows an image of world river map in a slide and asks them to check the end poins of most of the rivers and other waterbodies.
and shows a slide about how ocean is connected to other waterbodies.

Slide



Students understands that the ocean is connected to major lakes, watersheds, and waterways because all major watersheds on Earth drain to the ocean. Rivers and streams transport nutrients, salts, sediments, and pollutants from watersheds to coastal estuaries and to the ocean.

Phase 3 Application

The teacher asks them to locate the coastal areas around the world on the given map. Discuss the potential impact of sea level rise on these areas due to factors such as melting ice caps.

Students discovered that global coastal areas are under threat from increasing sea levels because of melting ice caps. Key concerns include land submersion, infrastructural damage, changes to crucial ecosystems, and the danger of saltwater contaminating freshwater resources. Addressing climate change is crucial to protect these at-risk zones.

Consolidation

The teacher consolidates the whole content that the ocean covers about 70% of Earth's surface and is composed of interconnected ocean basins. These basins have various geological features and are influenced by the movement of Earth's crust. The ocean circulation system, powered by factors like wind, tides, and the Sun, transports energy, matter, and organisms throughout the basins. Changes in ocean circulation affect climate and ecosystems. Sea level fluctuates due to plate tectonics, melting/growth of ice caps, and expansion/contraction of seawater. The ocean holds 97% of Earth's water and has unique properties. It plays a crucial role in the water cycle and is connected to other water reservoirs. Major watersheds on Earth drain into the ocean, linking it to lakes, rivers, and streams. Although the ocean is vast, its resources are limited.

Assessment and Extension Activities:

Mark the interconnected areas of the Oceans in Maps.

Name of The Teacher - **Jithu B Alex**

Name of The School -

Time Required - **45 minutes**

Subject - **Ocean Literacy Enhancement**

Topic - **The ocean and life in the ocean shape the features of the Earth**

Objective: To explore how marine life and processes shape the Earth's features and raise awareness about the importance of ocean ecosystems.

Curricular objectives

- To Understand Basic Geological Concepts.
- To identify how different rocks form under the ocean
- To comprehend Hydrothermal Vent creators
- To explore how various marine organisms, especially shellfish, extract carbon from the ocean to form their exoskeletons and understand the significance of these processes in the carbon cycle.
- To critically analyse the cause-effect relationships between marine life, geological processes, and the Earth's features.
- To understand the Human Impact on Oceanic Processes
- To apply Knowledge in Real-World Contexts

Skills : Critical thinking skill, communication skill

Instructional Aids: Pictures, slides, Rock stone, Shellfish, Video Content.

Strategies: Discussion, Demonstration, Grouping , ICT-Orientetd

Phase 1

Orientation

The teacher asks questions to assess their understanding of the deeper intricacies of the ocean: “Have any of you ever examined a seashell and wondered how it's formed or why it's so hard? Have you ever thought about why beaches are sandy, or why coastlines shift over time?

Students responded with their own insights

Phase 2 Presentation.

The teacher distributes students an ordinary rock stone with some features.
Teacher asks students to identify the peculiarities of those stone

Students observed that certain shellfish adhere to stones.

The teacher explains that the stone originated from the land and fell into the ocean. Over time, shellfish adhered to the stone, and their shells became integrated into its structure.

Demonstration

The teacher displays specimens of shellfish exoskeletons, asks the students to identify the organisms and determine their common characteristics

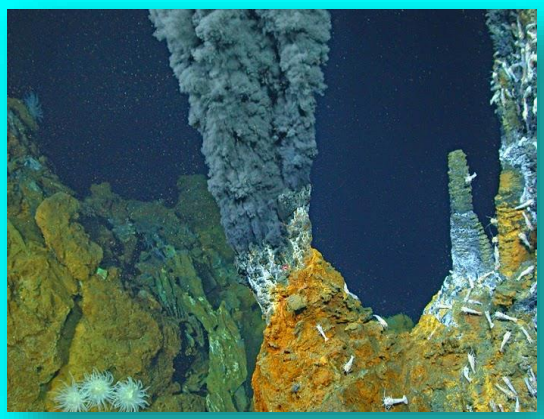
Students identify the local name of organisms Clam(കക്ക),Mussel (കല്ലുമ്മകായ)
Oyster - Oyster (മുത്തുച്ചിപ്പി), Sankh(ശംഖ്)
The students noticed that the shells were hard to protect inside, there was a space for the creature, and there were openings for it to move and eat.

The teacher explains that we commonly call these organisms as molluscs, Mollusc shells are primarily composed of calcium carbonate ($CaCO_3$). Molluscs extract calcium and carbonate from their surroundings and secrete an organic matrix to guide crystal formation. On this matrix, calcium carbonate crystallizes in distinct layers. The exact structure of the shell can vary based on the species. Moreover, molluscs have the ability to repair damaged shells by depositing additional calcium carbonate. Shellfish sequester carbon by incorporating it into their calcified shells and tissues. As they grow, they extract carbon from the water and trap it in solid form, contributing to the ocean's natural process of carbon storage and regulation.

The teacher plays a video that explains why shell reefs are important for the sustenance of nature. https://youtu.be/nwUpTROuV4I

Students understand that shellfishes help to clean oceans and backwaters, they absorb carbon largely for their shell formation and other needs. Shellfish are also under the threat of extinction due to over-capturing them. There are many governmental and non-governmental projects for the sustainment of shellfish.

The teacher displays images of underwater rocks and asks the students, “These stones formed under the sea, but they have different shapes and colours. Why do you think they vary in shape?”



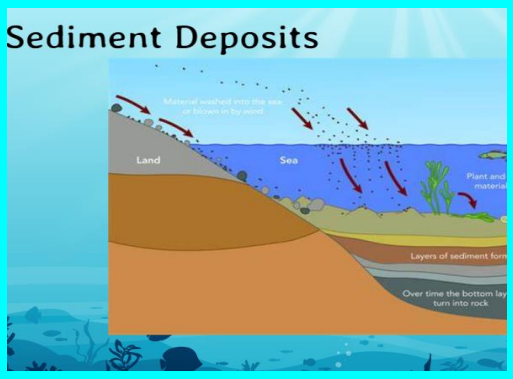
Students respond with their own insights

The teacher uses slides to explain how different types of rocks form, including those made by coral reefs, sediment deposits, and hydrothermal vents.

Slides-1

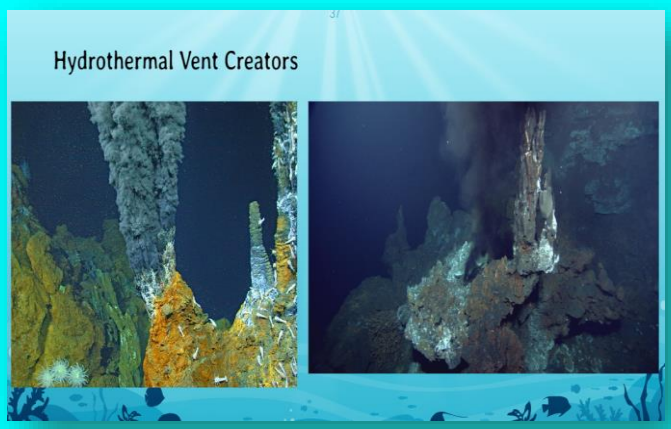
Coral reefs, primarily formed by tiny animals called coral polyps, extract calcium and bicarbonate ions from seawater to create protective calcium carbonate skeletons. As polyps die, new ones grow atop the old skeletons, layering and accumulating over centuries. These layers are cemented together with more calcium carbonate, binding coral fragments, sediments, and shells into a solid structure. Meanwhile, organisms like parrotfish erode but also enable fresh growth, further solidifying the structure. This ongoing process of growth, sedimentation, and natural cementation over time transforms coral accumulations

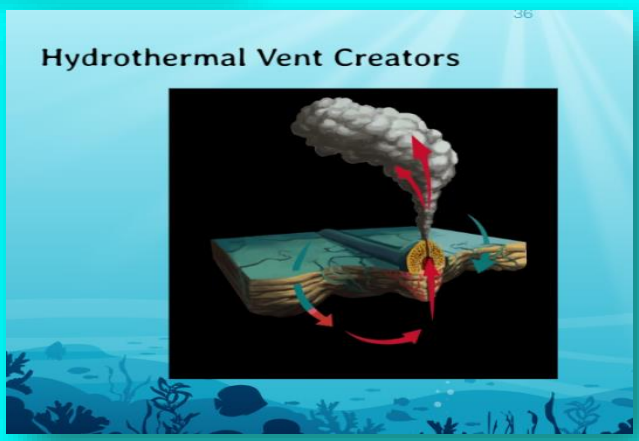
Slide-2



Sediment deposits underwater gradually form rock through a process called lithification. Initially, sediments like sand, silt, and clay accumulate on the ocean floor. Over time, as more sediments deposit on top, the layers below experience increased pressure, compacting them. Minerals from the surrounding water then act as a cement, binding these compacted particles together. This combination of compaction and cementation over long periods transforms loose sediments into solid rock, such as shale, sandstone, or limestone

Slide-3





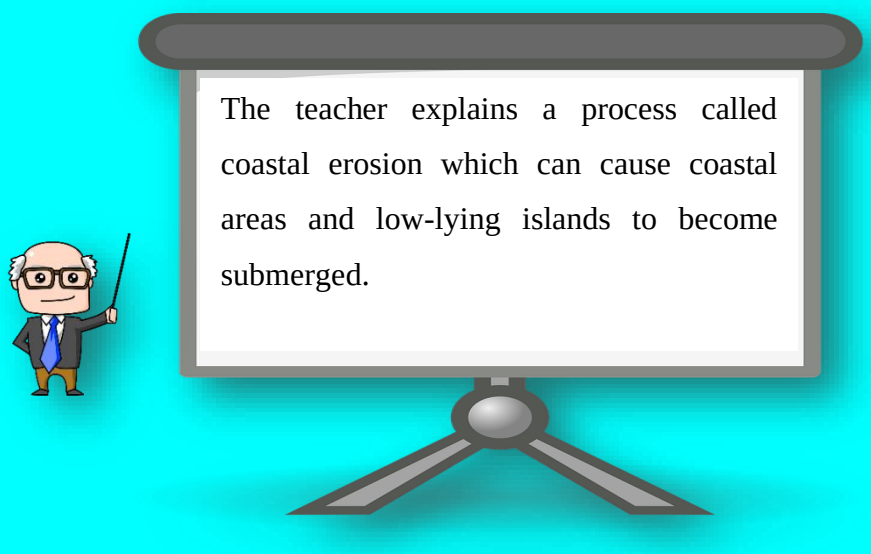
Hydrothermal vents in the ocean release superheated, mineral-rich water. As this hot fluid encounters the cold surrounding seawater, the rapid temperature drops causes minerals to precipitate out and solidify. Over time, these mineral deposits accumulate, forming distinctive chimney-like rock structures on the ocean floor.

Students understand the different types of rock formations under the ocean and the reasons behind them

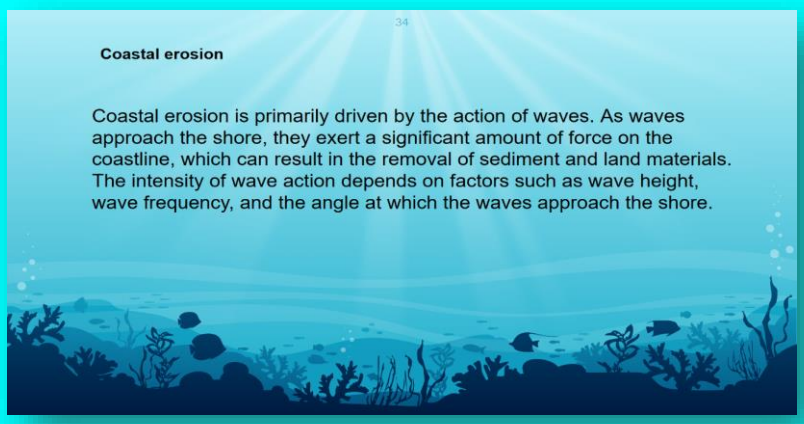
Demonstration

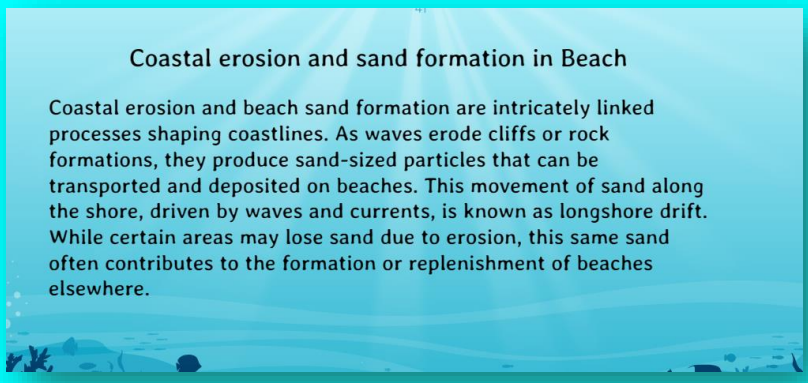
The teacher recalls the experiments from the previous class, which demonstrated sea level rise due to ice melting, and plate tectonics. The teacher asks the students, 'What will happen if the sea level rises?

Students responds that the coastal areas and low-lying islands may become submerged, displacing millions of people and leading to a refugee crisis.


The teacher explains a process called coastal erosion which can cause coastal areas and low-lying islands to become submerged.

Slide


Coastal erosion
Coastal erosion is primarily driven by the action of waves. As waves approach the shore, they exert a significant amount of force on the coastline, which can result in the removal of sediment and land materials. The intensity of wave action depends on factors such as wave height, wave frequency, and the angle at which the waves approach the shore.


Coastal erosion and sand formation in Beach
Coastal erosion and beach sand formation are intricately linked processes shaping coastlines. As waves erode cliffs or rock formations, they produce sand-sized particles that can be transported and deposited on beaches. This movement of sand along the shore, driven by waves and currents, is known as longshore drift. While certain areas may lose sand due to erosion, this same sand often contributes to the formation or replenishment of beaches elsewhere.

Non scientific construction and Coastal erosion

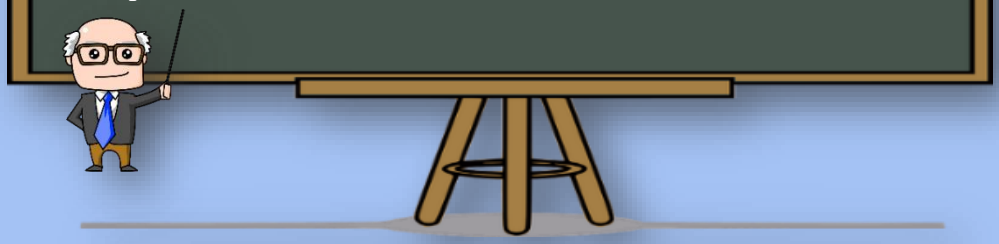
Human-made coastal structures, such as groins, jetties, and sea walls, significantly influence coastal sediment dynamics by interrupting natural littoral drift. Groins, built perpendicular to the shore, can arrest sediment movement, leading to accretion on the updrift side but increased erosion downdrift. Jetties, designed to protect harbor entrances, similarly disrupt sediment flow, causing an imbalance in sediment deposition and removal. Sea walls, constructed parallel to the coast, reflect wave energy, often intensifying beach erosion directly in front of them. Although these structures might serve localized purposes, their broader impacts can inadvertently exacerbate coastal erosion, emphasizing the need for a comprehensive understanding of sediment transport in coastal engineering decisions.

Students grasp the concept of coastal erosion and the factors contributing to it. They learn that beach sand originates from both coastal and land sources and is seasonally redistributed by waves and coastal currents.

Phase 3

Application :

The teacher divides the class into 3 groups and facilitates a "role-play" activity. Each group is assigned a specific role (coral reef builders, sediment depositors, hydrothermal vent creators,). The teacher conducts a class-wide discussion, reflecting on the activity. Students share their insights about their roles, and how these elements interact to shape Earth's features.



Students manipulate their ocean-floor landscapes, they're encouraged to describe the processes and outcomes of their actions. students critically analyse and understand the cause-effect relationship between the ocean, its life forms, and Earth's features.

Group -1

Biodiversity: Students realised that coral reefs are like underwater cities. They house 25% of marine life while occupying only a small fraction of the ocean." Symbiotic Relationships: "The relationship between the polyps and zooxanthellae is fascinating. It's a mutual relationship where both benefit." Threats to Reefs: "We were alarmed to discover how vulnerable coral reefs are to human activities like pollution, overfishing, and climate change." Importance of Coral Reefs: "They protect coastlines from erosion and are important for tourism and fishing industries."

Group 2

Sediment Depositors: Formation: "Sediments come from various sources, including eroded rocks and decaying organisms. Over time, these sediments can harden to form rocks." Role in Landforms: "Different types of sediment deposition lead to diverse landforms. For example, when rivers slow down upon reaching the sea, they deposit sediments, forming deltas." Erosion: "We saw how water, wind, and ice erode rocks and carry them as sediments to other places. It's a continuous cycle." Impact of Human Activities: "Activities like deforestation can speed up erosion, which can lead to more sediment entering rivers and streams."

Group 3

Hydrothermal Vent Creators:

Unique Ecosystem: The life around hydrothermal vents is astounding. Without sunlight, organisms rely on chemosynthesis for energy."

Formation: "These vents form at places where tectonic plates are moving apart. Cold sea water meets hot magma, resulting in mineral-rich plumes."

Extreme Conditions: "The pressure is immense, and the temperatures are very high, yet life thrives there."

Scientific Importance: "Studying these vents can give insights into Earth's early life and even life on other planets."

Phase 4
Consolidation
The teacher consolidates the key lessons from the class, emphasizing how the ocean plays a pivotal role in shaping Earth's geographical features. Both shellfish and coral reefs act as vital agents in purifying the ocean by absorbing carbon. Hydrothermal vent creators, with their unique geological activity, contribute significantly to the formation of certain underwater rocks. It's notable that sedimentary rocks while originating in the ocean, can also be found on land. The ever-changing contours of coastlines are largely influenced by sea levels and the constant waves. Coastal areas experience erosion due to factors like wind, waves, and currents. Moreover, the ocean, being a significant carbon reservoir, exerts a profound influence on the physical attributes of coastlines.

Phase 5
Assessment and Extension Activities:

- Construct a detailed and scientifically accurate model of an ocean floor landscape, (considering the geological processes and marine life they've learned about).
- Prepare a report explaining the model's features, the processes involved, and how these features might change due to human impacts on the ocean.

Instructional package 4: The ocean is a major influence on weather and climate

Name of the Teacher	**-**	**Jithu B Alex**
Name of the School	**-**	
Time Required	**-**	**45 minutes**
Subject	**-**	**Ocean Literacy Enhancement**
Topic	**-**	**The ocean is a major influence on weather and climate**

Objective: To explore the role of the ocean in weather patterns and climate regulation, and understand the impact of oceanic phenomena on global climate systems.

Curricular Objectives:

- To recollect the concept of Global Warming
- To Analyse the correlation between Global Weather and Global Ocean
- To Explore the concept of two climate phenomena's called El Niño and La Niña
- To Recognise that the condensation of water that evaporates from warm Ocean provides the energy for hurricanes and cyclones.
- To Understand the Concept of the carbon cycle.
- To identify Ocean holds 50 times more CO_2 than atmosphere

Skills **:** Critical Thinking, Deductive Thinking, Collaborative Learning

Instructional Aids : Video, Slide, Image.

Strategies **:** Ocean Carbon Cycle Simulation Game, Collaborative Learning.

Phase 1

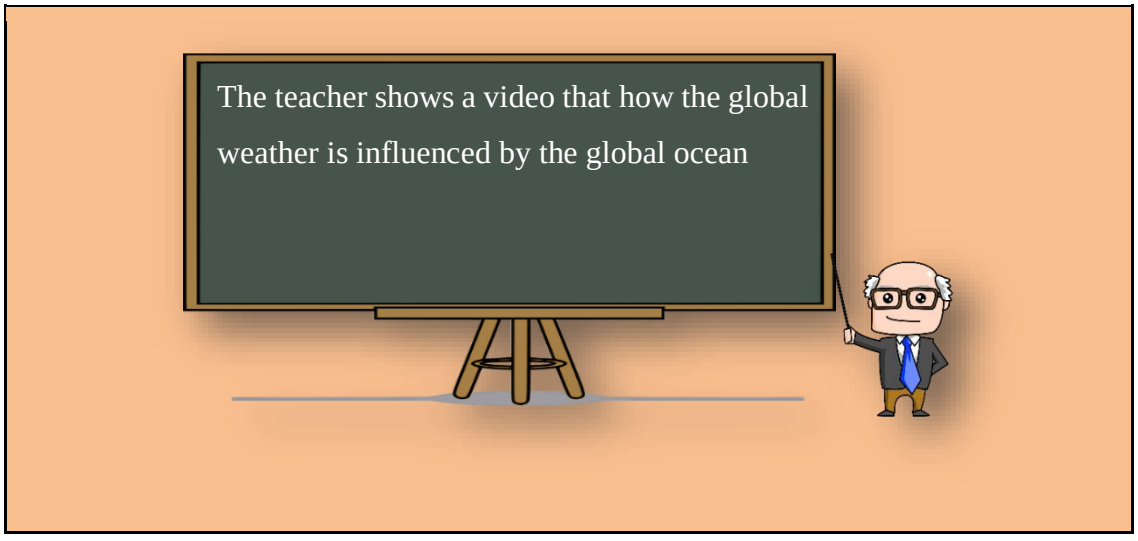
Orientation

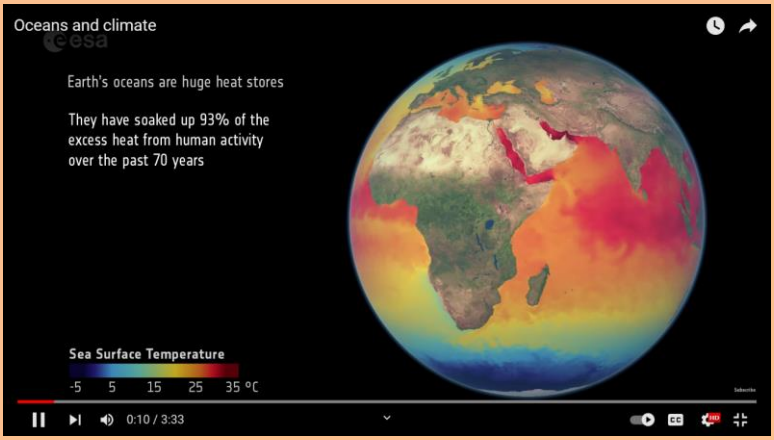
The teacher asks the students to recollect their understanding of global warming from prior years of study and share it in the class.

Global warming refers to the long-term increase in Earth's average surface temperature due to human activities, mainly the emission of greenhouse gases like carbon dioxide from burning fossil fuels, deforestation, and other industrial processes. Think of it like our planet getting a fever because of too much pollution.

Global warming has been in progress for at least 70-100 years. Have you ever considered where all this excess heat and carbon absorbed? Let's explore this topic in this chapter

Phase 2 Presentation:

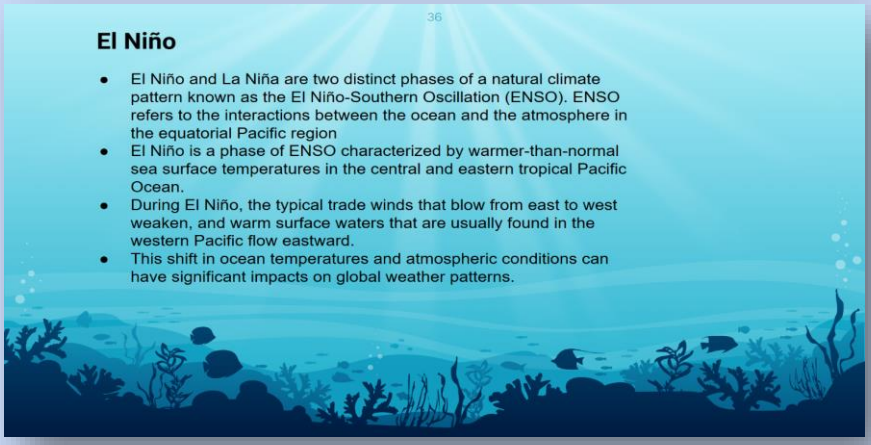


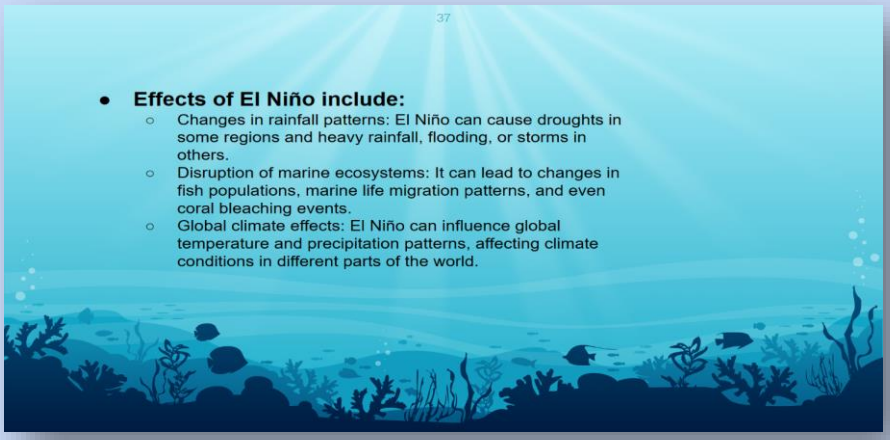


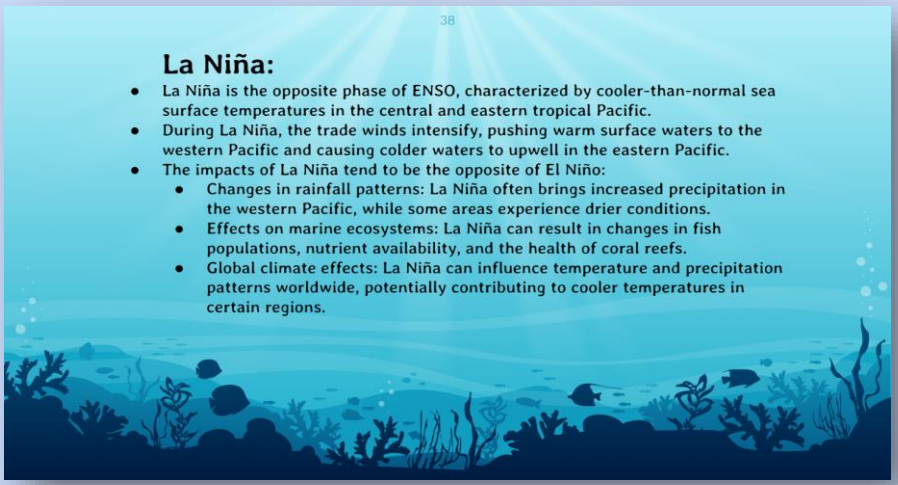
Students understand the significant role of Earth's oceans as vast thermal reservoirs, absorbing approximately 93% of the surplus heat resulting from human activities over the last 70 years. Ocean currents play an essential role in the redistribution of this heat globally, transferring warmth from the Equator to the poles. The fate of this oceanic heat significantly affects weather formations and regional climatic patterns. Beyond their heat-absorbing capacity, the oceans act as natural carbon sinks, sequestering nearly a quarter of carbon dioxide emissions attributed to human endeavours. This absorption has consequently led to the acidification of ocean waters, posing risks to marine ecosystems.

The teacher focuses the students' attention on two critical climate phenomena: El Niño and La Niña and starts explaining with slides and video aids.

Slide


36
El Niño
El Niño and La Niña are two distinct phases of a natural climate pattern known as the El Niño-Southern Oscillation (ENSO). ENSO refers to the interactions between the ocean and the atmosphere in the equatorial Pacific region
El Niño is a phase of ENSO characterized by warmer-than-normal sea surface temperatures in the central and eastern tropical Pacific Ocean.
During El Niño, the typical trade winds that blow from east to west weaken, and warm surface waters that are usually found in the western Pacific flow eastward.
This shift in ocean temperatures and atmospheric conditions can have significant impacts on global weather patterns.

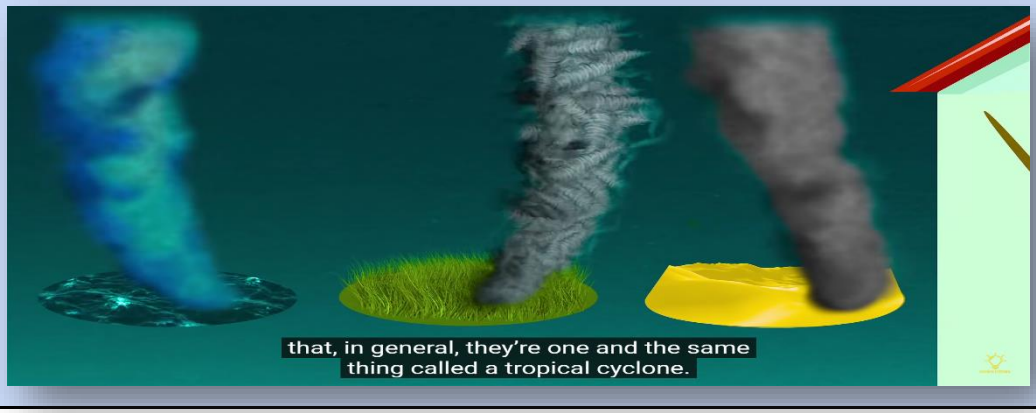

37
Effects of El Niño include:
Changes in rainfall patterns: El Niño can cause droughts in some regions and heavy rainfall, flooding, or storms in others.
Disruption of marine ecosystems: It can lead to changes in fish populations, marine life migration patterns, and even coral bleaching events.
Global climate effects: El Niño can influence global temperature and precipitation patterns, affecting climate conditions in different parts of the world.


38
La Niña:
La Niña is the opposite phase of ENSO, characterized by cooler-than-normal sea surface temperatures in the central and eastern tropical Pacific.
During La Niña, the trade winds intensify, pushing warm surface waters to the western Pacific and causing colder waters to upwell in the eastern Pacific.
The impacts of La Niña tend to be the opposite of El Niño:
Changes in rainfall patterns: La Niña often brings increased precipitation in the western Pacific, while some areas experience drier conditions.
Effects on marine ecosystems: La Niña can result in changes in fish populations, nutrient availability, and the health of coral reefs.
Global climate effects: La Niña can influence temperature and precipitation patterns worldwide, potentially contributing to cooler temperatures in certain regions.

Students understand the concept of El Niño and La Niña including their causes, effects, and significance in global climate patterns. Students identifies the factors contributing to the development of El Niño and La Niña, comprehend their effects on weather patterns, marine ecosystems, and global climate conditions. students recognise the broader context of these phenomena as part of the El Niño-Southern Oscillation (ENSO) cycle, involving intricate interactions between the ocean and the atmosphere.

The teacher shows videos of condensation of water that evaporated from warm Ocean provides the energy for hurricanes and cyclones and showcases the impact of hurricanes and cyclones caused by the condensation process. Finally, Discuss the destructive power and the importance of understanding these weather events for safety and preparedness.

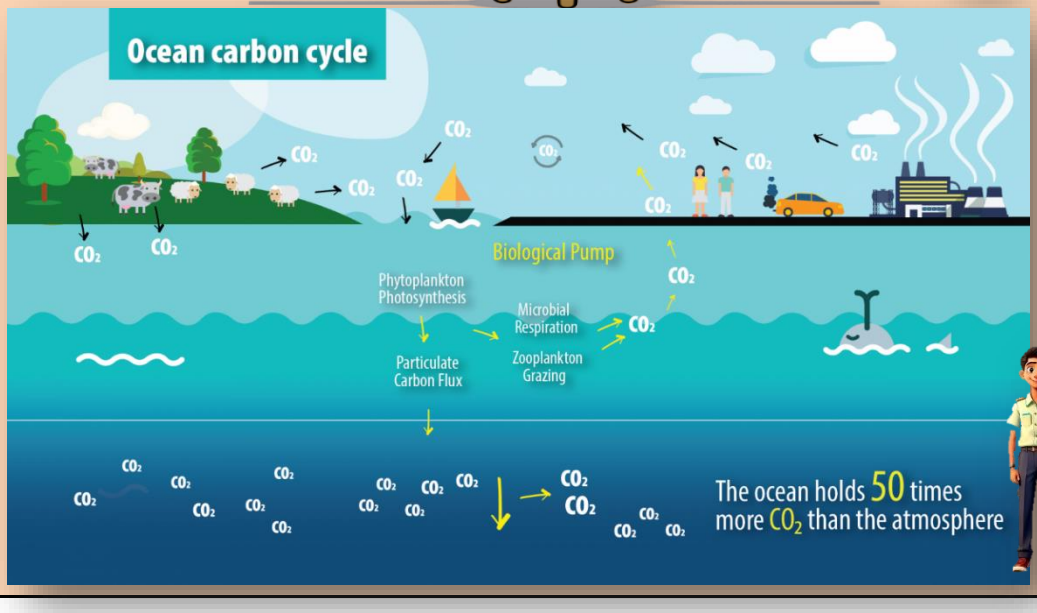
https://youtu.be/SmHXT10xccM



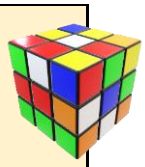
https://www.youtube.com/watch?v=cYxN1yfg_AE&pp=ygUVaHVycmljYW5lIGFuZCB0b3JuYWRv

Students gain knowledge and understanding of the condensation process of water evaporated from warm seas, its role in providing energy for hurricanes and cyclones, and the impact of these weather events on the environment and society. Students critically analyse the videos presented by the teacher, examining the destructive power of hurricanes and cyclones.

The teacher displays an image of the carbon cycle and instructs the students to study the pathways of carbon transfer. after that teacher helps to understand the diagram.



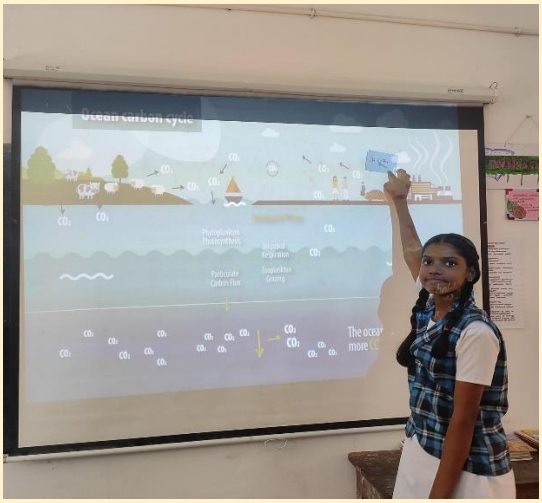
Phase 3
Application



SIMULATION GAME

Ocean Carbon Cycle Simulation Game: Using cards (atmosphere, ocean, plants, animals), a carbon cycle diagram, and optional labels, students are introduced to the carbon cycle and divided into groups. They then strategically place cards on the diagram, showing CO_2 and methane transitions. Through gameplay, students collaborate and engage in discussions, concluding with reflections on the ocean's role in climate change and Earth's overall health.

With the help of the teacher, students understand the ocean plays a critical role in the carbon cycle, serving as a vast reservoir that directly interacts with the atmosphere. Through processes like the absorption of atmospheric CO_2 at the surface, the ocean acts as a buffer against rising atmospheric carbon levels. This interaction, however, leads to ocean acidification, posing threats to marine life, especially those with calcium carbonate shells. Phytoplankton, marine microorganisms, absorb CO_2 during photosynthesis, and upon death, they can sink, sequestering carbon in deep ocean layers—a mechanism known as the biological pump. The physical pump, driven by temperature and salinity variations, further transports CO_2-rich cold waters from the surface to deeper ocean layers. Simultaneously, marine organisms utilize CO_2 to form calcium carbonate structures, which, upon death, contribute to carbon sequestration as they accumulate on the seafloor. However, in areas of upwelling, the ocean can release stored CO_2 back into the atmosphere. The rapid human-induced increase in atmospheric CO_2 is challenging the ocean's buffering capacity, with potential long-term implications for both marine ecosystems and the global carbon balance.



Through participation in the Ocean Carbon Cycle Simulation game, students are developing a comprehensive understanding of the movement of carbon dioxide and methane between the atmosphere and the ocean, deepening their comprehension of the carbon cycle and the crucial role the ocean plays in it. They actively engage in collaborative small group discussions, strategically placing cards representing carbon cycle components on a diagram or digital tool to simulate the continuous flow of carbon. By reflecting and discussing their placements, students gain insights into the interconnectedness of Earth's systems, recognize the ocean's significance in absorbing and storing carbon dioxide and methane, and understand the implications for climate change and the overall health of the planet.

Phase 4

Consolidation

Teacher consolidates that the interaction of oceanic and atmospheric processes controls weather and climate by dominating the Earth’s energy, water, and carbon systems. Heat exchange between the ocean and atmosphere can result in dramatic global and regional weather phenomena, impacting patterns of rain and drought. Significant examples include the El Niño Southern Oscillation and La Niña, which cause important changes in global weather patterns because they alter the sea surface temperature patterns in the Pacific. Condensation of water that evaporated from warm seas provides the energy for hurricanes and cyclones. Most rain that falls on land originally evaporated from the tropical ocean The ocean dominates Earth’s carbon cycle. Half of the primary productivity on Earth takes place in the sunlit layers of the ocean. The ocean absorbs roughly half of all carbon dioxide and methane that are added to the atmosphere

Phase 5

Assessment and Extension Activities:

Write a report on the ocean's influence of weather and climate on global patterns.

Instructional packages – 5 The ocean made Earth habitable

Name of The Teacher	**-**	**Jithu B Alex**
Name of The School	**-**	
Time Required	**-**	**45 minutes**
Subject	**-**	**Ocean Literacy Enhancement**
Topic	**-**	**The ocean made Earth habitable**

Objective: To explore the role of the ocean in the origin and development of life on Earth and understand its significance in creating a habitable planet.

Curricular Objectives:

- To understand the significance of photosynthetic organisms in the ocean in generating oxygen and its importance for the development and sustenance of life on land.
- To identify Phytoplankton as the only marine plants that are responsible for 50% of Earth's Oxygen.
- To comprehend the concept of the ocean as the cradle of life and the evidence supporting the common ancestry and ongoing evolution of millions of species on Earth.
- To discriminate the percentage level of oxygen producers.
- To recognize the vital role of the ocean in providing water, oxygen, nutrients, and climate moderation for life to exist on Earth.

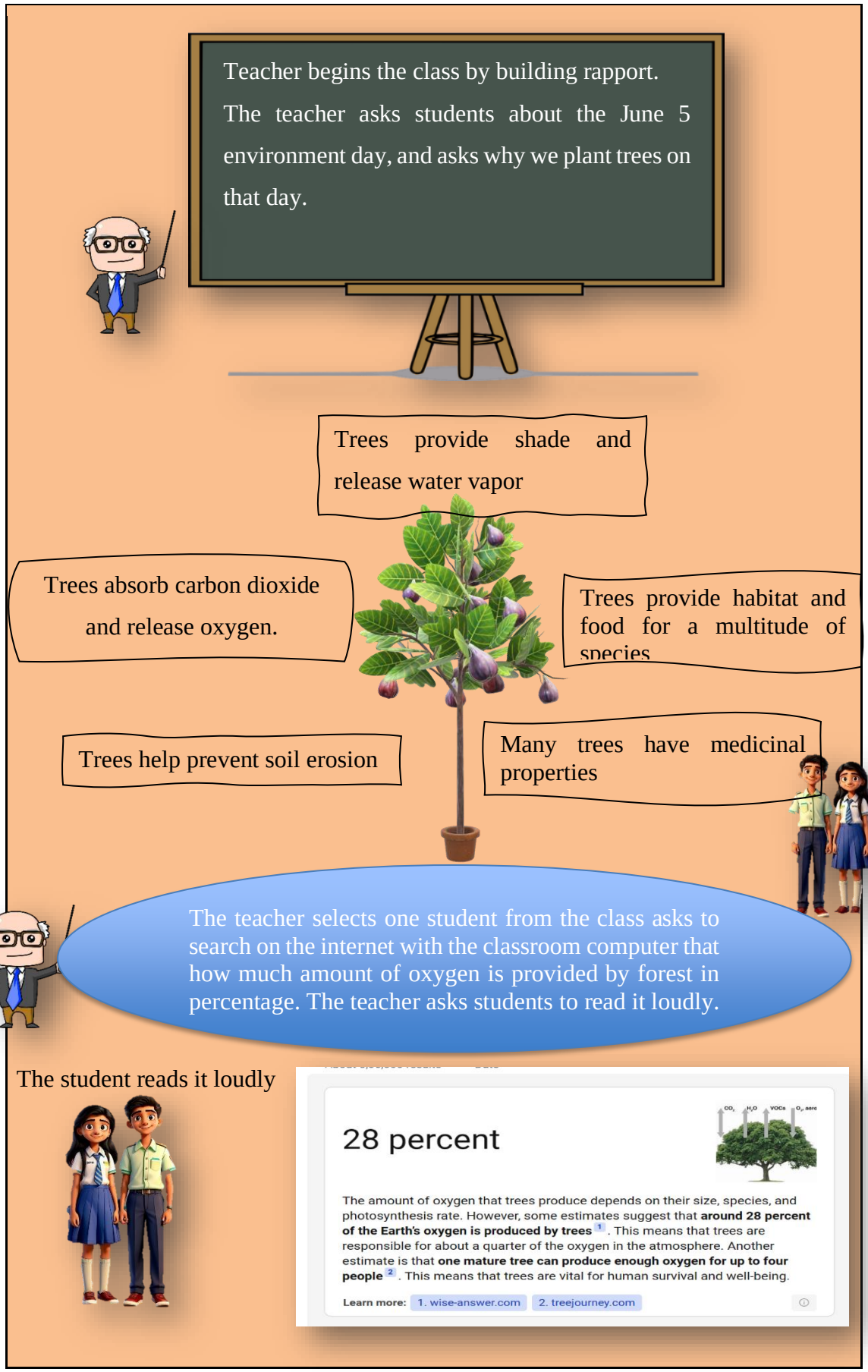
Skills

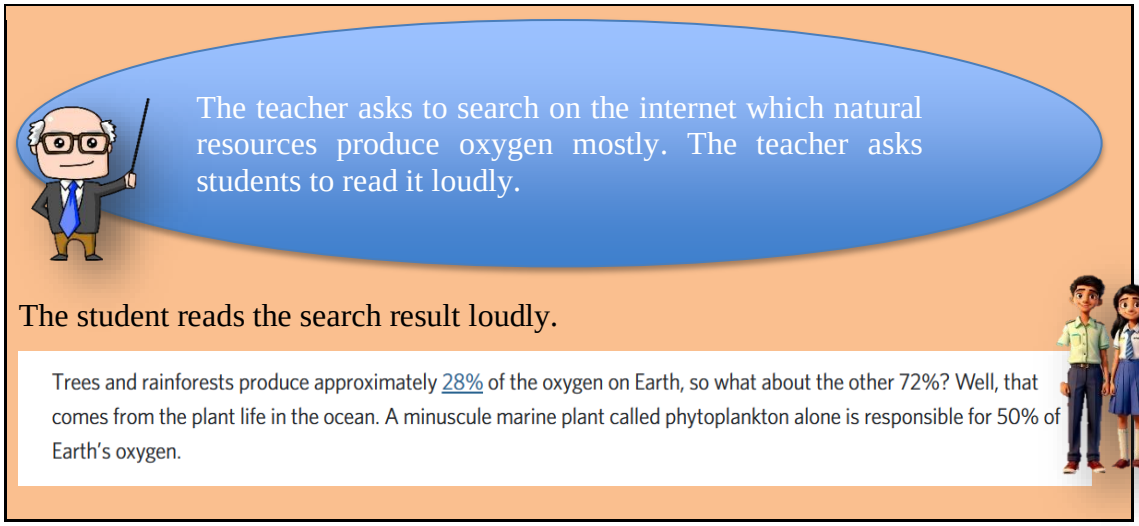
- Scientific Inquiry, Critical Thinking, Research Skill, Collaboration and Communication, Creativity and Expression

Instructional Material : Multimedia.

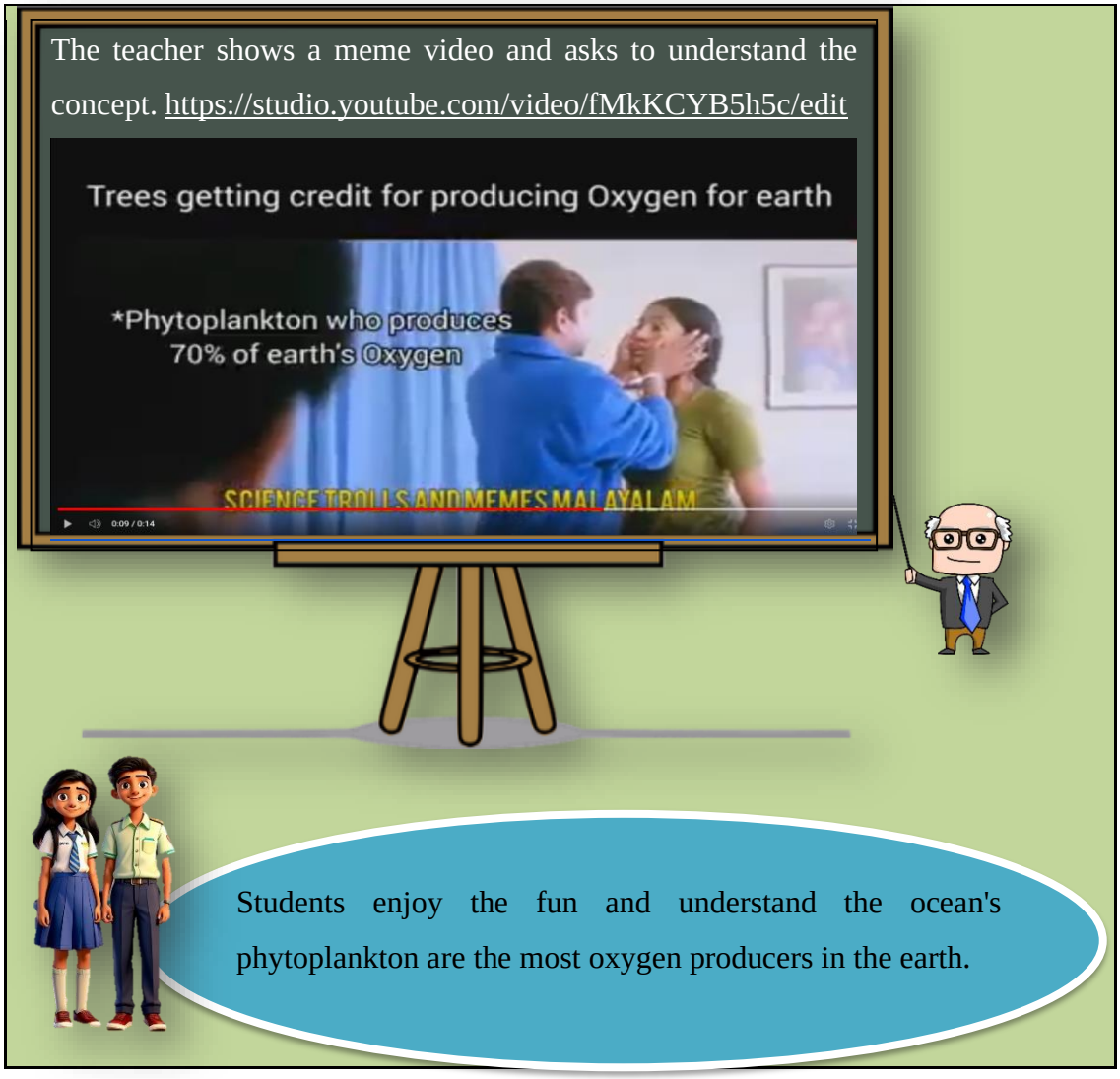
Strategy : Video, Images, Slideshow, Gamification, Memefication, Art Integration in education(Script-Expliciting Ocean Made Earth habitable).

Phase 1 Orientation

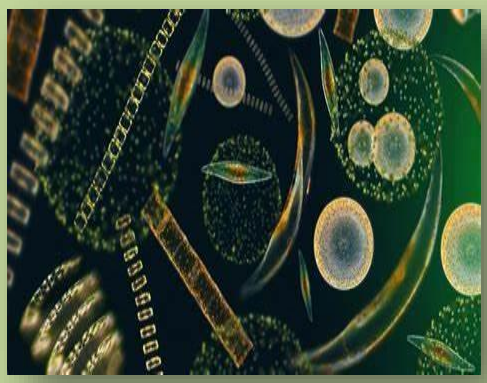


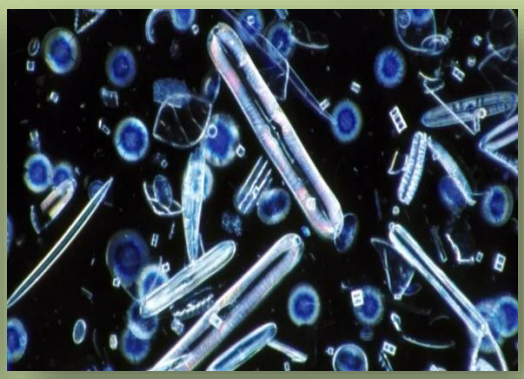


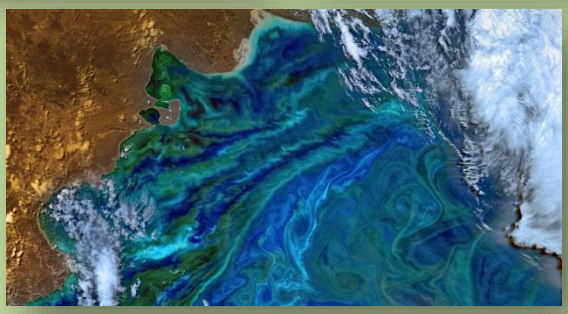
Phase 2 Presentation



The teacher displays images of phytoplankton on the slides and provides an explanation about their nature and importance.







Phytoplankton are predominantly single-celled organisms, though some species can aggregate and form colonies. Intriguingly, they can exist as both eukaryotic and prokaryotic entities. Serving as the foundation of the aquatic food web, they sustain a variety of marine life. Many aquatic beings, from zooplankton to small fish, rely on phytoplankton as a primary food source. As larger fish prey on these smaller creatures, a chain of consumption emerges, supporting diverse marine ecosystems. Beyond their ecological significance, phytoplankton play a crucial role in carbon sequestration, the process of capturing and storing carbon. This function is indispensable in moderating atmospheric carbon dioxide concentrations. Consequently, as integral components of the carbon cycle, they have a pivotal role in stabilizing Earth's climate.

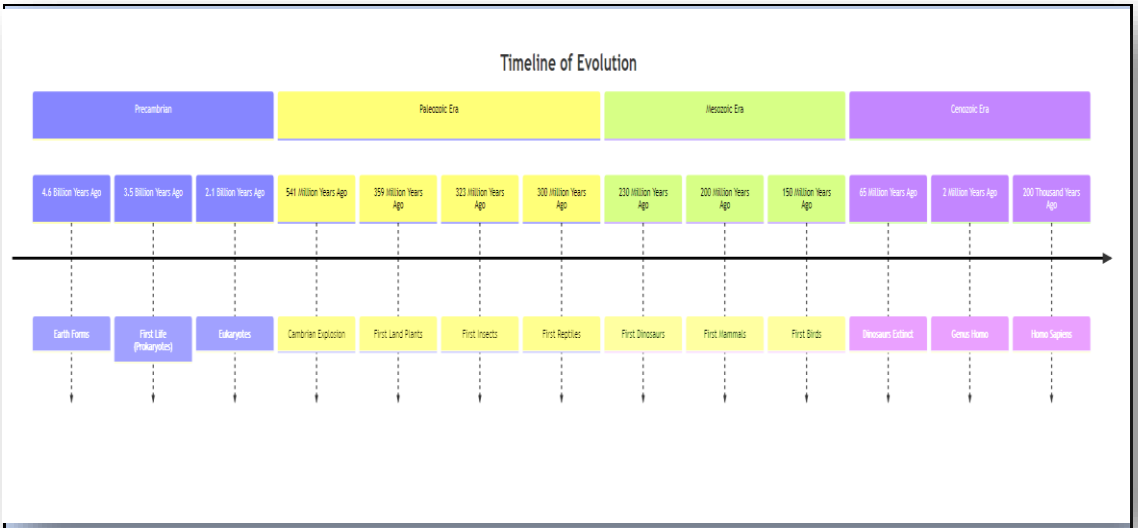
Teacher asks to students to recall what is photosynthesis.

Photosynthesis is a process used by plants, algae, and some bacteria to convert light energy, usually from the sun, into chemical energy in the form of glucose (sugar) and other energy-rich organic compounds. Oxygen is released as a byproduct.

The teacher explains that, similar to plants, phytoplankton use photosynthesis to generate oxygen.

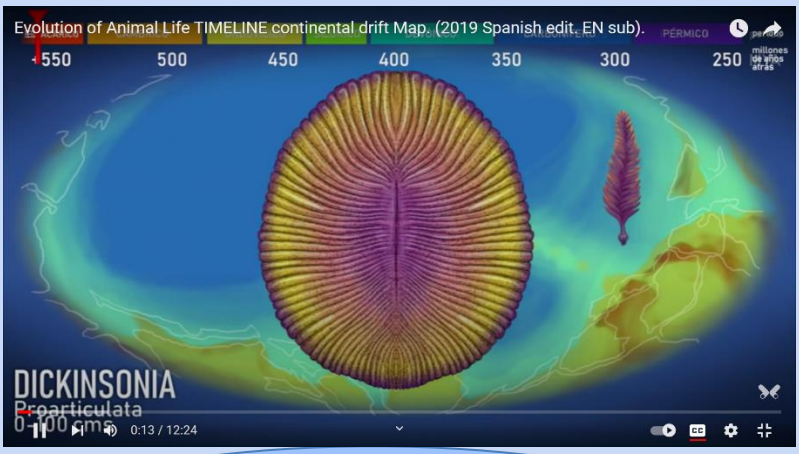
Students gain insights about phytoplankton, understanding them as microscopic organisms that perform photosynthesis, similar to green plants, to generate oxygen. A major portion of the atmospheric oxygen can be traced back to the photosynthetic activities of oceanic organisms. The accumulation of this oxygen in Earth's atmosphere was crucial for the development and sustenance of terrestrial life

The teacher displays a diagram illustrating evolution and then poses a question to the students: 'According to the theory of evolution, where did life originate?



Video

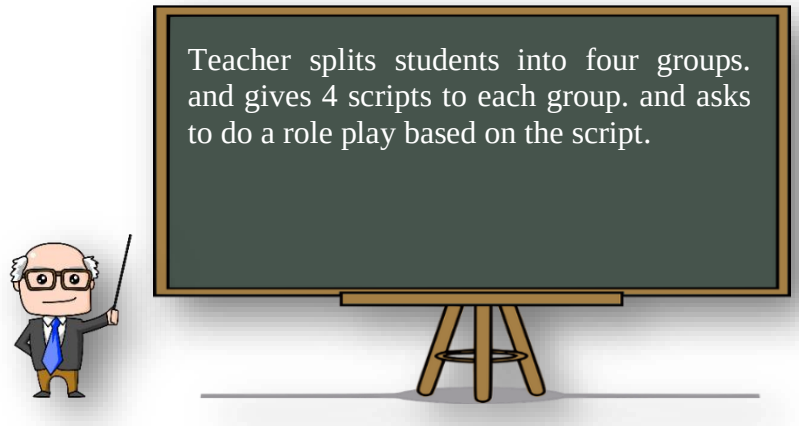
[(34) Evolution of Animal Life TIMELINE continental drift Map. (2019 Spanish edit. EN sub). - YouTube]



Students identify that life originated in the ocean. The millions of different species of organisms on Earth today are related by descent from common ancestors that evolved in the ocean and continue to evolve today.

Phase 3

Application



Script 1

(The scene begins in a grand viewing dome, with majestic marine life swimming just beyond the glass. Lissy, with her holographic camera, is in awe.)

Lissy: "This is beyond anything I've ever witnessed, Mayor Sneha. Aqua Haven truly embodies the essence of the ocean."

Mayor Sneha: "Thank you, Lissy. This city is a testament to human innovation and our deep connection with the oceans. They cover 70% of our planet, and it was only right we drew closer to them."

Midhil: "And as we float above, we're constantly reminded of Earth's vast interconnected ocean with its various basins like the North Pacific, South Atlantic, and of course, our Indian Ocean."

Zigma: (With a slight robotic tone) "Historical data indicates these ocean basins have unique geological features. From islands to trenches and ridges to rift valleys, they have been sculpted by the movement of Earth's crust."

Lissy: "Capturing this marine spectacle and Aqua Haven's design, it feels like I'm showcasing Earth's highest peaks and deepest valleys, all hidden within the ocean."

Mayor Sneha: "Exactly, Lissy. And the ocean isn't just about beauty. Its circulation, known as the 'global ocean conveyor belt,' is essential for regulating our climate."

Midhil: "The pathways of this conveyor belt, driven by wind, tides, and even Earth's rotation, are influenced by the shapes of ocean basins and land masses. This circulation moves water across vast distances, impacting ecosystems and marine life."

Zigma: "Additionally, sea levels, which reflect the average height of the ocean relative to land, are dynamic. They've been influenced by factors like plate tectonics, ice cap dynamics, and temperature changes."

Lissy: "And with all its vastness, the ocean plays a pivotal role in Earth's water cycle, connecting with all other water reservoirs. Every drop we see, every river, has a bond with the ocean."

Mayor Sneha: "Well said, Lissy. Here in Aqua Haven, we aim to cherish, study, and respect that bond."

Midhil: "Though we marvel at the ocean's expanse and resources, we remember they're finite. Our endeavours here emphasize conservation as much as exploration."

Lissy: "Aqua Haven isn't just a city; it's a symbol – of respect, understanding, and a future where we coexist harmoniously with the ocean's wonders.".

Script 2

(Anandhu and Sethu sit by the campfire, their attention captured by the mesmerizing flames, as Amma Rajalekshmi prepares to share a tale. The setting sun paints a golden hue on the traditional houseboats in the distance.)

Anandhu: "Amma Rajalekshmi, could you bless us with one of your enchanting sea stories tonight?"

Amma Rajalekshmi: "Ah, Anandhu, the depths of our seas hide countless tales. Have you ever heard about how our great oceans nurtured all life?"

Sethu: "No, Amma, but we're eager to listen."

Amma Rajalekshmi: "Long ago, even before the majestic Western Ghats touched the sky, our oceans were the sanctuaries of the first dances of life."

Anandhu: "So, life's first rhythms were in the water?"

Amma Rajalekshmi: "Indeed. Tiny organisms in these waters began the miraculous process of photosynthesis. They gifted our atmosphere with oxygen, paving the way for life to spread across land."

Sethu: "It's awe-inspiring to think that our very essence is interwoven with the ocean."

Amma Rajalekshmi: "Very true, Sethu. And it was in these waters that the dance of evolution began. From these oceans, countless beings emerged, leading to the vast tapestry of life we see today. Our bond with the sea runs deep."

Anandhu: "The dense forests, the animals, our age-old traditions... it all resonates with the song of the sea."

Amma Rajalekshmi: "Nature has tales more intricate and profound than any we could craft. The oceans sustain us, offering water, sustenance, and balance to our climate."

Sethu: "Then it's our duty to safeguard these waters."

Amma Rajalekshmi: "Exactly, Sethu. The ocean, our life's cradle, now seeks our protection. We must uphold this responsibility for the generations to come."

Anandhu: "Your tales, Amma Rajalekshmi, always instill in us a profound reverence for our land and sea."

Amma Rajalekshmi: "Always cherish and protect our gifts, dear ones. For now, let's relish the serenity of the waves and the blanket of stars above."

Script 3

(Sunrise at Kadalpuram beach. Joshua is playing by the shore, collecting seashells, when Athira approaches with marine samples and tools.)

Joshua: "Aunt Athira! What's that you're holding?"

Athira: "Ah, Joshua! These are tools to study the water's properties. Do you know our ocean holds 97% of Earth's water?"

Joshua: "That's a lot! But why does the ocean look so endless?"

Athira: "Well, it covers around 70% of our Earth, comprising vast interconnected basins like the Pacific, Atlantic, and our very own Indian Ocean."

(Hridhay rows his boat ashore, overhearing their conversation.)

Hridhay: "And every basin has its tales, young Joshua. Legends intertwined with truths, like the ones I share during our boat races."

Joshua: "Tell me one, Uncle Hridhay!"

Hridhay: "Long ago, our ancestors believed that the ocean's deepest trenches were home to gods. But, in reality, these trenches and ridges are formed by the movement of Earth's crust."

Aiswarya: (Joining in with some festival pamphlets) "And our Ocean's Day Festival aims to blend these legends with facts. Athira, are you ready for the marine workshop tomorrow?"
Athira: "Absolutely, Aiswarya. We'll discuss the ocean's circulation, how it's a conveyor belt powered by winds, tides, and even Earth's rotation."
Joshua: "Like the whirlpools during monsoon?"
Hridhay: "Somewhat! These circulations shape our climate, fishing patterns, and even the stories I tell."
Aiswarya: "And it's not just about the depths. The sea levels, which sometimes submerge our shores during heavy rains, are influenced by factors beyond just rain - like distant melting ice caps."
Joshua: "So, our ocean is connected to places far away?"
Athira: "Indeed! It's connected to all of Earth – through water cycles, rivers, and even the air we breathe. The ocean, Joshua, is like the heart of our planet."
Hridhay: "Which is why our village celebrates it. Every boat race, every story, and every festival is a tribute to its grandeur."
Aiswarya: "And a reminder for us to cherish and protect it for generations to come."

Script 4

(Scene begins on the deck of the Titanic. The vastness of the ocean surrounds the grand ship. Thomas curiously observes Eleanor as she examines some instruments and charts.)

Thomas: "With so much to see and enjoy on this grand ship, why are you so engrossed with these instruments and the sea?"

Eleanor: (Smiling) "Ah, young traveler, the sea and sky whisper secrets to those who listen. They tell tales of our world's past and hint at the future."

(Captain Smith approaches, having overheard their conversation.)

Captain Smith: "Eleanor, I've heard of your expertise. With the peculiar currents and cloud patterns, do you reckon there's cause for concern?"

Eleanor: "Captain, the ocean and skies are intrinsically linked. The ocean absorbs much of the sun's radiation, helping moderate the Earth's climate. It's this heat exchange between the ocean and atmosphere that drives our world's weather patterns."

Thomas: (Eagerly) "So, something happening here in the middle of the Atlantic might affect someone's weather on a distant shore?"

Eleanor: "Precisely, Thomas! Phenomena like El Niño or La Niña, though far from here, can alter global weather patterns."

Captain Smith: "It's humbling. We're on this marvel of human engineering, yet the vast sea around us holds greater marvels and mysteries."

(As they converse, passengers gather, drawn by the discussion. Eleanor seizes the opportunity to further educate.)

Eleanor: "Beyond just weather, the ocean plays a pivotal role in Earth's carbon cycle. The vast waters absorb carbon dioxide, influencing the very air we breathe."

Thomas: "So, it's like... the ocean is Earth's lungs?"

Eleanor: (Nodding) "An apt metaphor, Thomas. It breathes, it moves, and it sustains."

Captain Smith: "This journey, on the 'unsinkable' Titanic, has given me more to ponder than I anticipated. The dance of the sea and skies, the balance of our Earth's systems, is a marvel to behold."

Eleanor: "Indeed, Captain. Our voyage is not just through space but through the understanding of our planet's delicate symphony."

Eleanor: "Oh, and Captain? With all this talk of oceans and atmospheres, do ensure we keep an eye out. Wouldn't want our ship to, you know, collide with something."

Captain Smith: (Chuckling) "Ah, Eleanor, always the wit! We're on the 'unsinkable' Titanic after all. What could possibly go wrong?"

Phase 4

Consolidation

Teacher consolidates the class that Most of the oxygen in the atmosphere originally came from the activities of photosynthetic organisms in the ocean. This accumulation of oxygen in Earth’s atmosphere was necessary for life to develop and be sustained on land. The ocean is the cradle of life; the earliest evidence of life is found in the ocean. The millions of different species of organisms on Earth today are related by descent from common ancestors that evolved in the ocean and continue to evolve today. The ocean provided and continues to provide water, oxygen, and nutrients, and moderates the climate needed for life to exist on Earth

Phase 5

Assessment and Extension Activities: prepare an ocean diary that contains the theme of How the ocean is inter connected with yourself.

Instructional packages – 6
The ocean supports a great diversity of life and ecosystems

Name of The Teacher	**-**	**Jithu BAlex**
Name of The School	**-**	
Time Required	**-**	**45 minutes**
Subject	**-**	**Ocean Literacy Enhancement**
Topic	**-**	**The ocean supports a great diversity of life and ecosystems**

Objective: To introduce students to the vast array of marine organisms and ecosystems, highlighting the importance of marine biodiversity and the interdependence of species.

Curricular objectives

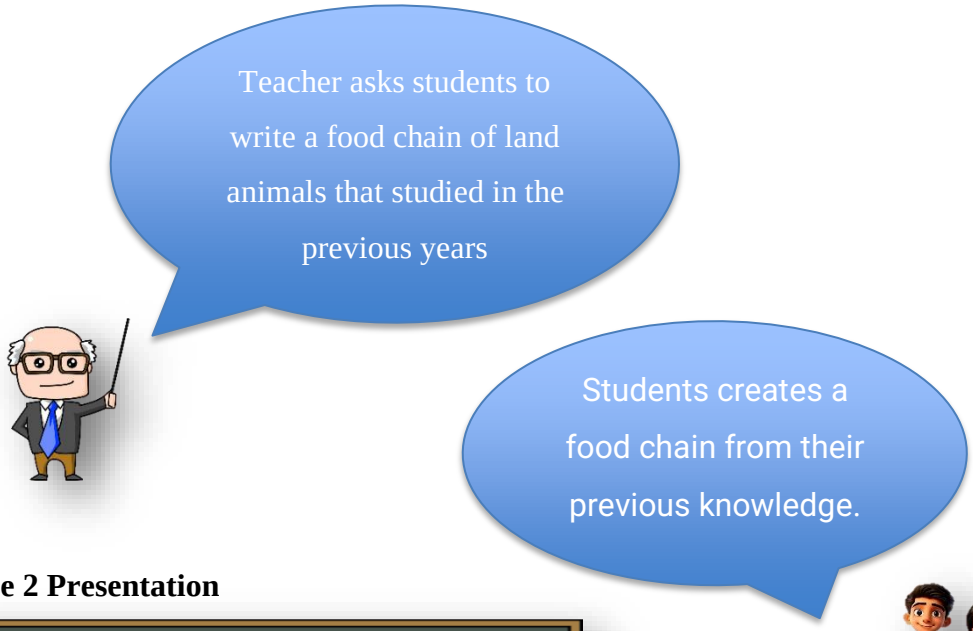
- Recognizing the importance of microbes in ocean ecosystems.
- Comparing diversity between ocean and land.
- Identifying unique life cycles, adaptations, and relationships among organisms in the ocean, such as symbiosis, predator-prey dynamics, and energy transfer.
- Understanding the vastness and diversity of ocean ecosystems
- Understanding different zones of oceans
- Recognizing factors influencing the distribution of ocean life
- Exploring deep ocean ecosystems, such as hydrothermal vents, submarine hot springs, and methane cold seeps, and understanding their unique reliance on chemical energy and chemosynthetic organisms.
- Recognizing the significance of estuaries: Students should understand the importance of estuaries as productive nursery areas for marine and aquatic species.

Skills : Critical thinking skills, communication skills, collaborative skills.

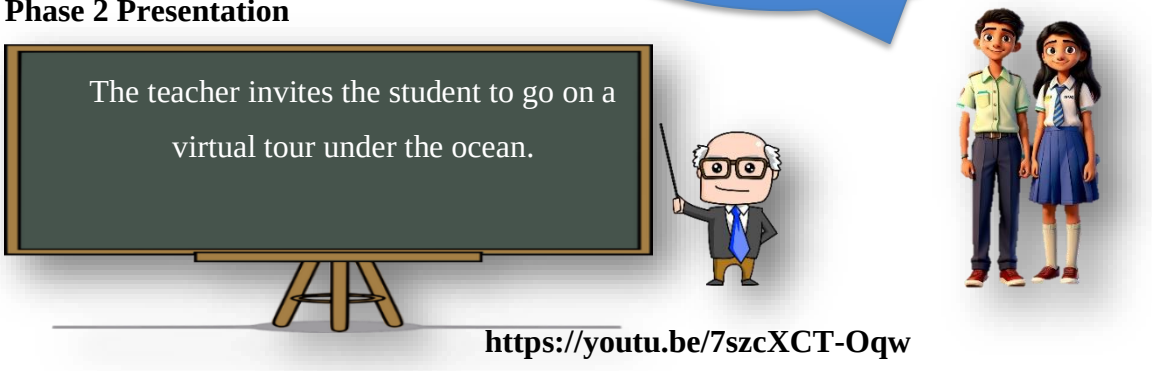
Instructional Material : Multimedia,Slides,Video – Virtual Tour, ICT-Oriented.

Strategy : ICT-Oriented , Gamification, Simulation , Grouping.

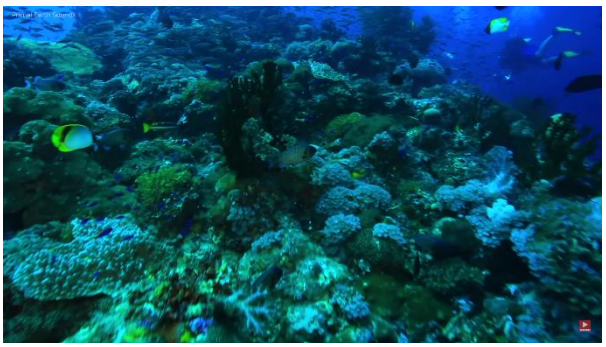
Phase 1 Orientation

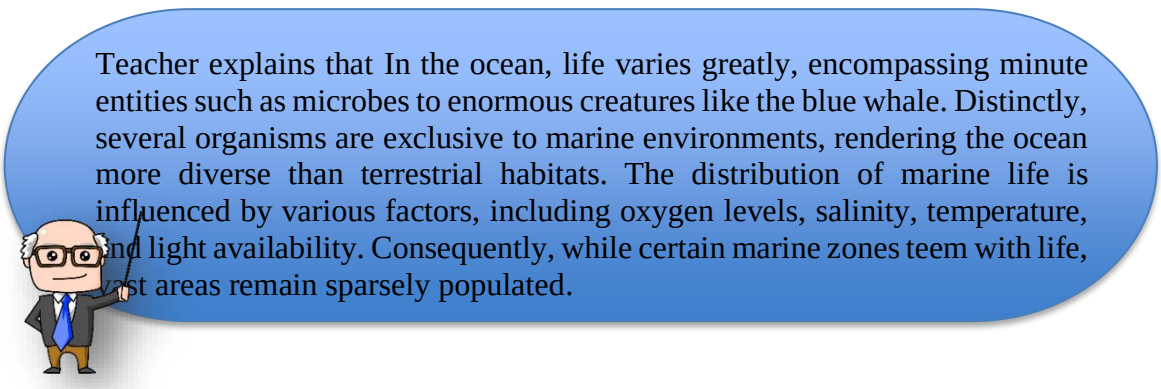


Phase 2 Presentation

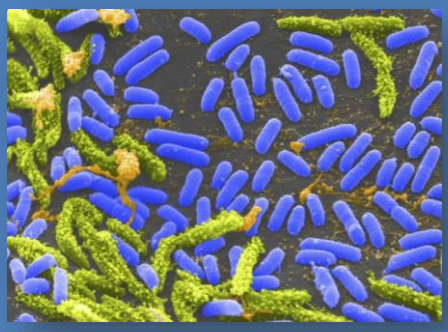


https://youtu.be/7szcXCT-Oqw





The teacher shows images of microbes and explains that most of the organisms and biomass in the ocean are microbes, which are the basis of all ocean food webs. Microbes are the most important primary producers in the ocean. They have extremely fast growth rates and life cycles and produce a huge amount of the carbon and oxygen on Earth.



Teacher shows slides of different types of relationships that exist between marine organisms and explains each of them in detail.

39

Relationships between marine organisms

Symbiosis : Symbiosis refers to a close and long-term relationship between two or more different species. In marine environments, symbiotic relationships are abundant and diverse.

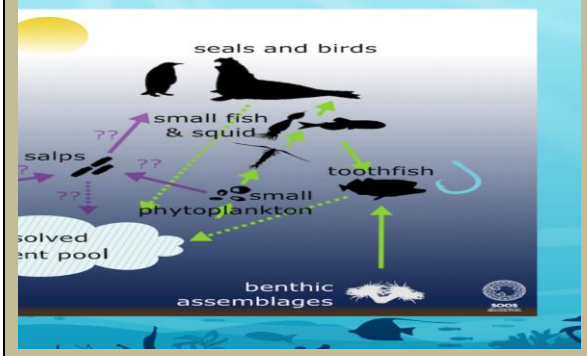
Mutualism : where both species benefit, such as the relationship between cleaner fish and larger marine organisms that they remove parasites from, benefiting both parties.
Commensalism : where one species benefits while the other is neither harmed nor benefited, such as barnacles attaching to a whale's skin and gaining a surface to live on, while the whale is unaffected.

Predator-prey dynamics

Predator-prey dynamics play a crucial role in shaping marine ecosystems. Predators are organisms that hunt and consume other organisms, while prey are the organisms being hunted. This dynamic relationship regulates population sizes and helps maintain the balance within ecosystems. For instance, marine mammals like dolphins are predators that feed on fish and squid, thereby controlling their populations. The interactions between predators and prey can have cascading effects throughout the food web, influencing the abundance and distribution of various species.

41

and energy transfer



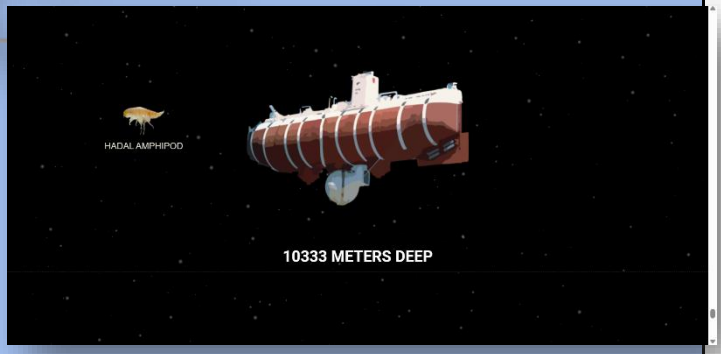
43

Marine ecosystems and energy transfer

Energy transfer in marine organisms is essential for sustaining life and ecosystem functioning. Marine food webs are based on the transfer of energy from primary producers, such as phytoplankton and seaweeds, to higher trophic levels. Through the process of photosynthesis, primary producers convert sunlight into chemical energy, which is then passed on to herbivores that consume them. This energy transfer continues through successive trophic levels as carnivores and omnivores consume other organisms. Each transfer of energy between trophic levels results in some energy loss, with only a fraction of the energy being transferred from one level to the next.

Students understand the different types of relationships of marine organisms and ocean biology provides many unique examples of life cycles, adaptations, and important relationships among organisms (symbiosis, predator-prey dynamics, and energy transfer) .

The teacher displays a simulation illustrating marine organisms and their average depths of residence within the ocean.



Students grasp the concept of ocean depths and learn about the varying habitats of marine organisms at different depths. Also, they learn about the different zone of the ocean such as the Epipelagic Zone (Sunlight Zone, Depth: 0 to 200 meters.), Mesopelagic Zone (Twilight Zone, Depth: 200 to 1000 meters), Bathypelagic Zone (Midnight Zone, Depth: 1000 to 4000 meters.), Abyssopelagic Zone (Abyss, Depth: 4000 to 6000 meters.) and Hadalpelagic Zone (Hadal Zone or Trenches, Depth: 6000 meters to the bottom of the deepest ocean trenches).

The teacher poses a question to the students, 'You now know about the deep ocean where sunlight can't reach. How do you think organisms can live there without sunlight?'"

‘

Students responded with their own insights

The teacher explains chemosynthesis in ocean with slides

Slide

Chemosynthesis

Chemosynthesis is a biological process through which certain microorganisms create organic matter using energy derived from the oxidation of inorganic compounds. Unlike photosynthesis, which relies on sunlight as an energy source, chemosynthesis occurs in environments where sunlight cannot penetrate, such as the deep sea or hydrothermal vent ecosystems.

Hydrothermal Vent Ecosystems

These are found on the ocean floor near mid-ocean ridges where tectonic plates are spreading apart. Seawater seeps into cracks in the Earth's crust, gets heated by magma, and then rises back to the surface as hot, mineral-rich fluids through hydrothermal vents. These vents release chemicals like hydrogen sulfide and methane, which serve as energy sources for chemosynthetic bacteria.

Chemosynthetic bacteria, also known as chemolithoautotrophic bacteria, use the energy from chemical reactions between these inorganic compounds and oxygen or other chemicals to produce organic molecules like carbohydrates. These bacteria form the base of the food chain in these extreme environments, supporting unique and specialized ecosystems with animals like tube worms, giant clams, and various species of crabs and fish.

Cold Seep Ecosystems:

Similar to hydrothermal vents, cold seeps are areas where methane and other hydrocarbons, as well as hydrogen sulfide, are released from the seafloor. Chemosynthetic bacteria in cold seep ecosystems use these compounds to generate energy and form the basis of the local food chain.

Students come to understand that hydrothermal vents and the process of chemosynthesis are vital to deep-sea ecosystems. Just as photosynthesis provides plants with energy, chemosynthesis equips certain microorganisms with energy in the absence of sunlight. This is the key reason marine organisms can thrive in the deep ocean where sunlight doesn't penetrate

Teacher introduces a new topic Estuaries and present a video that showing importance of Estuaries.

(5) What is an Estuary in Ecosystem? | Environmental Studies | Letstute - YouTube

Students cme to understand that estuaries are unique and vital ecosystems located where freshwater from rivers and streams flows into the ocean, mixing with the salty seawater. Estuaries provide important and productive nursery areas for many marine and aquatic species.

Phase 3

Application

Teacher divides the class into 10 groups and gives images and descriptions of several marine organisms to students . asks them to make food webs from given items.

Grouping

Phytoplankton (Producer) Description: These are microscopic plants that float in the upper layers of oceans and seas. Through photosynthesis, they convert sunlight into energy and form the base of the marine food web.

Zooplankton (Primary Consumer)
Description: Tiny, often microscopic animals that feed on phytoplankton. Examples include krill and copepods. They are the primary consumers and serve as food for many small marine animals.

Small Fish (e.g., Sardines) (Secondary Consumer)
Description: These are small, schooling fish that mainly eat zooplankton. They serve as a vital link between the microscopic world of plankton and larger marine animals.

Squid (Tertiary Consumer).
Description: Carnivorous marine cephalopods with soft bodies and tentacles. They primarily eat small fish and other invertebrates. They can change colour to camouflage or communicate with other squids.

Sea Turtles (Tertiary Consumer)
Description: Marine reptiles with a bony or leathery shell. Different species of sea turtles have varied diets, ranging from jellyfish to seagrasses and small invertebrates.

Larger Fish (e.g., Tuna) (Tertiary Consumer)
Description: Predatory fish that feed on smaller fish like sardines and sometimes on squids. Tuna are fast swimmers and have a streamlined body.

Dolphins (Quaternary Consumer)
Description: Intelligent marine mammals known for their playful behavior. They primarily eat fish and squids and are known for their complex social structures

Sharks (Apex Predator)
Description: Predatory fish that are at the top of the marine food chain. They feed on various marine organisms, from fish to marine mammals, depending on their species.

Seagrass(Producer) Description: Flowering plants adapted to life in the marine environment. They form meadows in shallow waters and are a primary source of food for herbivores like the dugong or green sea turtle.

Crabs (Secondary Consumer)
Description: Hard-shelled marine crustaceans that feed on detritus, plankton, mollusks, and small fish. They play a significant role in the marine ecosystem by recycling organic matter.

Students can understand the marine organism’s food habits from given description, they can understand the marine food chain well.

Consolidation

Ocean life spans a vast spectrum, from minuscule microbes to the colossal blue whales. However, it's the microbes that predominantly form the foundation of oceanic food webs, acting as vital primary producers. They play a pivotal role in Earth's carbon and oxygen cycles. Notably, the ocean boasts a richer diversity among major organism groups than terrestrial environments. This marine realm reveals unique life cycles, adaptations, and interactions encompassing symbiosis, predator-prey dynamics, and intricate energy transfers. Encompassing a variety of ecosystems, the ocean provides the most extensive living space on Earth. These marine ecosystems' distribution is influenced by environmental factors, leading to the uneven spread of life. In the deep ocean, ecosystems like hydrothermal vents and methane cold seeps derive energy from chemical processes and are sustained by chemosynthetic organisms. Furthermore, estuaries are vital, acting as nursery grounds for numerous marine and aquatic species

Phase 5

Assessment and Extension activity

Collect images and descriptions of local marine organisms and make it as a marine diary .

Instructional Packages- 7

The ocean and humans are inextricably interconnected part -1

Name of The Teacher	**-**	**Jithu B Alex**
Name of The School	**-**	
Time Required	**-**	**45 minutes**
Subject	**-**	**Ocean Literacy Enhancement**
Topic		**- How the ocean influences us.**

Objective: To explore the various ways in which humans depend on the ocean, discuss the impacts of human activities on the ocean, and encourage students to propose solutions and take action to protect the ocean and promote sustainable practices.

Curricular objectives

- To understand the significance of the ocean in sustaining life on Earth
- To explore the resources and benefits provided by the ocean
- To Identify the medicinal value of marine organisms.
- To recognize the ocean's role in transportation, national security, and trade.
- To Appreciate the cultural and recreational aspects of the ocean.

Skills

Critical thinking skills, communication skills,

Instructional Material

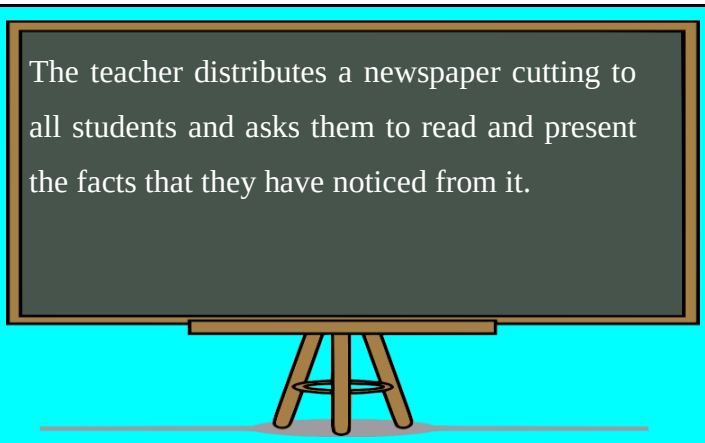
Multimedia, News Paper.

Strategy

ICT-Oriented, Cartoonification, Gamification(Green card Vs Blue Card).

Phase 1

Orientation



കേരളതീരത്ത് അത്യപൂർവമായ 'ഗോൽഫിഷ്' ചേറ്റുവ തീരത്ത്

By: Kerala Voter

Aug 29, 2022, 08:16 IST

അത്യപൂർവമായതും കടലിലെ സ്വർണം എന്നറിയപ്പെടുന്ന 'ഗോൽഫിഷ്' ചേറ്റുവയിലെ മത്സ്യത്തൊഴിലാളികൾക്കു കിട്ടി. കേരളതീരത്ത് അത്യപൂർവമായാണ് ഇവയെ കാണുന്നത്. രാജ്യാന്തര മാർക്കറ്റിൽ ലക്ഷങ്ങൾ വിലമതിക്കുന്ന അസംസ്കൃത വസ്തുക്കളായി മാറ്റിയെടുക്കാവുന്ന മത്സ്യമാണിത്.

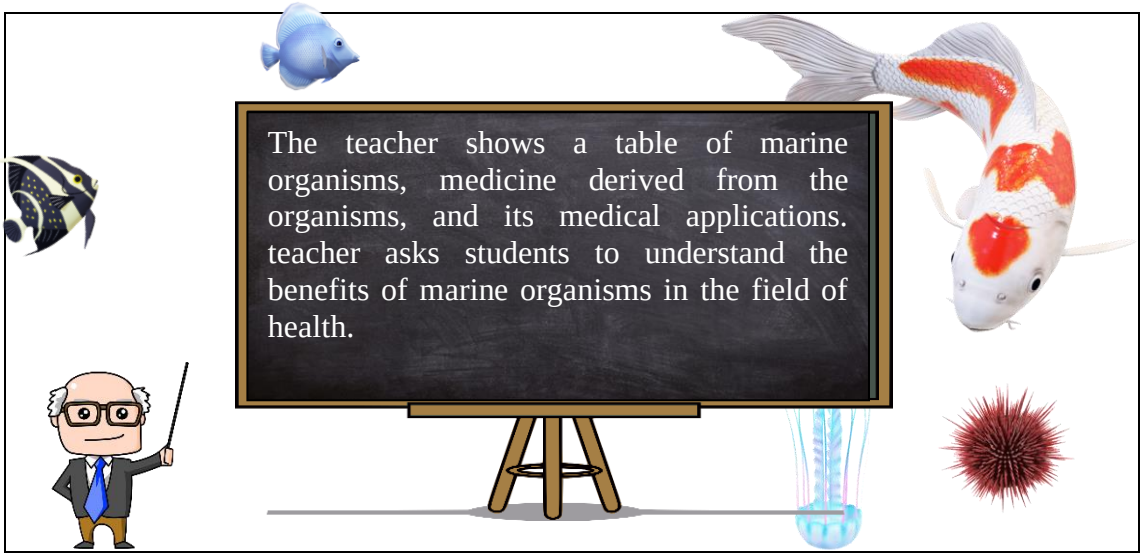
മത്സ്യത്തൊഴിലാളികളായ ചോപ്പൻ അബ്ദുസമദ്, ചേന്ദങ്കര ചന്തു എന്നിവർക്കാണ് ഇന്നലെ ഉച്ചയോടെയാണ് നാലേമുക്കാൽ കിലോയുള്ള മീൻ കിട്ടിയത്. കടലിൽ മാത്രം കാണുന്ന പടുത്തകോര, സ്വർണക്കോര എന്നിങ്ങനെ അറിയപ്പെടുന്ന ഗോൽഫിഷ് ചേറ്റുവ അഴിയിലൂടെ വേലിയേറ്റ സമയത്ത് പുഴയിലേക്ക് എത്തിയെന്നാണ് കരുതുന്നത്. ഗോൽഫിഷിന്റെ ബ്ലാഡർ (പളുങ്ക്) ഉപയോഗിച്ചുള്ള നൂൽ

ഹൃദയശസ്ത്രക്രിയയ്ക്ക് ഉൾപ്പെടെ ഉപയോഗിക്കാറുണ്ടെന്നു പറയുന്നു. വിദേശ രാജ്യങ്ങളിൽ ആവശ്യക്കാർ ഏറെയുണ്ട്.

Students understands some information that the "Gulfish" or "Gulf grouper" is a rare and highly prized fish found in the coastal waters of Kerala, India.

- The Gulfish is known for its unique characteristics, such as its gold-colored skin and the high value it commands in national and international markets.
- The fish was caught by two fishermen named Choppam Abdusamad and Chandankar Chantu, who managed to capture a fish weighing around four kilograms.
- The Gulfish is primarily found in the sea and is believed to migrate towards estuaries during breeding seasons.
- The article highlights the rarity and desirability of the Gulfish, mentioning its reputation as a valuable and sought-after seafood item.
- The bladder (swim bladder) of the Gulf grouper is used in a surgical procedure called nuel heart surgery. This is in high demand in foreign countries. The bladder, which is a part of the Gulf grouper's buoyancy organ, is believed to provide a solution for certain heart conditions. Doctors performing cardiac surgeries in foreign countries use the bladder of the Gulf grouper for this purpose. It is used to extract toxins from the heart and can potentially bring relief to patients with heart-related issues.

Phase 2 Presentation



Marine Organism	Medicine Derived	Medical Applications
Sponges	Eribulin	Cancer treatment
Coral Reefs	Prostaglandin	Blood pressure control during surgery
Sea Snails/Cone Snails	Ziconotide	Pain medication for severe and chronic pain
Marine Microorganisms	Streptomycin	Antibiotics for bacterial infections
Seaweed/Algae	Fucoidan	Anti-inflammatory, anti-viral, and anti-cancer properties

Students understand that marine organisms play an integral role in supporting human life by serving as valuable sources of medicinal substances.

The teacher divides the students into 4 groups and assigned some activities to each group.

Group 1

Discuss and present the best memories related to the ocean in the class

Group 2

Write a list of recreational activities held on ocean coasts and present it in the class.

Group 3

Teacher asks them to write how the ocean rejuvenates our mind and body.

Group 4

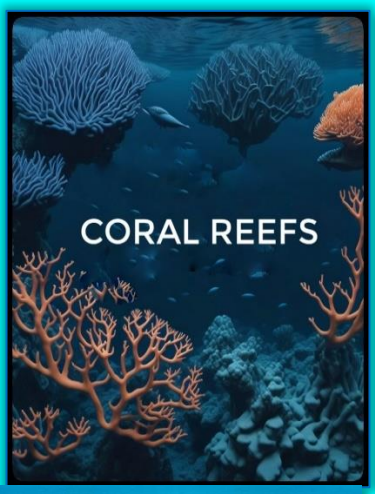
Write and present about cultural or historical events that related to the ocean and coast that they learned or heard

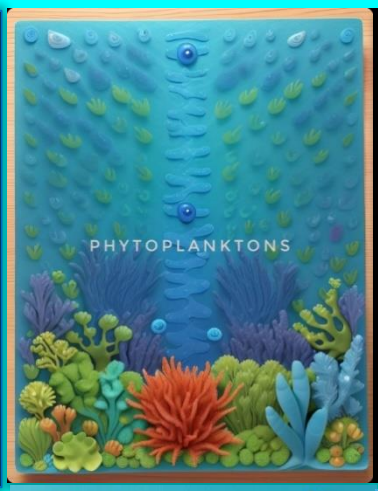
Students present their ideas in front of the class, students get the idea that the ocean is a source of inspiration, recreation, rejuvenation, and discovery. It is also an important element in the heritage of many cultures

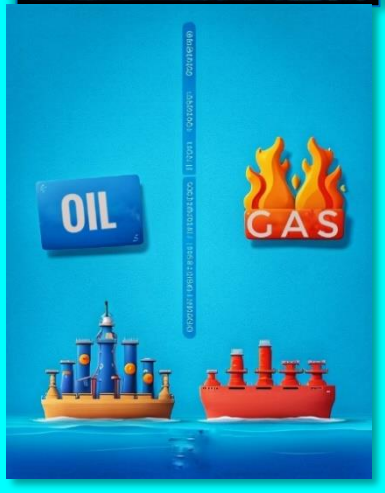
Grouping

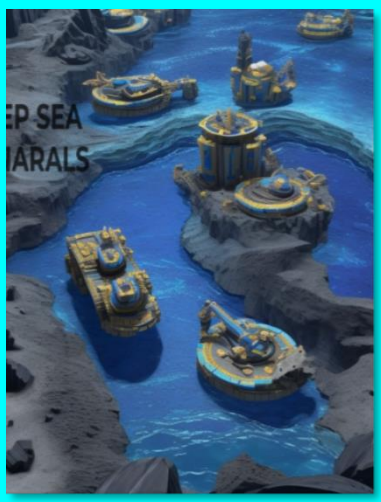
The teacher divides the class into 2 groups, each group contains 20 participants. The teacher gives 10 Blue cards to the first group and 10 green cards to the second group and asks them to read their cards. Blue cards contain just one or two words that represent marine resources and green cards contain benefits of marine resources.
The teacher give instructions to find out their real matches, that is to pair the cards of marine resources with its real corresponding benefit card.

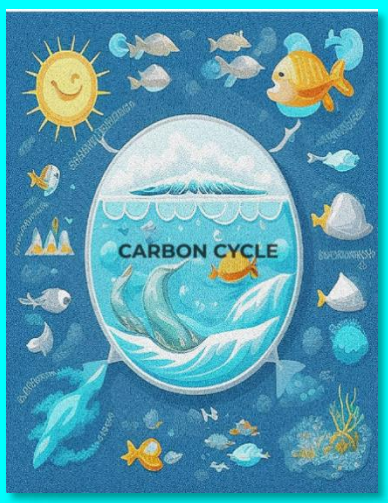
BLUE CARDS

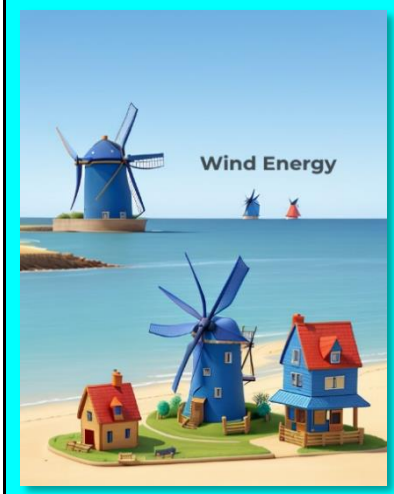


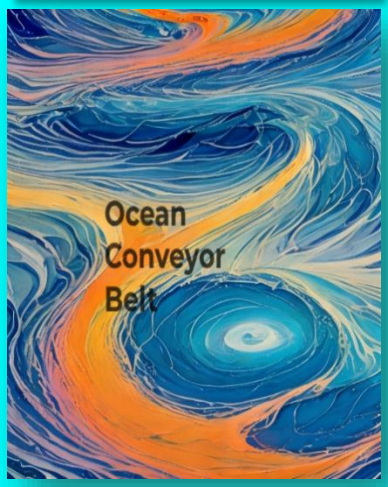












Green Cards

1) Support myriad marine species crucial for fisheries.They bolster global fisheries, ensuring protein sources for many.Act as barriers, diminishing the impact of waves, storms, and erosion.Attract visitors, benefiting local economies and jobs.Offer potential compounds for medical and biotechnological applications. Absorb CO_2, aiding in climate regulation.

2) It is a nutritional powerhouse, rich in omega-3 fatty acids, protein, and vital vitamins and minerals. Its consumption has a range of health benefits, supporting heart health, brain development, and providing relief from arthritis symptoms. Additionally, it contributes to maintaining good eyesight and combating depression. With its low unhealthy fat content, seafood aids in weight management, while also driving economic growth through employment in fishing industries

3)Microscopic marine organisms, serve as the foundation of the marine food web, feeding everything from zooplankton to whales. Through photosynthesis, they produce roughly half of the world's oxygen and absorb significant amounts of carbon dioxide, aiding in climate regulation. Additionally, they assist in nutrient recycling in aquatic systems, can be cultivated for industrial purposes like biofuels and supplements, and act as indicators of water quality, reflecting ecosystem health. Their multifaceted role highlights their crucial importance in both marine ecosystems and global processes.

4) They have been instrumental in powering the modern world. They provide a dominant energy source for industries, homes, and transport, driving significant economic growth through job creation and revenue generation. Beyond fuel it is vital in producing various everyday products, from plastics to pharmaceuticals. The sector has catalysed technological innovations, and due to the high energy density of these, they're efficient for storage and transportation. While they offer numerous benefits, it's crucial to balance these advantages with environmental and societal concerns, emphasizing the move towards sustainable energy alternatives.

5)In the realm of scientific research, vast ecosystems beneath the waves harbor potential remedies for various ailments. Many researchers believe that these deep and mysterious waters could be the key to unlocking novel therapeutic compounds. Drawing from marine organisms, this field seeks to harness the curative powers of the ocean.

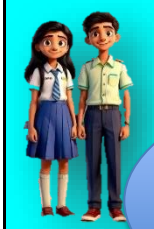
7)This vast, interconnected system of deep and surface currents circulates water around the globe, playing a crucial role in regulating temperatures and distributing nutrients. Influenced by temperature and salinity differences, it's often likened to a massive, continuous loop, transporting warmer surface waters to cooler depths and vice versa. In the academic discussions surrounding climate science and oceanography, this phenomenon is essential for understanding heat distribution on our planet.

9) "Far below the ocean's surface, in regions untouched by sunlight, lie treasures not of gold or silver but of significant commercial and technological value. These resources aren't just found on the seabed, but also embedded within it, formed over millennia. In the academic discussions around sustainable resources and future technology advancements, these become of paramount interest.

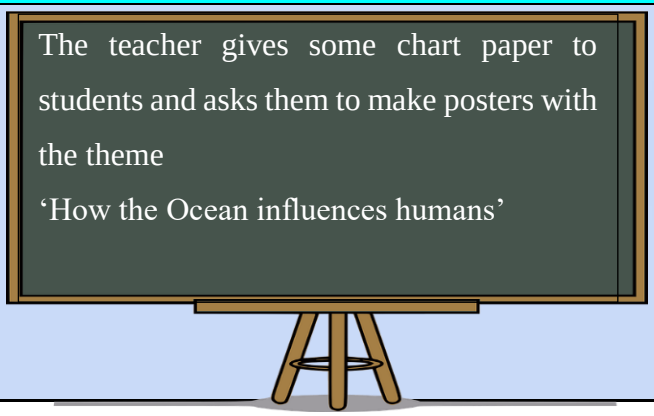
6) Oceans offer significant potential for this energy harnessing, primarily through offshore These farms deploy turbines anchored to the seabed, capturing the more consistent and powerful winds found over open water compared to land. Offshore winds tend to blow harder and more uniformly, allowing turbines to generate electricity more consistently. The vastness of oceans provides ample space to set up large wind farms without the typical spatial constraints encountered on land, resulting in the potential for higher energy yields. As technology advances, floating turbines are also being developed to exploit wind resources in deeper waters, further amplifying the ocean's potential as a renewable energy powerhouse.

8) A complex process regulates the flow and storage of one of the essential elements for life on Earth. This process not only aids in the regulation of global temperatures but also acts as a buffer against atmospheric changes, absorbing vast amounts of a certain greenhouse gas. Through the activities of marine organisms and the movement of the ocean's waters, this cycle ensures a balance between the sea and the atmosphere

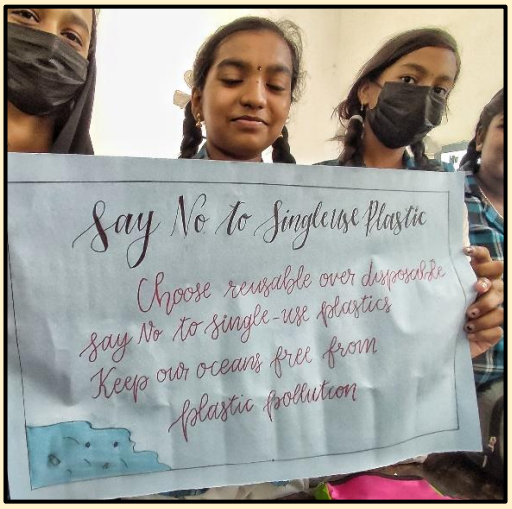
10) In the vast expanse of the open seas, where land doesn't impede nature's flow, gusts and breezes are often more consistent and powerful. Taking advantage of this untapped potential, towering structures rise from the depths, anchored to the seabed, capturing the kinetic energy of these persistent maritime currents. This innovation is a testament to humanity's drive for sustainable energy.

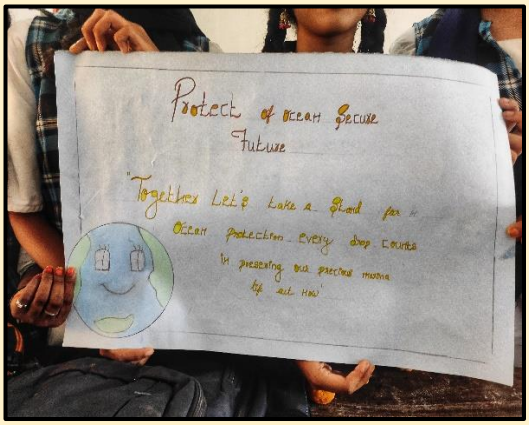


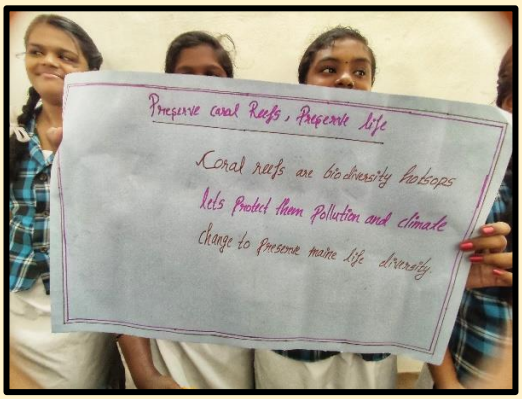
Students find out their real pair with the help of others in the group , so they understand every benefit of the ocean from the activity, Students understand how the ocean influences them in their life well.



Students made posters from their understanding and pasted it on the school campus.







Consolidation

Teacher consolidating the contents that the ocean has a profound impact on human existence in numerous ways. It plays a crucial role in our lives by providing freshwater, which is responsible for a significant portion of the Earth's rainfall, and it is responsible for producing a substantial amount of the planet's oxygen. Additionally, the ocean plays a vital role in regulating the Earth's climate, influencing weather patterns, and directly affecting human health.

Moreover, the ocean serves as a valuable source of sustenance, offering a diverse range of food resources. It also presents opportunities for discovering medicinal compounds and accessing essential mineral and energy reserves. These resources not only contribute to our well-being but also support job creation, bolster national economies, and facilitate the transportation of goods and people through its vast maritime routes. Furthermore, the ocean's significance extends beyond its practical contributions, as it serves as a source of inspiration, recreation, rejuvenation, and exploration. It holds great cultural value, deeply ingrained in the heritage of various societies around the world.

Phase 5

Assessment activities

1. Write an essay on the topic based on the resource card/benefits they have got.

Instructional Package - 8

The ocean and humans are inextricably interconnected part -1

Name of The Teacher	**-**	**Jithu B Alex**
Name of The School	**-**	
Time Required	**-**	**45 minutes**
Subject	**-**	**Ocean Literacy Enhancement**
Topic	**-**	**How human influence the ocean.**

Curricular objectives

- To understand the range of plastic pollution in the ocean
- To comprehend impacts of plastic pollution in the ocean.
- To analyse the impact of overfishing.
- To examine impacts of ocean acidification
- To Recognize the coral bleaching causes and effect.
- To Investigate the Effects of Temperature and pH Changes
- To promote Conservation Awareness

Skills

- Critical thinking skills, communication skills,

Instructional Material

- Multimedia, Images, News paper.

Strategy

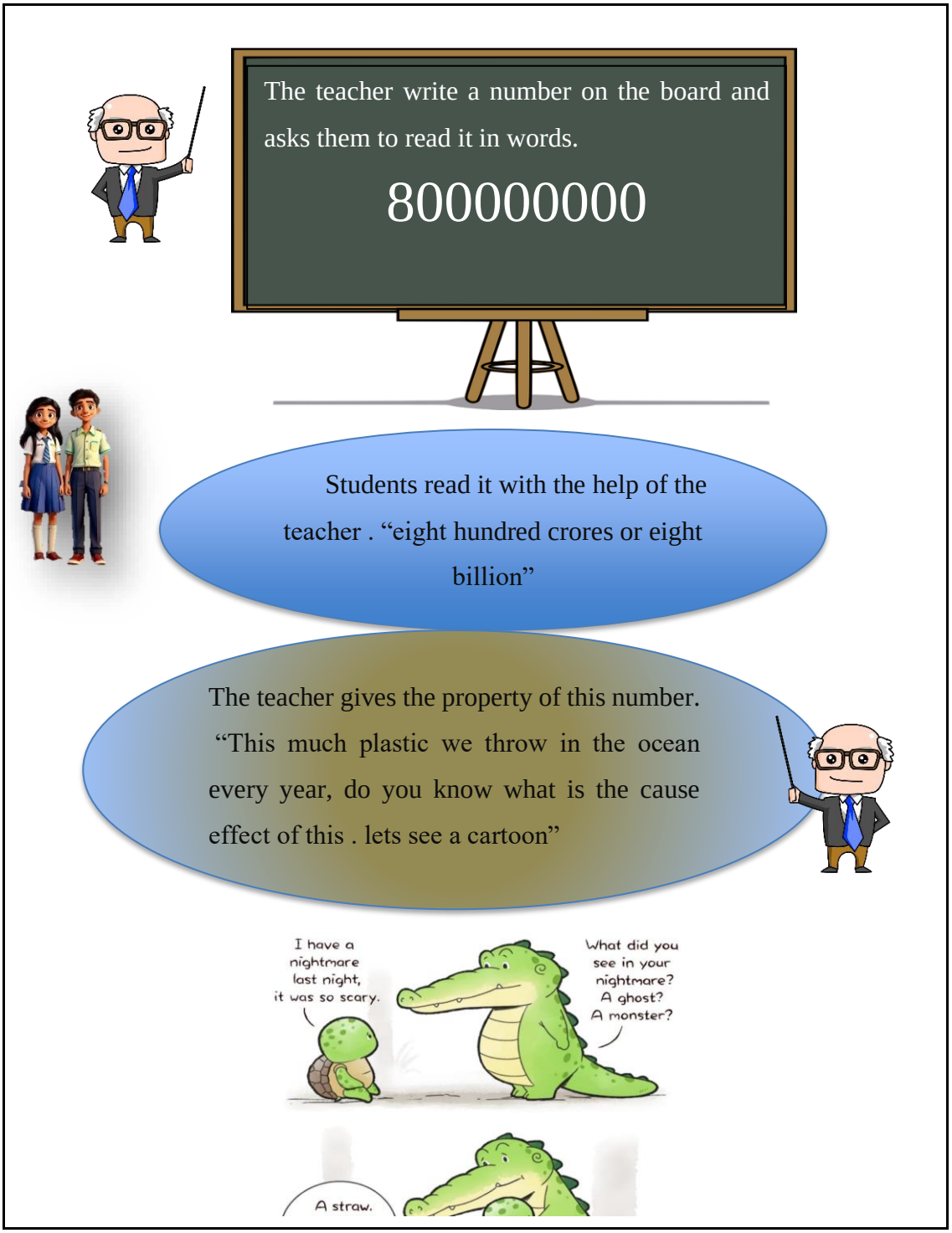
- ICT-Oriented, Cartoonification,Video

Phase 1 Orientation

The teacher starts the class with rapport building interaction.

Teacher recollects students the content ‘How the ocean influences us ‘ learnt from the last class.

Teacher introduces the topic that is to be discussed in the class: ‘How we influence the ocean.’

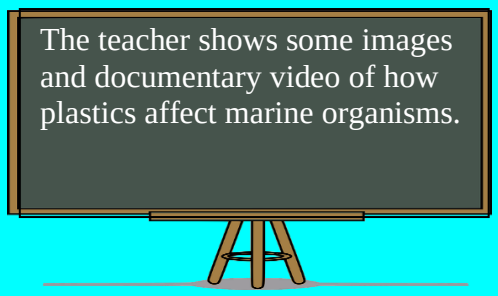


Students understand the idea and tell their opinion to the teacher.

* The cartoon says that straws and other nondegradable tiny plastics kill sea turtles and other marine organisms.

Phase 2

Presentation



Slides

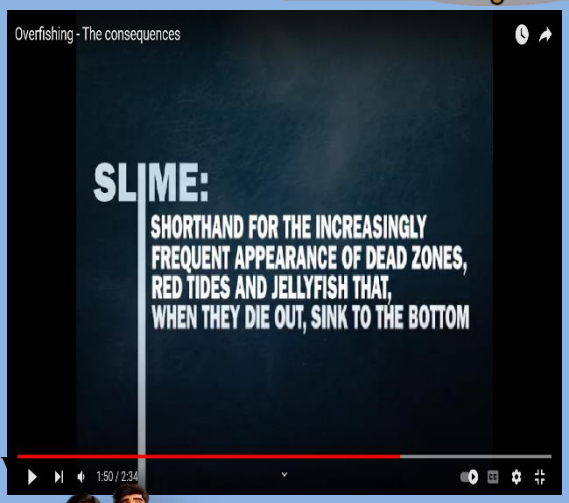
Video

https://youtu.be/1acjqraXMhs.

Students understand how plastics affect marine organisms' life, and how they affect humans once.

The teacher shows a video documentary and newspaper cutting about overfishing. And asks the students about how overfishing affects marine life.

Slide-8



Slide-8

ട്രോളിങ് നിരോധനം ജൂൺ 9 മുതൽ ജൂലൈ 31 വരെ

പരമ്പരാഗത വള്ളങ്ങൾക്കും നിരോധനം വരും

പൊന്നാനി: സംസ്ഥാനത്ത് ട്രോളിങ് നിരോധനം ജൂൺ 9 അർധരാത്രി മുതൽ ആരംഭിക്കും. ജൂലൈ 31 അർധരാത്രിവരെയാണ് നിരോധനംനിലനിൽക്കുക. മഴക്കാല മത്സ്യബന്ധന നിയന്ത്രണത്തിന്റെ ഭാഗമായി പരമ്പരാഗത വള്ളങ്ങൾക്കും ആഴക്കടൽ മത്സ്യബന്ധനത്തിന് നിരോധനം ഏർപ്പെടുത്താമെന്ന് കോടതി നിർദേശിച്ചിട്ടുണ്ട്. ഇതുസംബന്ധമായി വിവിധ മത്സ്യത്തൊഴിലാളികളുമായി സർക്കാർ അടുത്തയാഴ്ച യോഗം വിളിച്ചിട്ടുണ്ട്.

ട്രോളിങ് നിരോധനത്തിന്റെ പരിധിയിൽപ്പെടുത്തി നാടൻവള്ളങ്ങൾ കടലിൽപോകുന്നത് തടഞ്ഞാൽ നേരിടുമെന്ന നിലപാടിലാണ് പരമ്പരാഗത മത്സ്യത്തൊഴിലാളികൾ. ഇതുസംബന്ധിച്ച ഹൈക്കോടതി ഉത്തരവിൽ വ്യക്തത ആവശ്യപ്പെട്ട് സർക്കാർ തിരുത്തൽ ഹരജി നൽകണമെന്നും മത്സ്യത്തൊഴിലാളി സംഘടനകൾ ആവശ്യപ്പെട്ടു. ട്രോളിങ് നിരോധനത്തിന്റെഭാഗമായി മുന്ന് യന്ത്രവൽകൃത ബോട്ടുകൾ വാടകയ്ക്ക് നൽകാൻ ഫിഷറീസ് ടെണ്ടർ വിളിച്ചിട്ടുണ്ട്.

ട്രോളിങ് നിരോധന കാലയളവിൽ കടൽ പട്രോളിങ്ങിനും കടൽ രക്ഷാപ്രവർത്തനങ്ങൾക്കുമായാണ മൂന്ന് യന്ത്രവൽകൃത ബോട്ടുകൾ വാടകയ്ക്ക് നൽകാൻ താൽപര്യമുള്ള ബോട്ടുടമകളിൽ നിന്നും മുദ്രവെച്ച ക്വട്ടേഷനുകൾ ക്ഷണിച്ചത്. മെയ് 25 ഉച്ചയ്ക്ക് ശേഷം മൂന്നു മണിയോടെ ഫിഷറീസ് അസി. ഡയരക്ടർക്ക് മുമ്പാകെയാണ് ക്വട്ടേഷൻ സമർപ്പിക്കേണ്ടത്.

Students share their ideas about overfishing from their own knowledge, newspaper cutting, and documentary video.

The teacher consolidates the points of overfishing and trawling in the class. Trawling is a fishing method that involves dragging nets along the seafloor or through the water to catch fish. It can cause severe damage to habitats and result in unintended catches (bycatch) of non-target species. Overfishing happens when fish are caught at a rate that exceeds their ability to reproduce, leading to depleted populations. This can disrupt ecosystems, harm biodiversity, and impact fishing communities. Sustainable fishing practices, international cooperation, and marine protected areas are important to address these issues. Science-based fisheries management, fishing regulations, selective gear, and sustainable aquaculture can help ensure the long-term health of

Teacher shows a video of beautiful coral reefs and surrounding ecosystems.

Slide
https://youtu.be/ZiULxLLP32s

Teacher asks students about what would happen if the beauty of these corals were gone?
The phenomenon that occurs when coral reefs lose their vibrant colours and turn pale or white. It is primarily caused by environmental stress, particularly high-water temperatures. While coral bleaching can occur naturally, it has become a significant concern due to human-induced climate change and other human activities. Teacher shows a cartoon video of coral bleaching in the class,

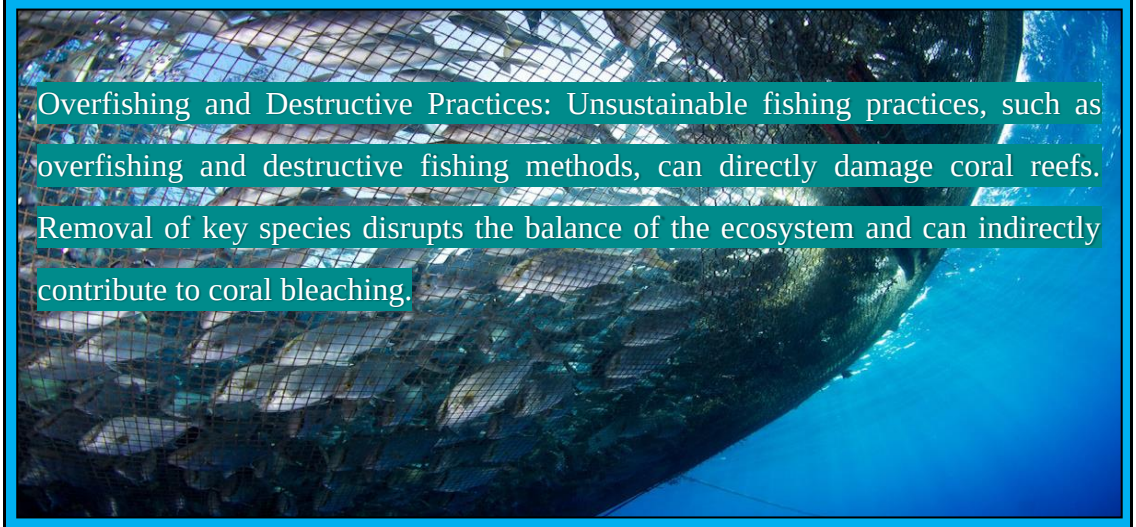
Slide 11
Video :https://youtu.be/aEdoizgeNJk

Explains the cause of coral bleaching that the coral bleaching occurs when corals expel the symbiotic algae living within them due to environmental stressors such as high water temperatures. This expulsion, known as bleaching, reveals the coral's white skeleton and makes them vulnerable to disease and mortality. The disruption of the symbiotic relationship and the resulting impacts highlight the urgent need to address coral bleaching as a significant ecological concern.

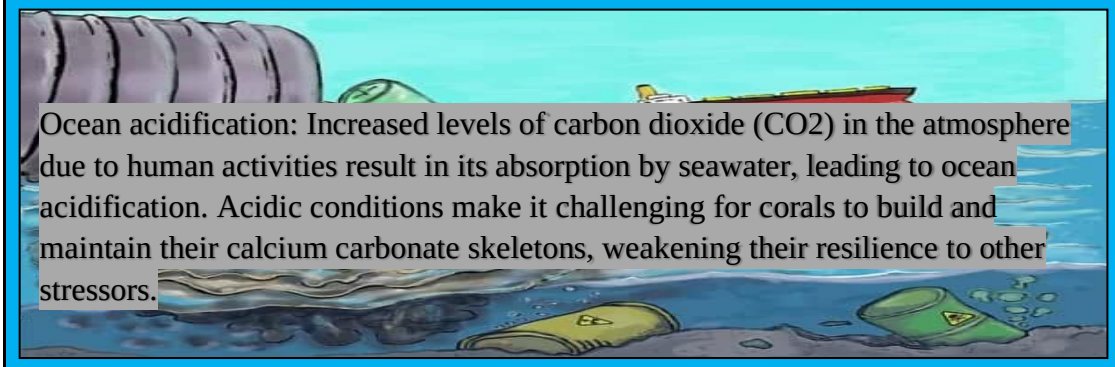
Students understand coral bleaching from the video and the explanations that they get from the teacher.

The teacher shows slides that explain cause of coral bleaching

Coral bleaching refers to the phenomenon whereby coral lose their vibrant colors and turn white. This occurs when corals are stressed by changes in conditions such as temperature, light, or nutrients. Under stress, corals expel the symbiotic algae living in their tissues, causing them to turn completely white.



Overfishing and Destructive Practices: Unsustainable fishing practices, such as overfishing and destructive fishing methods, can directly damage coral reefs. Removal of key species disrupts the balance of the ecosystem and can indirectly contribute to coral bleaching.



Ocean acidification: Increased levels of carbon dioxide (CO2) in the atmosphere due to human activities result in its absorption by seawater, leading to ocean acidification. Acidic conditions make it challenging for corals to build and maintain their calcium carbonate skeletons, weakening their resilience to other stressors.

Climate Change: Rising ocean temperatures associated with climate change are a major driver of coral bleaching. Heat stress disrupts the delicate balance between corals and their symbiotic algae, leading to their expulsion.

Increased UV Radiation: Ozone depletion and environmental pollution can amplify the amount of ultraviolet (UV) radiation reaching coral reefs. High UV radiation can damage the photosynthetic machinery of zooxanthellae and impair their ability to provide nutrients to corals.

Students understand the cause of coral bleaching.

Phase 3

Application

The teacher divides the class into 4 groups. Gives each group 4 topics such as plastic pollution, overfishing, coastal erosion, coral bleaching. The teacher instructs the students to discuss and find out the remedies for each environmental issue.

Students present their ideas to the whole class.

Group-1

Plastic Pollution Remedies

- Improved Waste Management Systems
- Promote and implement the 3R principle — reduce, reuse, and recycle
- Innovative cleanup projects
- Increase public awareness about the issue of plastic pollution and the steps individuals can take to reduce their own plastic use.

Group 2

Overfishing Remedies

- Establish protected marine areas where fishing is prohibited or limited. This allows fish populations in these areas to recover and can help replenish fish populations in surrounding areas as well.

- Governments should phase out subsidies that encourage overfishing and unsustainable practices, such as those that support large-scale industrial fishing operations.

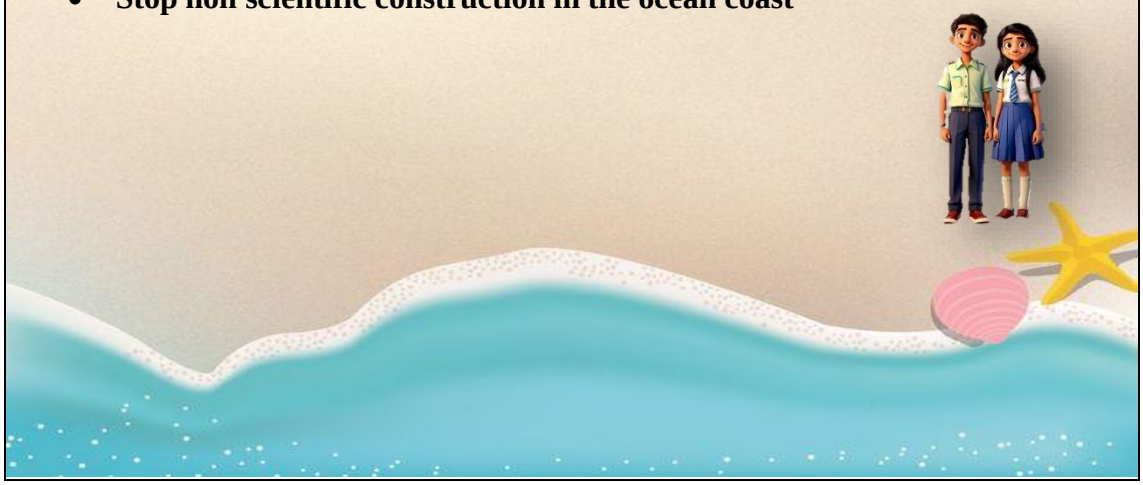
- Promote sustainable aquaculture practices to provide an alternative to wild-caught fish. However, aquaculture must be carefully managed to avoid environmental damage.

- Implement techniques and technologies that reduce bycatch, the unintentional capture of non-target species during fishing. Bycatch is wasteful and harmful to ecosystems.

Group 3

Coastal Erosion Remedies

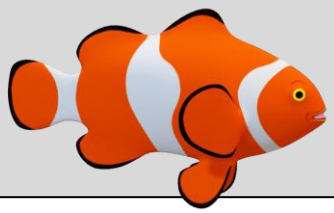
- **Restoration of Natural Defenses**: This involves restoring or enhancing natural defences against erosion such as mangroves, coral reefs, and wetlands.
- **Climate Change Mitigation**: Many strategies to reduce coastal erosion are linked to reducing the impacts of climate change, including efforts to reduce greenhouse gas emissions and adapt to sea level rise
- **Dune Stabilization**: Dunes can be stabilized through planting vegetation and/or using physical structures like fencing to reduce wind erosion.
- **Stop non scientific construction in the ocean coast**



Group 4

Coral Reef Degradation Remedies

- **Reduce Pollution:** By reducing pollution, particularly agricultural runoff and untreated sewage, we can lower the levels of nutrients in the water, which can contribute to coral disease and bleaching.
- **Ocean Acidification Mitigation:** Exploring methods to directly mitigate ocean acidification can be helpful, such as seagrass restoration, which can absorb some of the excess carbon dioxide in the water.
- **Mitigate Climate Change:** The most effective long-term solution for preventing coral bleaching is to mitigate climate change by reducing greenhouse gas emissions. The less the planet warms, the less severe and frequent coral bleaching events will be.
- **Legislation and Policies:** Implement and enforce regulations to limit harmful activities such as overfishing and destructive fishing practices, coastal development, and pollution.



The teacher consolidates the content by showing a slide that contains remedies for the above problems

Phase 4

Consolidation

The teacher consolidates the whole idea of the topic of how humans influence the ocean such as coral bleaching, ocean acidification, overfishing, plastic pollution etc. Humans affect the ocean in a variety of ways such as pollution, overfishing, coastal erosion, coral bleaching, etc.

Phase 5

Assessment activity

- Write an essay about other human activities that negatively influence the ocean
- Make posters on the theme of ‘Save Oceans, Save Us’.

Instructional Package -9

The ocean is largely unexplored.

Name of the Teacher	**-**	**Jithu B Alex**
Name of the School	**-**	
Time Required	**-**	**45 minutes**
Subject	**-**	**Ocean Literacy Enhancement**
Topic	**-**	**The ocean is largely unexplored.**

Objectives

To understand the ocean is largely unexplored.

Curricular Objectives

- To understand the ocean is the largest unexplored place on Earth and less than 5% of it has been explored.
- To realise that lots of career opportunities for the next generation of explorers and researchers will find great opportunities for discovery, innovation, and investigation.
- To classify Ocean Exploration Methods.
- To understand the future of our climate.
- To ensure sustainable use of ocean Resources.
- To admit the advancement in Technology exploring Ocean's complexities.

Skills

- Observation skills, communication skills, and interdisciplinary approach. Mathematic modelling, Advanced technologies.

Instructional Material

- Newspaper report, Slide

Strategy

- ICT- Oriented, Inter-disciplinary Approach, Mathematical Model

Phase 1

Orientation

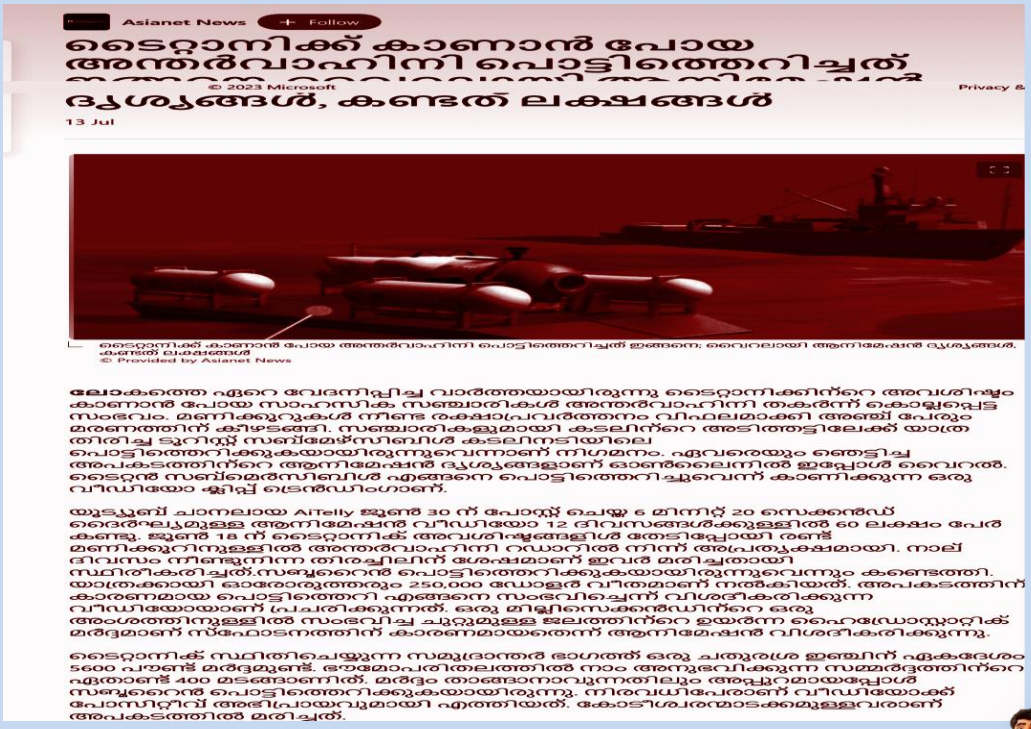
The teacher starts the class by building rapport, asking some questions related to previous classes,

- Have you understood how the ocean is helping us?
- Do you guys really love to explore the oceans?
- What is the most inspiring knowledge that you gain from the classes about the ocean?

The teacher asks students to get ready to know about how to explore oceans in many ways. .

Students respond to questions and get ready for the class.

The teacher shows a newspaper report on the slide.
The teacher asks students to read the content of the newspaper.
Also asks what they find from the news.



Asianet News + Follow

ടൈറ്റാനിക് കാണാൻ പോയ അന്തർവാഹിനി പൊട്ടിത്തെറിച്ചത് ദൃശ്യങ്ങൾ, കണ്ടത് ലക്ഷങ്ങൾ

13 Jul

ടൈറ്റാനിക് കാണാൻ പോയ അന്തർവാഹിനി പൊട്ടിത്തെറിച്ചത് ഇങ്ങനെ; വൈറലായി ആനിമേഷൻ ദൃശ്യങ്ങൾ, കണ്ടത് ലക്ഷങ്ങൾ
© Provided by Asianet News

ലോകത്തെ ഏറെ വേദനിപ്പിച്ച വാർത്തയായിരുന്നു ടൈറ്റാനിക്കിന്റെ അവശിഷ്ടം കാണാൻ പോയ സാഹസിക സഞ്ചാരികൾ അന്തർവാഹിനി തകർന്ന് കൊല്ലപ്പെട്ട സംഭവം. മണിക്കൂറുകൾ നീണ്ട രക്ഷാപ്രവർത്തനം വിഫലമാക്കി അഞ്ച് പേരും മരണത്തിന് കീഴടങ്ങി. സഞ്ചാരികളുമായി കടലിന്റെ അടിത്തട്ടിലേക്ക് യാത്ര തിരിച്ച ടൈറ്റൻ സബ്മെർസിബിൾ കടലിനടിയിലെ പൊട്ടിത്തെറിക്കുകയായിരുന്നുവെന്നാണ് നിഗമനം. ഏവരെയും ഞെട്ടിച്ച അപകടത്തിന്റെ ആനിമേഷൻ ദൃശ്യങ്ങളാണ് ഓൺലൈനിൽ ഇപ്പോൾ വൈറൽ. ടൈറൻ സബ്മെർസിബിൾ എങ്ങനെ പൊട്ടിത്തെറിച്ചുവെന്ന് കാണിക്കുന്ന ഒരു വീഡിയോ ക്ലിപ്പ് ട്രെൻഡിംഗാണ്.

യൂട്യൂബ് ചാനലായ AiTelly ജൂൺ 30 ന് പോസ്റ്റ് ചെയ്ത 6 മിനിറ്റ് 20 സെക്കൻഡ് ദൈർഘ്യമുള്ള ആനിമേഷൻ വീഡിയോ 12 ദിവസങ്ങൾക്കുള്ളിൽ 60 ലക്ഷം പേരെ കണ്ടു. ജൂൺ 18 ന് ടൈറ്റാനിക് അവശിഷ്ടങ്ങളിൽ തൊട്ടടുത്തായി രണ്ട് മണിക്കൂറിനുള്ളിൽ അന്തർവാഹിനി റഡാറിൽ നിന്ന് അപ്രത്യക്ഷമായി. നാല് ദിവസം നീണ്ടുനിന്ന തിരച്ചിലിന് ശേഷമാണ് ഇവർ മരിച്ചതായി സ്ഥിരീകരിച്ചത്.സഞ്ചാരികളുടെ പൊട്ടിത്തെറിക്കുകയായിരുന്നുവെന്നും കണ്ടെത്തി. യാത്രക്കായി ഓരോരുത്തരും 250,000 ഡോളർ വീതമാണ് നൽകിയത്. അപകടത്തിന് കാരണമായ പൊട്ടിത്തെറി എങ്ങനെ സംഭവിച്ചെന്ന് വിശദീകരിക്കുന്ന വീഡിയോയാണ് പ്രചരിക്കുന്നത്. ഒരു മിസൈലിന്റെ ഒരു അംശത്തിനുള്ളിൽ സംഭവിച്ച ചുരുളുള്ള ലോഹത്തിന്റെ ഉയർന്ന ഹൈഡ്രോസ്റ്റാറ്റിക് മർദ്ദമാണ് സ്ഫോടനത്തിന് കാരണമായതെന്ന് ആനിമേഷൻ വിശദീകരിക്കുന്നു.

ടൈറ്റാനിക് സ്ഥിതിചെയ്യുന്ന സമുദ്രാന്തർ ഭാഗത്ത് ഒരു ചതുരശ്ര ഇഞ്ചിന് ഏകദേശം 5600 പൗണ്ട് മർദ്ദമുണ്ട്. ഭൂമിയുടെ ഉപരിതലത്തിൽ നാം അനുഭവിക്കുന്ന സമ്മർദ്ദത്തിന്റെ ഏതാണ്ട് 400 മടങ്ങാണിത്. മർദ്ദം താങ്ങാനാവുന്നതിലും അപ്പുറമായപ്പോൾ സബ്മെറൈൻ പൊട്ടിത്തെറിക്കുകയായിരുന്നു. നിരവധിപേരാണ് വീഡിയോക്ക് പോസിറ്റീവ് അഭിപ്രായവുമായി എത്തിയത്. കോടീശ്വരന്മാടക്കമുള്ളവരാണ് അപകടത്തിൽ മരിച്ചത്.

Students read the content of the news and present what they find in the class
Such as

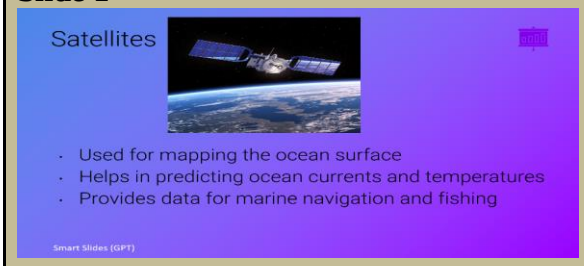
- The tragic incident involving the exploration of the remains of the Titanic, where five adventurous divers lost their lives.
- The ill-fated submarine excursion of tourists, which resulted in their deaths after the submarine collided with debris.
- The immense stress and pressure that can lead to structural failure and, in this case, the submarine's tragic fate.
- The search for the Titanic's remains began on June 18 and lasted for four days.
- The search team faced various obstacles, such as deep-sea pressures, low visibility, and the need to navigate through debris fields etc.

The teacher explains to the students that
In 2023, our technologies failed to find the submarine for 4 days. Only 5% of the oceans are explored totally, the vast amount of area in the ocean is to be explored. It is not always possible to explore the ocean using submarines. There are many other methods to explore the ocean, unfortunately, but nowadays we cannot explore our ocean fully, Because the technologies and human resources in marine exploration are not enough today.

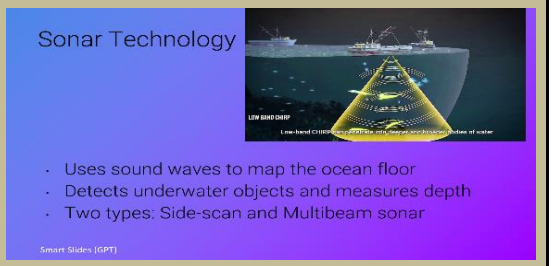
Phase 2 Presentation

Teacher shows ocean exploration methods to students in a slide show .

Slide 1



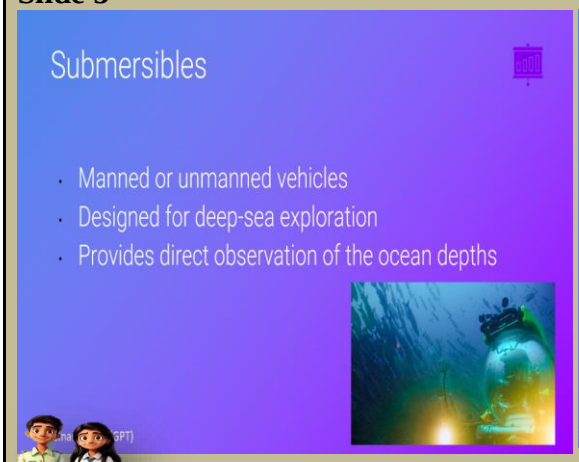
Slide 2



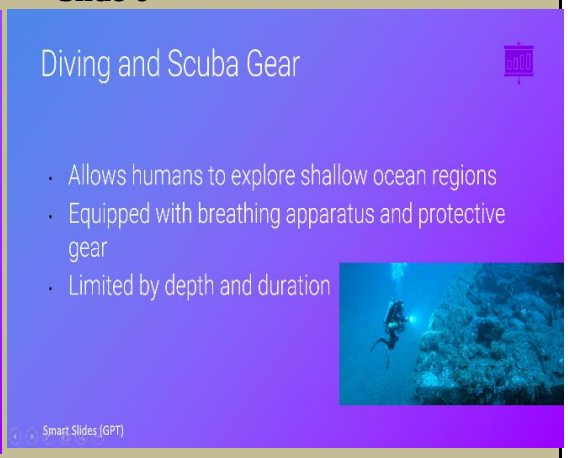
Slide 3

Slide 4

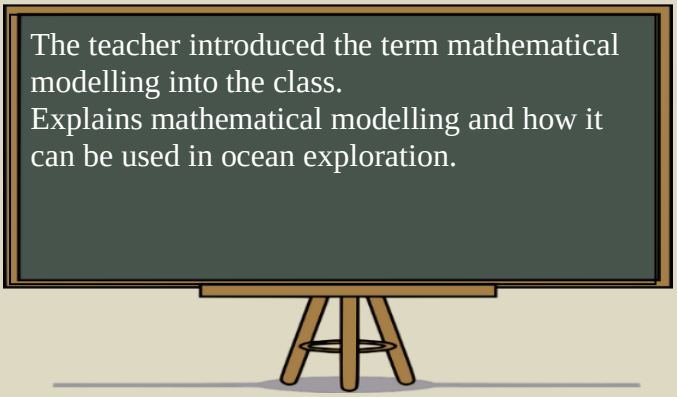
Slide 5



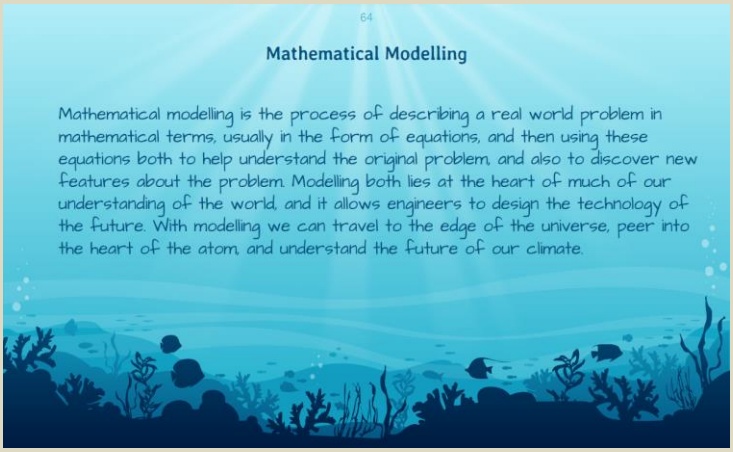
Slide 6



Students understand different ocean exploration methods.

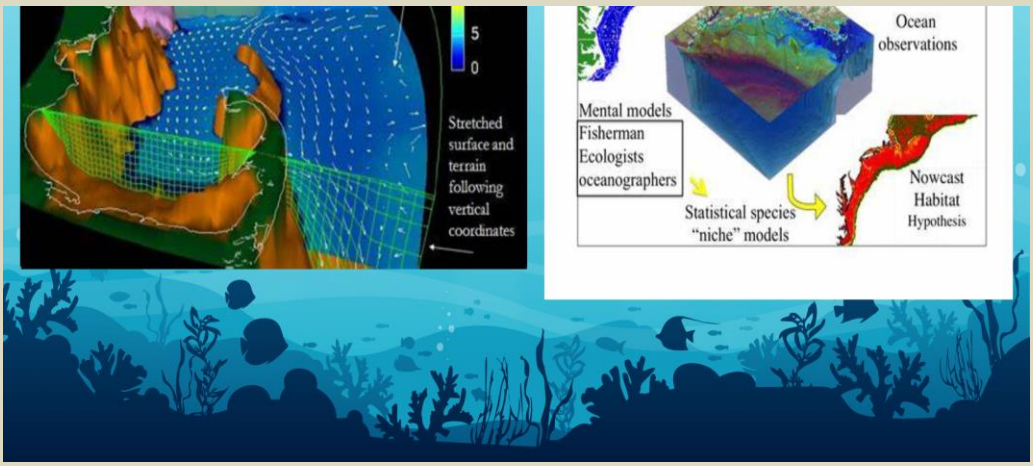


Slide 7

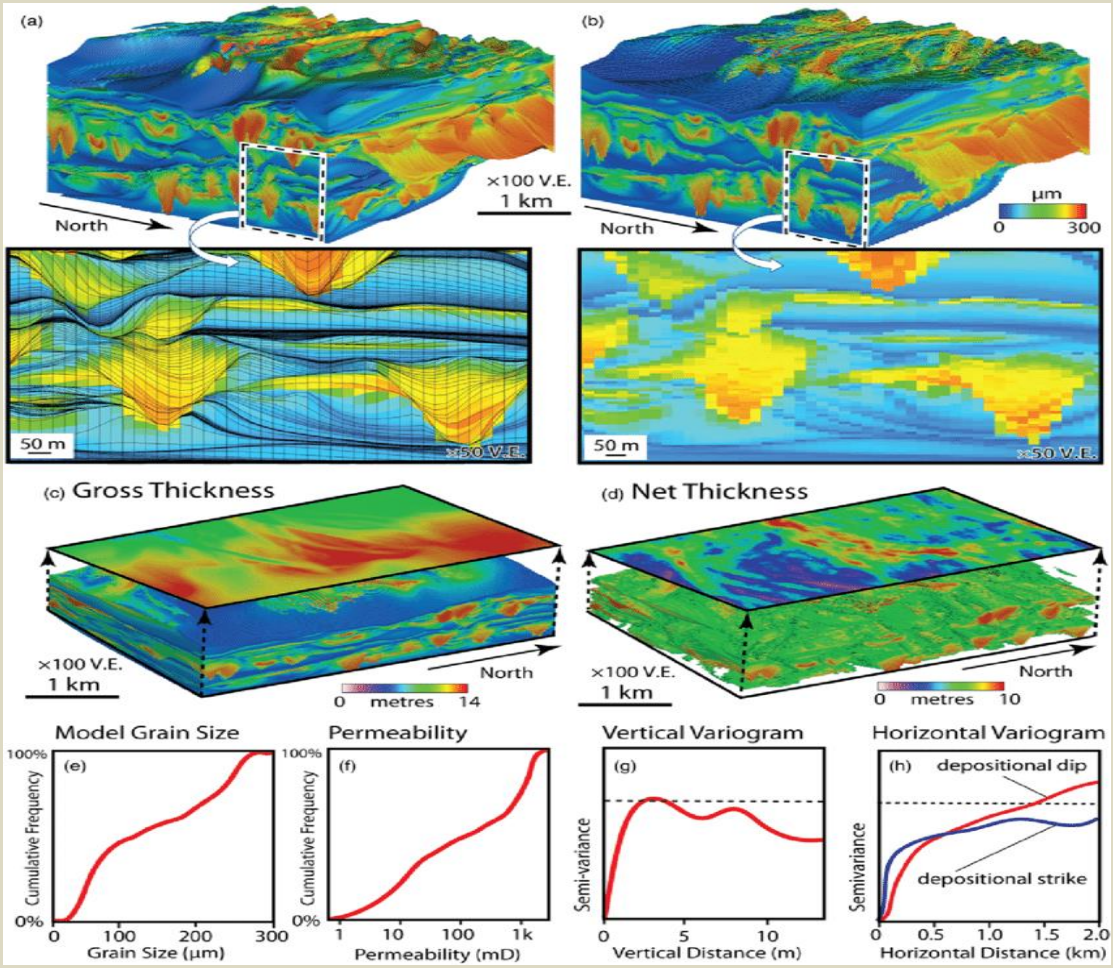


Mathematical modelling in ocean exploration examples.

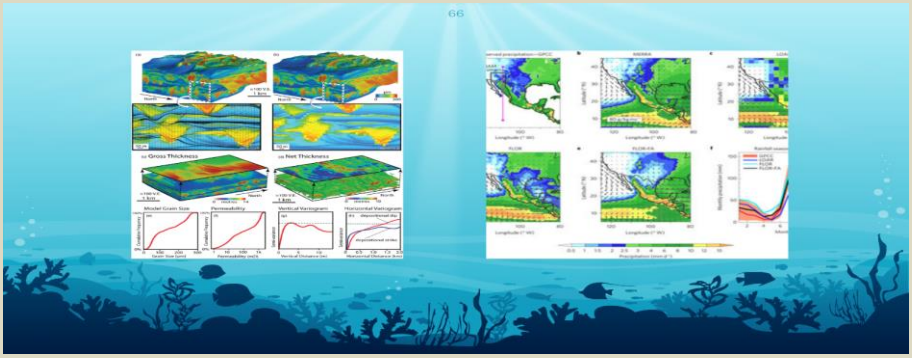
Slide 8



Slide 9



Slide 10



Students understand the importance of mathematical modelling in ocean exploration.

Phase 3 Application.

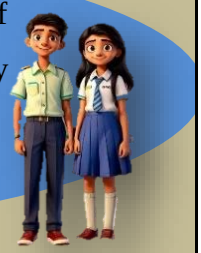
The teacher gives an activity that instructs them to categorize each topic that had studied in previous classes into the appropriate academic subjects such as physics, chemistry, biology, social studies, geography, environmental science, and mathematics, and discuss their findings with the class,

Physics	Chemistry	Biology	Environmental science	Geography	Social Studies	Mathematics
Ocean-atmosphere interactions, heat exchange, and thermohaline circulation	Salinity, dissolved gases, and their effects on ocean properties.	Marine organisms' role in shaping geological features (e.g., coral reefs).	Coastal erosion, sediment deposition, and the role of oceans in shaping landforms.	Study of ocean currents, waves, tides, and physical structures like trenches and seamounts.	Historical exploration routes.	Calculating the volume, depth, and area of various ocean features; statistical analysis of geographical data.
Pressure variations in the depth of the ocean.	Ocean's role in the chemical composition of the atmosphere.	Evolution of life from oceans, marine microorganisms' role in oxygen generation.	The importance of the ocean in creating suitable conditions for life.	Exploration of the vastness and interconnectedness of the world's oceans.	Impact of ocean-driven climate on human civilisations, cultures, and migration.	Mathematical Modelling for ocean exploration
Technologies used for deep-sea exploration.	Ocean Acidification	Marine biodiversity, taxonomy, marine ecosystems,	Study of different marine habitats and conservation efforts.	Mapping and studying the spatial distributions of ocean features, understandi	Cultural significance of marine biodiversity, indigenous	

		and ecological interactions.		ng the divisions of oceans and seas, and learning about underwater topography.	knowledg.	
		Potential discovery of new marine species, deep-sea ecosystems	Impact of human activities on marine ecosystems, conservation efforts.	Coastal geomorphology, landforms influenced by ocean processes.		
		Sustainable seafood sources, marine biotechnology.		Ocean's role in global climate patterns and events like El Niño and La Niña. Study of oceanic climatic zones, mapping of current patterns and their influence on regional climates.	Maritime history, oceanic trade routes, cultural significance of oceans, maritime laws and regulations. the significance of discoveries, and geopolitical aspects of marine territories.	
		Carbon cycle	Controlling global warming	Exploration and mapping of uncharted territories, the spatial distribution	Study of major fishing zones, impact of human settleme	

				of exploration endeavours.	nts on coastal regions, and human interactio ns with marine resources	

Students gain valuable insights into the interconnectedness of different academic subjects and how they collectively contribute to enhancing their own knowledge of the oceans.



Phase 4
Consolidation.

The ocean, the largest unexplored place on Earth with less than 5% explored, presents boundless opportunities for future generations of explorers and researchers to make groundbreaking discoveries and innovations. To ensure the sustainable use of ocean resources, understanding their potential is crucial, especially as human utilization of these resources has significantly increased in the last 50 years. Advancements in technology and mathematical models aid in exploring the ocean's complexities, while fostering collaboration among diverse disciplines such as biology, chemistry, climatology, programming, engineering, geology, meteorology, physics, animation, and illustration, leading to fresh perspectives and inquiries in ocean exploration.

Phase 5
Assessment and Extension Activity

Imagin that you are going to explore ocean tomorrow, write a diary of your journey that contains detail report of the journey.