APPENDIX 2.A

INSTRUCTIONAL MATERIAL BASED ON SOCIO-CONSTRUCTIVIST APPROACH
TEACHING EPISODE 1. - WEATHER AND ITS ELEMENTS

Instructional Objectives

(a) Knowledge
1.1. Students will be able to recall the different elements of weather

(b) Comprehension
1.2. Students will be able to explain how distance of Sun from earth causes change in weather conditions.

(c) Application
1.3. Students will be able to infer about the concept of weather.
1.4. Students will be able to construct a weather report table/graph using its different elements

Material needed—
LCD Projector, Laptop, samples of weather reports, worksheets, videos on ‘weather and its elements; effect of sun on weather’.

5E model lesson plan

Engagement— Ask students, “Do you remember the things that you were asked to pack when you were heading for a hill station?” Have them list what they think. Using this list, let them realize the importance of weather of a particular place by asking, “have you heard elders in your family discuss the weather before planning a family trip?” Further ask them to give some more such examples when we consider the weather first. Students may give some more examples. Let the students think from where they can get daily reports of weather.

Exploration—
(in group of 5 students) Continue the lesson by distributing each group a sample of weather report for successive 7 days carrying information about temperature, humidity and rainfall.

Chandigarh, India
Weather overview

<table>
<thead>
<tr>
<th>Current Time</th>
<th>Tuesday, June 1, 2010 at 11:21:18 PM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forecast</td>
<td>Wed Jun 2</td>
</tr>
<tr>
<td>Weather:</td>
<td>Sprinkles</td>
</tr>
<tr>
<td>Description:</td>
<td>late. High sunny.</td>
</tr>
</tbody>
</table>
In this activity, students will record the information from weather reports and fill all the columns according to data in the table. Let students work together in group to find whether all the seven days have the same maximum and minimum temperature, humidity and rainfall. Have them list what they think the elements of weather are. Using the list, let them create a definition of weather.


Then distribute a worksheet having unfilled table to each group of students.

<table>
<thead>
<tr>
<th>Date</th>
<th>Max. temp(°C)</th>
<th>Min. temp(°C)</th>
<th>Max. humidity(%)</th>
<th>Min. humidity(%)</th>
<th>Rainfall</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

In this activity, students will record the information from weather reports and fill all the columns according to data in the table. Let students work together in group to find whether all the seven days have the same maximum and minimum temperature, humidity and rainfall. Have them list what they think the elements of weather are. Using the list, let them create a definition of weather.
**Explanation** – When students complete the activity, let them present their findings to the class. Review each element (temperature, humidity, rainfall) of weather.

- Is maximum and minimum temperature recorded same for all the days?
- Are all the parameters same on any two days?
- Do you notice the considerable variations over a week?

With this teacher lead the students to understand that the day-to-day condition of the atmosphere at a place with respect to the temperature, humidity, rainfall, wind speed, etc., is called weather of that place. Further teacher show the students an animated video on ‘weather and its elements’ for detailed information of the concept.

**Extension** – Display a 48 hours weather report of Chandigarh at different times on the screen with the help of LCD projector.

**Current local time in Chandigarh**

<table>
<thead>
<tr>
<th></th>
<th>Wednesday</th>
<th>Thursday</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>48 hour forecast</strong></td>
<td><strong>Morning</strong></td>
<td><strong>Afternoon</strong></td>
</tr>
<tr>
<td><strong>Temperature</strong></td>
<td>82°F</td>
<td>96°F</td>
</tr>
<tr>
<td><strong>Wind Speed</strong></td>
<td>8 mph</td>
<td>8 mph</td>
</tr>
<tr>
<td><strong>Sunrise</strong></td>
<td>5:23 AM</td>
<td>6:55 AM</td>
</tr>
<tr>
<td><strong>Duration of day</strong></td>
<td>14 hours, 6 minutes</td>
<td><strong>Nautical twilight begins</strong></td>
</tr>
<tr>
<td><strong>Sun</strong></td>
<td>52° East-northeast</td>
<td>297° West-northwest</td>
</tr>
<tr>
<td><strong>Civil twilight</strong></td>
<td>4:55 AM</td>
<td>7:29 PM</td>
</tr>
<tr>
<td><strong>Find sunrise and sunset-times for other dates</strong></td>
<td><strong>See current position of the Sun</strong></td>
<td><strong>Sun near zenith</strong></td>
</tr>
</tbody>
</table>


Ask students to identify the time when the maximum and minimum temperature of the day occurs? Lead them to understand why in summer we feel so miserable in the afternoon and comparatively comfortable early in the morning. Further help students understand how all changes in weather depends upon the distance of sun from the earth by showing an animated video on ‘effect of sun on weather’.

**Evaluation** – Display a table showing weather reports of 7 successive days in June (2009) and December (2009)
### Chandigarh, India

#### Rising and setting times for the Sun

<table>
<thead>
<tr>
<th>Date</th>
<th>Sunrise</th>
<th>Sunset</th>
<th>Length of day</th>
<th>Difference</th>
<th>Time</th>
<th>Solar noon</th>
<th>Altitude</th>
<th>Distance (10^4 km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Jun 2009</td>
<td>05:21</td>
<td>19:21</td>
<td>14h 00m 26s</td>
<td>+ 48s</td>
<td>12:21</td>
<td>81.3°</td>
<td>151.694</td>
<td></td>
</tr>
<tr>
<td>2 Jun 2009</td>
<td>05:20</td>
<td>19:22</td>
<td>14h 01m 12s</td>
<td>+ 45s</td>
<td>12:21</td>
<td>81.5°</td>
<td>151.716</td>
<td></td>
</tr>
<tr>
<td>3 Jun 2009</td>
<td>05:20</td>
<td>19:22</td>
<td>14h 01m 56s</td>
<td>+ 43s</td>
<td>12:21</td>
<td>81.6°</td>
<td>151.737</td>
<td></td>
</tr>
<tr>
<td>4 Jun 2009</td>
<td>05:20</td>
<td>19:23</td>
<td>14h 02m 38s</td>
<td>+ 41s</td>
<td>12:21</td>
<td>81.7°</td>
<td>151.757</td>
<td></td>
</tr>
<tr>
<td>5 Jun 2009</td>
<td>05:20</td>
<td>19:23</td>
<td>14h 03m 17s</td>
<td>+ 39s</td>
<td>12:21</td>
<td>81.8°</td>
<td>151.777</td>
<td></td>
</tr>
<tr>
<td>6 Jun 2009</td>
<td>05:20</td>
<td>19:24</td>
<td>14h 03m 54s</td>
<td>+ 37s</td>
<td>12:22</td>
<td>81.9°</td>
<td>151.797</td>
<td></td>
</tr>
<tr>
<td>7 Jun 2009</td>
<td>05:20</td>
<td>19:24</td>
<td>14h 04m 29s</td>
<td>+ 34s</td>
<td>12:22</td>
<td>82.0°</td>
<td>151.816</td>
<td></td>
</tr>
</tbody>
</table>


Have students correctly answer the following questions.

- Is there any difference in the time of sunrises during summer and winter?
- When do you find sunrises earlier?
- Do you also find any difference in the time of sunset during the month of June and December?
- When are the days longer?
- When are the nights longer?

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5
Instructional Objectives

a) Knowledge
   2.1. Students will be able to name the department which collects the information about climate of different places.
   2.2. Students will be able to recall the term ‘Climate’

b) Comprehension
   2.3. Students will be able to discriminate between weather and climate

c) Application
   2.4. Students will be able to recognize the climate of a place on the basis of its average temperature and rainfall over a long period of time.

Material needed: LCD projector, Laptop, samples of climate information of some states, video on ‘climate’.

5-E Model lesson plan

Engagement: Tell students a story about two neighbor family of Mr. Sidhu and of Mr. Sharma. Mr. Sharma decided to spend summer holidays in Kashmir with his family and Mr. Sidhu decided to go to Rajasthan. Mr. Sharma took woolen clothes with them and Mr. Sidhu and family took cotton clothes with them. What should be the reason? My maternal uncle lives in Kinnaur. He always wear warm clothes and usually talk about snowfall. My cousin brother lives in Rajasthan land he never talks about snowfall but usually about the deserts. Why my cousin brother never have an experience of snowfall in Rajasthan? And why my maternal uncle didn’t find deserts in Kinnaur?

Exploration: Continue the lesson by distributing each group a sample of information about climate of Srinagar and Kerala from 1980 to 2005 in the form of table carries information about monthly maximum and minimum mean temperature and mean rainfall of both places.

<table>
<thead>
<tr>
<th>Month</th>
<th>Daily minimum mean temperature (°C)</th>
<th>Daily maximum mean temperature (°C)</th>
<th>Mean total rainfall (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>-2.3</td>
<td>4.7</td>
<td>57</td>
</tr>
<tr>
<td>Feb</td>
<td>-0.6</td>
<td>7.8</td>
<td>65</td>
</tr>
<tr>
<td>Mar</td>
<td>3.8</td>
<td>13.6</td>
<td>99</td>
</tr>
<tr>
<td>Apr</td>
<td>7.7</td>
<td>19.4</td>
<td>88</td>
</tr>
<tr>
<td>May</td>
<td>10.7</td>
<td>23.8</td>
<td>72</td>
</tr>
<tr>
<td>June</td>
<td>14.7</td>
<td>29.2</td>
<td>37</td>
</tr>
<tr>
<td>July</td>
<td>8.2</td>
<td>30.0</td>
<td>49</td>
</tr>
<tr>
<td>Aug</td>
<td>17.5</td>
<td>29.7</td>
<td>37</td>
</tr>
<tr>
<td>Sep</td>
<td>12.9</td>
<td>27.8</td>
<td>33</td>
</tr>
<tr>
<td>Oct</td>
<td>6.1</td>
<td>21.9</td>
<td>36</td>
</tr>
<tr>
<td>Nov</td>
<td>0.9</td>
<td>14.7</td>
<td>27</td>
</tr>
<tr>
<td>Dec</td>
<td>-1.6</td>
<td>8.2</td>
<td>43</td>
</tr>
</tbody>
</table>
### Table: Kerela Information about climate

<table>
<thead>
<tr>
<th>Month</th>
<th>Daily minimum mean temperature (°C)</th>
<th>Daily maximum mean temperature (°C)</th>
<th>Mean total rainfall (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>22.2</td>
<td>31.5</td>
<td>23</td>
</tr>
<tr>
<td>Feb</td>
<td>22.8</td>
<td>31.9</td>
<td>24</td>
</tr>
<tr>
<td>Mar</td>
<td>24.1</td>
<td>32.6</td>
<td>40</td>
</tr>
<tr>
<td>Apr</td>
<td>24.9</td>
<td>32.6</td>
<td>117</td>
</tr>
<tr>
<td>May</td>
<td>24.7</td>
<td>31.6</td>
<td>230</td>
</tr>
<tr>
<td>June</td>
<td>23.5</td>
<td>29.7</td>
<td>321</td>
</tr>
<tr>
<td>July</td>
<td>23.1</td>
<td>29.2</td>
<td>227</td>
</tr>
<tr>
<td>Aug</td>
<td>23.2</td>
<td>29.4</td>
<td>138</td>
</tr>
<tr>
<td>Sep</td>
<td>23.3</td>
<td>30.0</td>
<td>175</td>
</tr>
<tr>
<td>Oct</td>
<td>23.3</td>
<td>29.9</td>
<td>282</td>
</tr>
<tr>
<td>Nov</td>
<td>23.1</td>
<td>30.3</td>
<td>185</td>
</tr>
<tr>
<td>Dec</td>
<td>22.6</td>
<td>31.0</td>
<td>66</td>
</tr>
</tbody>
</table>

Let students work together in group to find which state is more wet and hot? Which state does show comparatively colder climate? Why does meteorologist record and preserve the weather for past several years?

Using this all information, let them create a definition of climate.

**Explanation:** When students complete the task, lead them to understand that the data was presented in two forms, firstly in form of average of temperatures recorded during the months and secondly, average of such temperature over many years and have the students to think about climate conditions of two places in India.

- What have we observed as the cause of climate of any particular place?
- Does the average rainfall of any place effect on the climate of that place?
- Does the climate remain same all over India?

Taking clues from all above information, teacher explains that the average weather pattern taken over a long time, say 25 years, is called the climate of that place and the person who collect and record the information of weather every day is called ‘Meteorologist’.

**Extension:** Further teacher shows students a video on ‘climate’ for understanding of the basic and different concepts of climate.

Have students work in groups to make a list of states of India having hot and dry climate. Teacher helps students to make a table to differentiate between climate and weather.

**Evaluation:**

- Indicate the type of climate of following area:
  a) Jammu and Kashmir
  b) Rajasthan
c) Kerala

d) North-east India

• The two regions of India with extreme climate conditions are
  
  and
  
• A place receive very little rainfall and the temperature is very high throughout the year, the climate of the place will be ______ _________ and ______ ________.

TEACHING EPISODE 3: ADAPTATION OF ANIMALS LIVING IN POLAR REGION

Instructional Objectives

a) Knowledge:
  
  3.1. Students will be able to recognize some of the arctic animals.

b) Application:
  
  3.2. Students will be able to Infer about the adaptation features that enable animals to survive in polar environment.

Material Needed – Oil, cotton, soft toys, LCD, Laptop, screen, puppet, fur cloth, pictures, webcam footage, videos on polar region, polar bear, penguins and other polar animals.

5 E Model Lesson Plan

Engagement:

Begin by pictures of Polar region (looking at and discussing the picture) and discuss about frostbite, teacher asks.” How can scientist and people who live in the arctic region, survive in such cold environment? Students will probably identify proper clothing as a necessity; in which case, let them consider what type of fabric and clothing best in cold temperature.

Give students a text to read having information about arctic animals. Tell them to read this within the group. Ask students to name animals from the given text that live in the Arctic region, and list them in their notebooks. How these animals are able to keep themselves warm in such cold environment and what they know about arctic animals and what other questions they have about the topic?

Exploration: In this phase, display a video to the students showing habitat, habits and lifestyle of polar bear. Pictures, webcam footage, or even polar bear toy / puppet can be used.
Have students explore fur, skin, blubber, scales, shells, claw, and colors of animals and purpose of each. Continue the lesson by distributing ice cubes and insulated fur cloth to each group and let them experience the fur’s insulating quality.

**Explanation:** With the help of white colored soft toy covered with in white cotton, lead the students to understand and explain how polar bear’s white fur body help them to hide and make them invisible in white snow from predators. Have the students discuss about how long curved and sharp claws help polar bears to walk on ice path. How the double layer of fat under the skin of polar animals insulate their body from cold and keep them warm. How does very strong sense of smell help the bear to locate and catch the prey?

**Extension:** Display students picture of penguins huddled together on the screen with the help of LCD projector.

Have them recall how warm they feel when they are in a hall full of people. Further display students a video on ‘Penguins and climate adaptation’ which help them to notice how the streamlined bodies and web feet of penguin make them good swimmer.

**Evaluation:**

- How can animals and people stay warm in cold / polar environment?
- What kinds of animals live in polar environments?
- Which features adapt polar bears to live in extremely cold conditions?
TEACHING EPISODE – 4: Adaptation of animals living in tropical rainforests

Instructional Objectives:

a) Knowledge
   4.1. Students will be able to recall some of the tropical rainforests found in India.
   4.2. Students will be able to recognize the animals living in tropical rainforests.

b) Comprehension
   4.3. Students will be able to relate the climate of tropical rainforests and special habits/features adapted by the animals to the best survive there.
   4.4. Students will be able to categorize the adaptation features for tropical and polar region.

Material Needed: Globe/map of world, laptop, LCD projector, pictures and videos on tropical rainforest region and animals.

5 E Model Lesson Plan

Engagement: Show students location of equator line on the globe/map of world. Ask students to name the states lying on or near this equator line. Further ask students to predict the type of...
climate in these states. Students may or may not respond. The teacher displays pictures of tropical rainforest to students and leads them to think how hot and humid climate of tropical rainforests support wide variety and number of animals and plants to grow.

Further let them think about the problem of competition for food and shelter and how are the animals in tropical rainforests adapted to overcome this problem.

Exploration: Teacher display students a video and series of pictures having name, features, habitat, life style and problems which the animals living in the tropical rainforests have to face.

Begin by the picture of red eyed frog; let students explore the special features (green colored skin and sticky pads on feet) which help it to survive on trees of tropical rainforests.

Teacher further display pictures of long tailed monkey and have them explore the advantage of long tail for grasping the branches?

Teacher displays picture of Bird Toucan and let students explore, how long large beak of the bird supports it to reach fruit branches.

Explanation: By using the information explored by students from pictures / videos, let the students to work in group to relate the climate of tropical rainforests and special habits or features adapted by the animals to the best survive there.
Let them explain how hot and humid climate is favorable for a wide variety and number of animals to grow.

How large number and variety of animals living in tropical rainforests, causes intense competition for food and shelter.

**Extension:**

By giving students examples of other animals living in tropical rainforest and displaying webcam images/videos of lions and tigers, lead them to understand the adaptation features like living on the trees, development of strong tails, bright colors, sharp patterns, loud voice, diet, sensitive hearing, sharp eye sight, thick skin, ability to camouflage in order to protect themselves from predators.

Further display them a video on the ‘life style of elephant’ and have them notice adaptations.(Trunk for strong smell and picking up food, tusks, large ears) needed for living in tropical rainforests.

Teacher writes some adaptation features on black board and ask students to classify these for tropical rainforest animals and polar animals.

**Evaluation:**

- Which option best describe a tropical region?
  
  (i) Hot and Humid  
  (ii) Moderate temperature and heavy rainfall  
  (iii) Cold and humid  
  (iv) Hot and dry
• A carnivore with stripes on its body moves very fast while catching its prey. It is likely to be found in

(i) Polar region   (iii) Ocean
(ii) Deserts      (iv) Tropical rainforests

• How does an elephant living in tropical rainforest adapt itself to survive?
• Explain, with examples, why we find animals of certain kind living in particular climate conditions.

TEACHING EPISODE – 5 -- SOIL PROFILE

Instructional Objectives

a) Knowledge:

5.1. Students will be able to recall the meaning of soil profile.

b) Comprehension:

5.2. Students will be able to identify the different horizons of soil.

c) Application:

5.3. Infer about the various soil layers on the bases of physical and chemical composition

Material Needed: Samples of soil, glass tumblers. LCD projector, laptop, hand lens, videos and web images/pictures of soil profile.

5 E Model lesson:

Engagement: What’s the difference between soil and dust? Students often think of soil as inert and dead, but the living systems that create and make up healthy soil are incredibly dynamic and complex. Ask them, what the first thing is that construction workers do when they build houses or buildings. (Dig holes). Ask them have they ever looked down in a deep hole and have they even seen at the sides of a recently dug ditch? Now show students pictures of road cut or construction site. Does the soil on the sides and down at the bottom look the same as the soil on the top? Why not? What a soil profile is?

Exploration: Distribute each group of students packets of soil sample, glass tumblers (three quarter filled with water). Tell them to add handful of soil samples in glass tumblers. Now let it...
stand undisturbed for sometime. Afterwards, ask them to observe it carefully.

- Have them explore different layers of particles of different sizes in the glass tumblers.
- Which particle would settle first and be on the bottom (sand or small rocks)?
- Are there some dead rolling leaves or animal remains floating on water?
- Let them draw a diagram showing different layers (Humus, water, clay, sand, gravel)

**Explanation:** Review with students what they observed in their soil sample in the activity. Lead them to understand 'the vertical sections in different layers of soil are called soil profile'. Further display animated video and pictures of soil profile on the screen with the help of LCD.

Lead them to relate their finding about different layers of soil with the A, B, C horizons and bed rock horizon of soil profile.

Tell them about chemical composition, amount of humus, type of particles, texture and importance of each layer.

**Extension:**

Give a hand lens to each group of students. Ask them to record color, texture and kinds of materials of the top soil in their soil profile log (Dark, loose, moist, full of organic material).

Give students sample of subsoil. Have them examine it with a hand lens. They should make comparisons and record color, texture and kind of materials on their profile log (light color,
Have students place gravel in bottom of jar. Then a layer of subsoil and on the top places a layer of top soil.

Students should draw their soil profile model and label the parts. Record character and kind of materials found in each layer.

**Evaluation:**
- Sketch the cross section of soil and label the various layers.
- In addition to the rock particles, the soil contains:
  1. Air and water
  2. Water and plants
  3. Mineral, organic matter, air and water
  4. Water, air and plants

**TEACHING EPISODE 6 -- WEATHERING AND SOIL FORMATION**

Instructional Objectives:

a) **Knowledge:**
   6.1. Students will be able to name the process of soil formation.
   6.2. Students will be able to recall the different types of weathering

b) **Comprehension:**
   6.3. Students will be able to discriminate between physical and chemical weathering

c) **Application:**
6.4. Students will be able to reason out the role of physical weathering in increasing the rate of chemical weathering.

**Material needed:** Water, Cups, sugar cubes, hammers/ mallet, spoons, laptop, LCD projector

**Engagement:** Show big pole of sand to students and for the activation of prior knowledge ask them, “How does sand become sand?” (Possible answers – comes from bigger rocks, made of minerals). Then tell students that sand forms by a special type of process. What is that process known as? Have they ever heard about weathering? What are different types of weathering?

**Exploration:** Give each group of students a cup of water, 2 sugar cubes, a small hammer / mallet (to break sugar cubes) and spoon. The students hypothesize as to what’s going to happen to each sugar cube. Students drop a whole sugar cube into water, stir for one minute, and write down observations about the sugar. Next take second sugar cube, tap with hammer 3 times. Write down observations about the sugar. Discuss in group, being sure to refer back to individual hypothesis. Then discuss as a whole class. Do all groups make same observations while cube should have partially dissolved, crushed sugar should have broken down into smaller pieces.

**Explanation:** When students complete the activity, lead them to understand the difference between chemical and mechanical (physical) weathering. Let the students discuss about the sugar cubes that dissolved is an example of chemical weathering because have an individual sugar and water molecules, but instead a solution. Example; once you have baked a cake you can no longer take out the individual ingredients. Further help them to explain about crushed sugar cube as an example of physical (mechanical) weathering as it is still sugar, but broken down into smaller pieces. Next let students relate the whole sugar cube as rock and the formation of solution and smaller particles of cube by chemical and physical weathering as the process of formation of soil. Let them explore how weathering of rocks causes the formation of soil.

**Extension:** Give students two cups of water, two sugar cubes, hammer / mallet and 2 spoons. Tell them to Crush one sugar cube and leave the other whole. Drop whole sugar cube in one cup water and crushed sugar cube in other cup of water. Stir both cups, at same rate, for 1 minute. Have students make and record observations. Let them discuss the result as a small group, then as a whole class. Tie in that physical (mechanical) weathering increases the rate of chemical weathering. Lead them to understand when the material is broken down into smaller pieces, how the surface area is increased, and make the chemical weathering faster.

**Evaluation:**
- Draw Venn diagram of Chemical and Physical Weathering
- What is weathering
- How weathering of rocks causes soil formation?
TEACHING EPISODE – 7 TYPES OF SOIL

Instructional Objectives:

a) Knowledge:

7.1. Students will be able to recall the names the different types of soils.

b) Comprehension:

7.2. Students will be able to identify the types of soil having minimum and maximum water holding capacity.

7.3. Students will be able to explain how water holding capacity of soil, necessary for the growth and survival of plants.

c) Application:

7.4. Students will be able to infer about the soil types on the basis of composition and proportion of the particles of various sizes

Material Needed: Hand lens, soil samples (sand soil, loamy soil, and clayey soil), graduated beaker, water.

5 E Lesson Plan

Engagement: Tell the students that you have a problem. You bought some house plants but weren’t sure what type of soil to plant them in. One worker said to use soil ‘A’ (sandy soil), the worker at home depot said to use soil ‘B’ (loamy soil), and the worker at a Nursery said to use soil ‘C’ (clayey soil). Ask the class if they will help to decide which soil is best for growing the plants.

Exploration: Pass out the soil samples to the groups and have them explore first through observation keeping the soil in bags. Let them record their observations. Next, have students open bag ‘A’ sand use their hand lens and their sense of touch to describe the sample. Ask them to make a record of their observations. Repeat the same with bag ‘B’ and ‘C’. To check the permeability of water, have students put one cup of soil ‘A’ into the graduated beaker. Give each group a graduated sample filled with water. Instruct them to pour the water into the beaker. Let them observe the speed of the water goes through each sample. Repeat with the other samples and record all the observations.

Explanation: Review the plant need water, nutrients and sunlight in order to survive and grow. Ask which soil sample they think would work the best for our house plants. Let them discuss the
reasons and lead the discussion to help them classify the soil types on the basis of the proportion of particles of various sizes and water holding capacity.

Lead them to understand how mixture of sand, clay and other soil particles (silt) make loamy soil best for growing the plants.

**Extension**: Distribute samples of clayed, loamy and sandy soils to each group of students. Tell them to take a fistful of soil from one of the samples and remove any pebbles, rocks or grass blades from it. Now let them to add water drop by drop and knead the soil. (Add just enough water so that a ball can be made from it, but at the same time it should not be sticky). Let them try to make a ball from this soil. Now tell them to roll this ball, on a flat surface and try to convert it into a cylinder. Further let them try to make a ring from this cylinder. Let them repeat the activity with other samples also and record the changes. Does the extent to which a soil can be shaped indicate its type?

Can you suggest which type of soil would be the best for making pots, toys and statues?

**Evaluation:**

- List the differences between clayed soil and sandy soil.
- The water holding capacity is higher in
  
- Sandy soil (i)  
- Clayed soil (ii)
  
- Loamy soil (iii)  
- Mixture of sandy and loamy soil (iv)

- If the soil contains greater proportion of big particles it is called ________.
- If soil contains greater proportion of fine particles relatively higher, then it is called ________.
- Which type of soil is best for making pots?
TEACHING EPISODE- 8: MOISTURE IN SOIL & ABSORPTION OF WATER BY SOIL

Instructional Objectives:

a) Comprehension:

8.1. Students will be able to explain how vapors coming out of the soil shimmer in summer days.

8.2. Students will be able to compare the different types of soil on the basis of their physical and chemical properties.

b) Application:

8.3. Students will be able to compute the percentage of moisture content in soil.

Material Needed: Burner, soil samples (loamy, clayey and sandy), boiling, tube, stand plastic, funnel, filter paper, and beaker.

Engagement: Teacher asks students “Have you ever passed through a farmland during a hot summer day? Have you noticed that the air above the land is shimmering? Why is it so? When rain falls on ground where does water go? Does all the soil absorb water to same extent? How can you find out the absorption rate of water?

Exploration: Distribute plastic funnel and filter paper to each group of students. Ask them to fold and place filter paper in plastic funnel. Further tell each group to weigh 50 g of dry powdered soil and pour it into funnel. Ask each group of students to pour a certain amount of water drop by drop on all over the soil. Let them explore the weight of water absorbed by the soil by subtracting the amount of water left in the measuring cylinder from the amount of water retained by the soil.

Initial volume of water in measuring cylinder = U ml
Final volume of water in measuring cylinder = V ml
Volume of water absorbed by the soil = (U - V) ml
Weight of water absorbed by the soil = (U - V) g

Now lead the students to calculate the percentage moisture content in soil by using formula

Weight. of moisture x 100 / Original weight of the soil

Explanation: Discuss the results by repeating the activity with different soil samples (loamy, clayed, and sandy).

- Would you get the same results for all the samples?
- Which soil would have the highest absorption rate?
- Which soil would have the lowest absorption rate?
- 8-10 days after the rain, the level of water in a pond or well rises. Which type of soil will allow water to reach a well faster and in greater amount?
Which type of soil retains the highest amount of water and which retains the least.

Extension: Ask students to take a boiling tube. Put two spoonful of soil sample in it. Heat it on a flame and find out what happens upon heating. Does they notice water drops anywhere? Let them discuss that on heating, water in the soil evaporates, moves up and condenses on the cooler inner walls of the upper part of the boiling tube. Lead them to apply the concept to real situation when on a hot summer day, the vapors come out of the soil reflect the sunlight and air above the soil seems to shimmer. Further ask students to take the soil out of the tube. Let them compare it with the soil which has not been heated and record the differences.

Evaluation:

- Do all the soils absorb water to the same extent?
- How can you find out the moisture content of loamy soil?
- Can you suggest any method to let more rain water reach the water underground?

TEACHING EPISODE - 9: SOIL EROSION

Instructional objectives:

a) Knowledge:
9.1. Students will be able to recall the meaning of soil erosion.

b) Comprehension
9.2. Students will be able to assess the major causes of soil erosion.

c) Application:
9.3. Students will be able to infer about different ways which help to reduce soil erosion.

5E model lesson plan

Engagement: Take students on a walk outside the school building and ask them to note where the soil is worn away or seems to have collected. Upon returning to the classroom ask them to make a list of the sites where soil was worn away or collected. Suggested answers may be bottom of slide under swing, end of splash guard by rain spout at entrance to door, path leading to the playground at the bottom of hill/ slope. Teacher asks them whether they notice anything different about these areas. (There was just dust, not grass). What do you think caused these changes?

Exploration: Let students construct a model to investigate how these changes have occurred. Teacher provides material (piece of sod, fine potting soil, and a heavy clay soil) to students and instructs them to make their own model of a landscape. Have them use a paint roller tray as the base of landscape. Ask them to keep bottom well empty by not putting any landscape material in
it. Once students have construct their models, tell them to label and make a prediction as to what happen it 'rains' on the landscape.

One should pour a cup of water all at once into the rainmaker. Hold the rainmaker about 4 inches above the upper end of landscape. When it is finished raining have students observe the final effects of the rain on the landscape. Let students go back to their prediction and record what actually happened.

**Explanation:** Let students compare the predictions which they made before it rained on landscape and what actually happened to landscape when it rained on it. Let them discuss how is landscape different after the rain than before the rain on it? What happened to the soil? Where did it go? Why did it happen? As students share their ideas and understandings, lead the discussion to some valuable statements like the dirt and soil washed away the soil collected at the bottom, the water hollowed out the soil, the rain carried the soil down the hill, when water washed away the soil it formed a hole. Relate their observations to the process soil erosion and help them to identify label erosion. Have students work to create definition of soil erosion. Lead them to understand that removal of land surface by water, wind or ice is known as soil erosion.

**Extension:** Let students brainstorm different ways which help to reduce soil erosion. Help them to understand that just used water to stimulate erosion, but it can also be caused by wind, people, animals, etc. In the absence of plants, soil becomes loose, so it can be moved by wind and flowing water. Erosion of soil is more severe in areas of little or no surface vegetation, such as desert or base lands. So cutting of trees and deforestation should be restricted and effort should be made to increase the green areas. Teacher introduce term 'terracing' as a practice of creating benches or nearly level layers on a hillside setting and thus helps to slow rain water as it rains down the terraced area and prevent soil erosion.

**Evaluation:**
- What is soil erosion?
- How terracing reduce soil erosion?
- Enlist some major causes of soil erosion.

**TEACHING EPISODE – 10 - AVAILABLE WATER FOR HUMAN USE**

**Instructional Objectives:**

**a) Comprehension:**

10.1. Students will be able to relate the total amount of water in the world with the actual amount of available water for human consumption.

10.2. Students will be able to describe the different ways with which water can be saved

**b) Application:**

10.3. Students will be able to infer about the water bodies on the earth which are useful for human consumption
Material Needed:

Buckets, Bath mugs, Glass tumblers, spoons, water, pictures of earth taken from space, animated video on ‘availability of water on earth’, laptop, LCD projector.

5E Model lesson

Engagement: Ask students, “What do we need to live?” Students may give different responses like food, air, water. Display pictures of earth taken from space to the students and ask why does it appear blue?

Are you aware that what percentage of the earth’s surface is covered with water? Which water bodies are there on earth? Is all the water available on the earth fit for human consumption?

Exploration: In this phase, take a medium sized bucket and fill it up with (20ml) water and ask students, “How much water is there in bucket?” Let students assume that the water in the bucket represents all the water present on earth. Now place buckets (each with 20 ml water), bath mugs (5ml), glass tumblers and spoons to the desks of each group of students. Ask each group of students to take water from bucket into bath mug and further transfer thirty spoons of water from bath mug to glass tumbler and finally take out a quarter spoonful of water from glass tumbler.

Have students explore which of the container represent total fresh water on earth, useable water present on groundwater and water in all lakes and rivers of world.

Explanation: When students complete the task, lead them to understand and explain that the water left in the bucket represents the saline water presents in the seas, oceans and partly as groundwater. Have students discuss about how this water is not fit for human use. Have students realize and discuss the water left in the bath mug represent the water, which is present in the frozen form in glaciers, ice caps and permanent snow, again not available readily. Further lead the students to understand that water present in glass tumbler gives a measure of usable water present as groundwater and water in the spoon represents all the lakes and rivers of the world.

Extension: Continue the lesson by showing students an animated video on ‘availability of water on earth’.

- Ask students to roughly calculate that what percentage of all water found on earth is actually readily available for human use?
- Does the finding worry you?
- Should we appreciate the actual amount of water available for human use?
Evaluation:
- If the freshwater stored in ground much more than that present in the rivers and lakes of the world?
- Is water really a limitless resource?
- Water available for our use is roughly 0.006% of all water found on the earth. (True/False)

TEACHING EPISODE -11 - WATER SCARCITY

Instructional Objectives

a) Comprehension:
11.1. Students will be able to generalize about the concept of water scarcity.

b). Application
11.2. Students will be able to predict the problems faced by people due to water scarcity.
11.3. Students will be able to illustrate the ways which help to save water

Material Needed: Chart papers, Clippings from newspaper, magazine, articles, pictures, videos related to water scarcity.

5 E model lesson plan

Engagement: Introduce the activity by defining the word scarcity and asking students to provide examples of scarcity with which they are familiar. Then ask students if they have ever experienced water scarcity, such as drought. If so, what was it like? What was the cause of the scarcity? If no students have been through a water shortage, ask them what they think it would be like and what they think they do have to do in such a situation.

Exploration: Continue the lesson by displaying videos, cuttings from newspapers, magazines; articles and pictures related to water shortage (long queues for water, fights, taps running dry and protests for demand of water). Let students work together in groups to bring out the message they get from the clippings/cuttings? Ask them to write the observations in notebook. Have they ever felt a shortage of water at home or at school?
Explanation: By making the students aware about the fact that the amount of water recommended by United Nation for drinking, washing, cooking and maintaining proper hygiene is a minimum of 50L per person per day, lead them to understand that this amount is about two and a half bucket of water per person per day. Let them discuss approximately how much water they use per day? Let students share their experiences with whole class about the total consumption of water by their family each day. Have them discuss the ways with which water can be saved and let them draw related posters.

Extension: Tell the class that in some places around the world, water scarcity is the way of life, why might this be the case? Do people always settle in the places that have abundant water supplies, or do some people live in dry, desert climates? Suggest that even in the places where water scarcity is not a problem today, it might become a problem in the future. Ask them what might happen if a country’s population increased? Might there be changes to water availability? How do students hypothesize answers to these questions? Discuss their ideas in the class.

Evaluation:
- Which one of the following is not responsible for water scarcity?
  (i) Rapid growth of individuals (ii) Increasing population
  (iii) Heavy rainfall (iv) mismanagement of water resources
- Why should we celebrate water day every year?
- How can we save water?

TEACHING EPISODE 12 - WATER CYCLE

INSTRUCTIONAL OBJECTIVES:

a) Knowledge:
12.1. Students will be able to name the three forms of water in water cycle.

b) Comprehension:
12.2. Students will be able to explain how continuous cycling of water helps to maintain balance of total amount of water on earth.

c) Application:
12.3. Students will be able to infer about the process of water cycle.

Material needed: - Clear jars, water, plastic wrap, rubber bands, chalkboard, video on water cycle.
5E Model lesson plan

Engagement: Ask students to bring a glass of water and put it next to their tables. Can they guess how old water is? Further explain “the water in your glass may be fallen from the sky. But the water itself has been around pretty much as long as earth has! Does the earth have a limited amount of water? If yes, then from where this continuous supply of water come from? The water keeps going around and around and around (well, you get the idea) in what we call the water cycle?”
Exploration: Distribute jars, plastic wrappers and rubber bands to each group of students. Instruct students to fill their jar about the 1/3 full with water. Tell them to cover the top with plastic wrap and secure it with a rubber band. Let students place the jars directly in sunlight. Ask them to write their predictions about what might happen to water in their notebooks. Let them explore what process involved in the water cycle occurred inside the jar. What caused the water to evaporate? Let students answer questions to communicate that they understand how the water cycle works?

Explanation: After introducing students about water cycle, teacher describes how this cycle works, defining the word ‘evaporation’, condensation, precipitation and collection’ and show the correlating slides and animated videos on LCD projector. Review it with students, teacher further asks “how we get rain and snow?” Encourage children speculate about the movement of water through the environment. Hand out supplies and ask to produce a model of water cycle. Assess the answers. Students may not fully understand the concept. If there are students who really cannot answer the questions, pair them up with a student who has a firm grasp of the concept and have him/her reteach. Then let the students answer the questions verbally in a conference with the teacher.

Extension: Ask students to name the three forms of water. Now show a video on water cycle to the students and lead them to understand that when water circulate through the water cycle it can be found in all three forms that is solid, liquid and gaseous at any given time somewhere on the earth.

Now ask students to categorize the three forms of water in water cycle and discuss how the continuous cycling of water among its three forms keeps the total amount of water on the earth constant when the whole world is using it.

Evaluation:
- Can you recall the process involved in water cycle?
- How can we get rain?
- Following figure shows the process involved in the water cycle. These are labeled by numbers. Match these numbers with the process given in the jumbler form.
TEACHING EPISODE – 13 - USES OF TREES

Instructional Objectives:

a) Knowledge
13.1. Students will be able to name the different things that we get from trees.

b) Comprehension
13.2. Students will be able to explain the need of taking a good care of trees.

c) Application
13.3. Students will be able to predict the importance of trees.

Material needed:-
A set of word sort cards on 3x5 index cards, A hierarchical map to show ‘things come from a tree’, A video on ‘Be a friend to trees’, LCD projector, laptop.

5E Model lesson plan

Engagement: - Teacher surprises the students by telling them news where senior people of town decided to put up a factory by clearing an area of the forest just outside the town to solve the problem of unemployment but many people (social workers/ botanists/ ecologists) objected to this idea. “This is because the forests serve as green lungs and water purifying system in nature”. What are other things of our daily use that come from trees?
Exploration: - Teacher divide the class into groups six and pass out a set of word cards to each group and tell students to carefully look at the cards. Discuss what the cards have in common. There are words related to trees! What would we do without trees? Let them explore how are the word cards related to products that come from trees and that each group will use the word cards to make four categories. Let each group of students decide on categories; and words that belong in each category and on the basis have them sort the words.

Explanation:- The teacher is to observe and ask how student know that a card belongs in a particular category. Further display students a video on ‘Be a friend to trees’. Let students allow to adjust and move their words around. Do they make change? Let them discuss the reasons behind to make changes.

Extension: - Display a hierarchical map to show “things that come from a tree.” Use a large outline of a tree, with four main branches and smaller branches coming out from each of the main branches. Put the title on the trunk. Have students decide on the fore categories and place each category card on one of the four main branches. Let them add the other cards to appropriate branches. Group sorts the word cards and match all words with respective categories on the hierarchical tree map. Tell them to read and review.

Evaluation:-
- Why should we need trees?
- Why should we need to take good care of trees?
- Which of the following is not a forest product?
  (i) Gum  (ii) Plywood  (iii) Sealing wax  (iv) Kerosene

TEACHING EPISODE - 14 - INTRODUCING HABITAT AND BIODIVERSITY

Instructional Objectives:
- a) Knowledge:
  14.1. Students will be able to recall the meaning of Habitat and Biodiversity.
- b).Comprehension:
  14.2. Students will be able to explain the importance of biodiversity.
- c). Application
  14.3 Students will be able to infer about the concept ‘Food Web’.

Material needed:: Plant and animal identification cards, string, tape, scissors, laptop, LCD projector.

Engagement: Ask students to give their definitions of habitat. Bring them to this definition of a habitat. “A habitat is a place where a plant or animal naturally lives and grows.” Ask students to name some habitat and to predict the types of animals that live in desert habitat. Tell them that today’s activity will look at some of the plants and animals that live in desert.

Exploration: Tell students that their task is to illustrate how some plants and animals from desert habitat and related to each other. Divide the students into small groups. Give each group a set of identification cards, tape and a pair of scissors.
Tell student to read the “clues” on the cards, and then use the string to link plants and animals together. When groups finish, have them present their web and describe how the plants and animals relate to each other.

**Explanation:** Ask student if they know what this web is called. Have student brainstorm names. Guide them to conclude that they have created a food web. Help them to define that ‘a community of organisms where there are several interrelated food chains’ is called food web. Explain that a food web is composed of many food chains. Give an example of a food chain from the food web, such as a pricky pear, an arid land honey ant, and a horned lizard. Ask student, what would happen if one part of the food web ‘disappeared.’ Take a card out of the food web to illustrate this. Have student predict the outcome. Write their responses on board. Ask students how this would affect the habitat. Explain to students that if we do not take care of environment and do not keep it healthy, then it is hard for plant and animals to survive in, as part of the food web would be missing.

**Extension:** Ask students what would happen if owl, lizard, bats and cacti disappeared from the deserts? Would the habitat be more or less diverse? Explain the definition of diversity. Introduce the term “biodiversity.” Ask student to predict what does this word mean? Define the word by breaking it apart into “bio” and “diverse.” They should conclude that “biodiversity” literally means biological diversity. Expand this definition to “a variety of living things in a habitat.” Discuss with student why biodiversity is important in habitats. Lead them to the conclusion that biodiversity is an indication of a healthy environment.

**Evaluation:**
- Example why biodiversity is important to habitats, including the one we live in?
- Have students written a paragraph on the habitat they live in and weather it has biodiversity or not.
- What would happen to plants and animals if a part of the food web is missing?

**TEACHING EPISODE-15 - THUNDERSTORMS**

Instructional objectives
a) **Knowledge:**
15.1. Students will be able to recall the meaning of Thunderstorm.
b) **Comprehension**
15.2. Students will be able to identify correct precautionary measures during Thunderstorm lightening

c) Application
15.3. Students will be able to infer about the process of formation of Thunderstorm.

**Material needed:** Paper cups, candles, wooden sticks, Thread, video on ‘destruction caused by thunderstorms’.

**5E Model lesson**

**Engagement:** Teacher recites a poem on “Clouds and Rain.”

```
*Roaring clouds across the sky
Tell us that monsoon’s here
Dark and floating clouds then
Pour raindrops every where.
Clouds make lightning flash overhead
And irrigate fields with rain.
Clouds make earth its fragrances spread
When wet with drops of rain.
Rising from the ocean vast
Clouds fill up with rain
Rain to ocean back at least
To mingle with ocean again!
```

Is it really a happy ending after Rain? Does rain also create problems? In nature it self are there certain situations that can sometimes create disaster and post threat to humans, animals and plant life? Have you heard about thunderstorms?

**Exploration:** Thunderstorms develop in hot, humid tropical areas like India very frequently. The rising temperature produces strong upward rising wind. Tell students that their task is to show how variation in pressure and temperature of air causes thunderstorms. Divide students in groups. Ask each group to take 2 empty paper cups of the same size. Hang the two cups in the inverted position on the two ends of a wooden stick. Tie a piece of thread in his middle of the stick. Let them hold the stick by the thread as in a balance. Let them put a burning candle below one of the cups. Ask them to record all the observations. Let them explore why is the balance of the two bags disturbed? Does the warm air rises up?

**Explain:** Let the students discuss their findings and with these lead them to understand the fact that as the warm air rises up it pushes the cups above the candle and the disturbance of the balance suggest that the warm air is lighter than the cold air. Further teacher explains that the rising temperature produces strong upward rising wind. These winds carry water droplets upward, where they freeze and fall down again. The swift movements of the falling water droplets along with rising air create lightning and sound. This event is called thunderstorm.
Difference in temperature between two regions

Set convection in air

Warm air rises, creating low pressure area

Cool air converges to the low pressure area

Warm air rises, cools and the water vapors condense to form clouds

The bigger water drops in the cloud fall to the ground as rain or snow

Falling water droplets and rising air move vigorously to produce thunderstorm.

Extension: Display student, a video and some webcam images on “Reasons of destruction on a thunderstorm”.

With this lead them to understand how to take shelter under isolated tree and holding an umbrella with a metallic end are dangerous in lightning. Ask students to make a list of preventive measures that can be taken to avoid the harm during the situation.

Evaluation: -

- Can you explain why smoke always rises up?
- If a storm is comprised by lightning then which of the following precautions you will take?

Tick the right options.

(1) Do not take shelter under an isolated tree. __________
(2) If you are in a forest better to take shelter under a smaller tree __________
(3) Take shelter under an umbrella with a metallic end. __________
(4) Do not sit near a window. __________
(5) A car or a bus is a safe place to take shelter. __________
(6) If you are in water, get out and go inside a building __________
TEACHING EPISODE-16 - SEWAGE

Instructional Objectives:-

a) Knowledge:
16.1. Student will be able to define the terms ‘contaminants.’

b) Comprehension
16.2. Students will be able to understand the term ‘Wastewater’.
16.3. Students will be able to describe the concept ‘Sewage’.

c) Application
16.4. Students will be able to reason out ‘sewage’ as the major cause of pollution of water bodies.

5E Model lesson

Material needed: mind map on ‘uses of water’ worksheets of unfilled table, LCD projector, and laptop.

Engagement: - Teacher shows a mind map of ‘uses of clean water’ to student and fills one example of it. Then ask students to add more examples

Uses of clean water

Thus all of us use water in our home and make it dirty. It is called wastewater. Should we waste this water? Have you ever thought where the wastewater goes and what happens to it?

Exploration: - Tell students that their activity is to survey the contaminants. Distribute worksheets having unfilled table. Let students work together in groups to locate an open drain near the school and inspect water flowing through it. Have them record color, odor any other observation of drain water and fill the columns of table.

<table>
<thead>
<tr>
<th>S.No</th>
<th>Type of sewage</th>
<th>Point of origin</th>
<th>Substances which contaminate</th>
<th>Other remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sullage waste</td>
<td>Kitchen</td>
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<tr>
<td>2</td>
<td>Foul waste</td>
<td>Toilets</td>
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<tr>
<td>3</td>
<td>Trade waste</td>
<td>Industrial &amp; commercial organizations</td>
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Explanation: - Let each group discuss their observations with other groups and also with teacher. Taking the help of clues and hints from their discussion lead them to know that sewage is wastewater released by homes, industries, hospitals, and other users. It also includes rainwater that has rundown the street during a storm or heavy rain. The water that washes off roads and rooftops causes harmful substances with it. Thus sewage is liquid water. Most of it is water, which has dissolved and suspended impurities. These impurities are called contaminants.
Extension:- Expand the knowledge of students by displaying a list of items on LCD and telling them that the sewage is not simple but a complex mixture containing suspended solids and other organic and inorganic impurities.

List of items:-
- phosphate
- urea
- vegetable waste
- animal waste
- vibrio cholrae (bacteria)
- phosphorus
- metals
- pesticides
- fruits
- vegetables
- nitrates
- typhosae (bacteria)
- human faeces
- oil
- dysentery causing organisms
- urine
- herbicides

Distribute each group a worksheet of unfilled table and let students identify and classify the items under the headings given in the table.

Table:

<table>
<thead>
<tr>
<th>S.No</th>
<th>Organic impurities</th>
<th>Inorganic impurities</th>
<th>Nutrients</th>
<th>Microbes</th>
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Evaluation:-

- Solve crossword puzzle.

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Across:-
3. Liquid waste products
4. Solid waste extracted in sewage treatment
6. A word related to hygiene
8. Waste matter discharged from human body

Down:-
1. Used water
2. A pipe carrying sewage
5. Micro-organism which causes cholera
TEACHING EPISODE-17: WATER POLLUTION

Instructional objectives:

a) Comprehension:
   17.1. Students will be able to categorize between point and non point sources of water pollution.

b) Application:
   17.2. Students will be able to predict about the consequences due to water pollution.
   17.3. Students will be able to illustrate some ways to reduce water pollution.

Material required: A model of watershed, Cocoa/ sludge mixture, Small bottles,

5E Model lesson plan

Engagement: Teacher defines pollution as ‘harmful substances deposited in the air, in the water, or on the land’ and allows students to brainstorm different types of pollution. Accepting all useful and meaningful answers teacher says “Today’s lesson will focus on water pollution; what causes it and how we can help to reduce pollution of water”.

Exploration:

Teacher displays a model of watershed to the students. A watershed is simply an area of land that drains into a particular body of water. Pointing out the various areas in the watershed model: the construction area, farm, subdivision, industrial plant, sewage treatment plant, river banks, and golf course; teacher ask students to identify and name the type of pollution sources these are? Teacher pours cocoa/ sludge mixture from the small bottle into industrial plant and sewage treatment plant. For the industrial plant, squirt the mixture into the top of the plant and watch it flow through the pipe and into the water creek. For the sewage treatment plant, squirt the mixture into the two round recessed areas in front of the plant. These represent the sewage tanks. Have students watch the results. The ‘pollutants’ are discharged directly into the water. This leads students to know about point sources of pollution which can be traced back to specific area. Now teacher sprinkle cocoa on to loose soil construction site, deforested area, shores of river. Using one or more water bottles ask students to make it ‘rain’ over the areas where cocoa has been sprinkled. Now let them discuss the results and with this lead them to understand about non-point sources of water pollution which originate from many sources.
Explanation: Teacher explains about two types of water pollution sources.
A) Point sources which can be traced back to specific sources. For example industrial plant and sewerage treatment plant.
B) Non-point sources which originated from many sources. Each times it rains, run-off from the streets; pick up litter, car lubricants, pet waste, excess fertilizers and pesticides, leaves etc. these water pollutants reach our waterways via wind, storm, drains and general run-off.. For example loose soil, construction site etc.

Extension: Now teacher discuss when it rains, the rain water runs off over root tops, down the streets, and carries pollution with it. The rain water travels either directly into river/ stream or travels down the storm drains. Point to cocoa ‘dirt’ which may be pesticides, fertilizers, litter, soil, animal waste; that has now entered our water body. Let students discuss about the consequences when pollutants enter our rivers or streams. Fertilizer is a nutrient, which increases N and P in water. Animal waste adds harmful bacteria to the water. Pesticides are toxic, animal waste adds harmful bacteria to the water and litter can injure people and animals and even block drainage pipes. Further ask students to brainstorm more things they can do to prevent these pollutants from entering the river and streams.

Evaluation:
1. Differentiate between point and non-point sources of water pollution.
2. Write some correct practices to prevent pollution from entering into streams or rivers?
3. How can you reduce water pollution?

TEACHING EPISODE- 18: RECYCLING

Instructional objectives:
a) Comprehension :  
18.1. Students will be able to identify the waste material from their surrounding that can be recycled

b) Application:
18.2. Students will be able to infer about the concept of recycling

Material required : A bag of trash, recyclable products

5 E Model lesson Plan

Engagement: Begin by doing a brief review of what students know about renewable and non renewable resources, teacher invites students to take a closer look at everyday items they throw in the trash. What they think about the products such as bottles, cans, cartons, plastic and food are made of and how these are generally discharged. Students were also made to review about natural recourses, both renewable and non renewable and brainstorm where all garbage goes after they throw it out?
Exploration: Ask students to examine their own ideas and habits about recycling and let them discuss what a serious effect litter and mass water disposal have on the environment. Have them realize that recycling is one of the solutions to limit ongoing global problems. Let them think how recycling generally works? What kind of products can be recycled? Teacher brings a bag of trash in the classroom and litters its contents on the floor. Then ask students to for help in cleaning up trash throughout the room. Before they start, set up three different ‘garbage stations’ where they can place the refuse – compost pile, the recycling bin, and the trash can. Tell students to put the food garbage in the compost pile, the things that think can be used again in the recycling bin, and the things that they think cannot be reused in the trash. This activity will serve as a starting point to get students think about recycling (and how to do it). Let students pick the trash and sort it based on what they think belongs in each of the designated areas. Once all the garbage has been sorted and placed in each of the ‘garbage station’, ask questions such as: have you ever sorted out garbage before? Who placed this (item) in this (garbage station)? Why did you decide to put it there? When people sort their garbage? What does happen to recyclable items? Accepting all reasonable answers teacher encourage students to elaborate their responses.

Explanation: Teacher explains that many people separate their garbage into different areas such as composite pile, recyclable bins, or trash can – in order to reuse as much of it as they can and limit waste composting can be used to turn food garbage into soil fertilizer for gardens and house plants. Recyclable items go to recycling centers and other facilities where they are specially treated and can be used again and that trash is becoming a bigger and bigger problem across the world. Students also left with the idea that recycling garbage can help to lessen the growing trash problem. Reinforce the point by taking all the items in the compost and recycling areas and piling them into a mountain of garbage in the (unusable and wasteful) trash can station.

Extension: Let students think more about limiting waste disposal through recycling. Teacher draws on the blackboard the ‘three arrowed’ triangular symbol that represents recycling and asks students whether they know what this symbol represents? Have they seen this symbol before? Lead the discussion to explain that the image symbolizes recycling and the three arrows stands for collect, reprocess and reuse. Point out how the symbol represents a wheel going around and around –just like recyclable material being used again and again without being thrown away. Students should know that this symbol can be found on many everyday products to indicate that these can be recycled.

Evaluation:
- Name any five products of daily life that can be recycled.
- The three arrows in triangular symbol of recyclable products stand for __________, __________, and __________.
- Why waste papers and bottles should be given to kabriwala?
Appendix 2.B
Criterion Reference TEST

NAME_______________________ CLASS __________
GENDER______ SCHOOL_____________________

MCQ:
Read all the questions carefully. Only one answer is correct. Choose the right option and mark tick (√) on it.

1. Which of the following element does not determine the weather?
   a. temperature   b. Rainfall   c. humidity   d. photosynthesis

2. A place receives very high rainfall and the temperature remains above 25 degree C throughout the year, what will the climate of that place?
   a. Hot & Dry   b. Wet & Hot   c. Cold & Wet   d. Cold & Dry

3. Which of the following is not water saving feature / habit?
   a. low flow toilets   b. low flow shower heads   c. rainwater catchment system   d. instant water heaters on sink

4. A vertical section through different layers of soil is called
   a. Horizon   b. soil profile   c. terracing   d. weathering

5. The water holding capacity is highest in
   a. sandy soil   b. Clayey soil   c. Loamy soil   d. Mixture of sand & loam

6. Chose the correct option. The total water
   a. in the lakes and rivers of the world remain constant
   b. under the ground remain constant
   c. in the seas and oceans of the world remain constant
   d. of world remain constant

7. Select which of the following is not responsible for water shortage?
   a. Rapid growth of industries   b. management of water resources
   c. increasing population   d. heavy rainfall

8. Dirty water can be recycled. It can thus be
   a. Reused   b. discarded   c. thrown into rivers   d. thrown into oceans

9. Oil spills in the seas are
   a. Harmful to marine animals   b. Useful to ships
   c. harmful to ships   d. Useful to ships

10. II. Mohan takes 100g soil and allow it to dry for two hours. After drying, soil is weighed. It loses 10g. Calculate the percentage of moisture in soil
    a. 20%   b. 10%   c.60%   d.5%


ODD MAN OUT


FILL IN THE BLANKS

15. All the changes in weather depends upon the distance of _______________ from the earth.
16. _______________ department collects and records the information of weather every day.
17. _______________ and _______________ are the two types of weathering.
18. Three forms of water in water cycle are ___________ , ___________ and ___________.
19. Dissolved and suspended impurities in sewage water are called _______________.
20. A forest is a purifier of _______________ and _______________.

TRUE / FALSE

21. Growing more trees will save the future. ☐
22. Hot and dry climate best describe a tropical region ☐
23. Western ghats and Assam are the parts of India where tropical rainforest climate is found. ☐
24. Clayey soil is used to make toys, pots and statues. ☐
25. The fresh water stored in the ground is more than that present in the rivers and the lakes of the world. ☐
26. Water shortage is a problem faced by people living in rural area. ☐
27. Water from rivers is the only source for irrigation in the field. ☐
28. Sewage causes pollution of air. ☐
29. Chlorination helps in removing foul odor of waste water. ☐
30. Soil helps trees to grow and generate. ☐
31. Waste water should be released in open drains. ☐
32. During thunderstorm lightning we should take shelter under an umbrella with a metallic end ☐

COMPLETE WITH HINTS

33. Mosquito breed in standing ___________ water collecting in pits. (Clean / Dirty).
34. Wastewater which is generated in homes, industries, agriculture fields and in other human activities is called _________. (sewage/compost)

35. Sewage from houses is usually in the form of ___________. (solid/liquid)

36. Trees protect soil from ___________. (soil erosion/insects)

37. Save _________ if we wish to save our earth. (water/Plastic)

38. Left over food should be ___________. (used for composting/disposed off in dustbin.)

MATCH UP

39. The condition of the atmosphere around us _____________________________

40. Loss of top layer of soil by wind or water _____________________________

41. The average weather taken over a long period of time _____________________________

42. A place where living organisms live, survive and reproduce _____________________________

43. A variety of living beings in a habitat _____________________________

44. A community of organisms where there are several interrelated food chains _____________________________

45. A violent, local atmospheric disturbance accompanied by lightning, thunder, and heavy rain, often by strong gusts of wind, and sometimes by hail. _____________________________

SOLVE PUZZLE by using the hints given below from item no. 46 to 57.

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...
Up to down:
46. Process of soil formation (1)
47. A method to prevent soil erosion (2)
48. due to excess of rain (3)
49. Soil which has larger particle size and cannot hold much water (4)
50. due to deficiency of rain (5)

Left to Right:
51. Minimum temperature of the day (6)
52. Dead and decayed organic matter of organisms(7)
53. Maximum temperature of the day (8)
54. The pipelines carrying sewage from home (9)
55. Different layers of soil profile (10)
56. A non biodegradable solid waste which cannot be recycled (11)
57. Cutting down of trees (12)

Enlist/Enumerate the following (at least give 4 points for each)
58. Special features of long tailed monkey which help it to survive in extreme hot and humid conditions.
   -
   -
   -
   -

59. Water borne diseases
   -
   -
   -

60. Waste material from your surroundings that can be recycled
   -
   -
   -

Categorize/Classify the given elements as:
61. Point or non point sources of water pollution

<table>
<thead>
<tr>
<th>Runoff from farm fields, golf courses lawns and gardens, construction sites, road, street and parking lots, Factories, power plants, sewage treatment plants, underground coal mines, old wells.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Point sources</td>
</tr>
</tbody>
</table>
62. Adaptation features for tropical rainforest or polar region

1. diets heavy on fruits 2. white fur 3. loud voice 4. sticky pad on feet 5. layer of fat under skin 6. wide and large paws 7. bright colors 8. strong tail 9. long and large beak

<table>
<thead>
<tr>
<th>Tropical rainforest</th>
<th>Polar region</th>
</tr>
</thead>
</table>

SHORT ANSWER TYPE QUESTIONS (Each question carry 2 marks)

DIAGRAMATIC QUESTIONS

63. The pictures below represent the adaptation features of polar animals to survive in extreme cold conditions:

(a)   (b)   (c)   (d)   (e)

I(i) Write the body parts shown in a, b, c, d
I(ii) Write the purpose of (e)

64. (i) Label the diagram by filling A, B, C, D, E, F, G

(ii) Name the animal shown in figure

(iii) In which climate it is adaptive to live

(iv) Write the purpose of F
65. Make a graph along 'x' axis and 'y' axis showing the variation of maximum temperature during 03 to 09 August by using the following information.

<table>
<thead>
<tr>
<th>DATE</th>
<th>Max. temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>08-08-09</td>
<td>26°C</td>
</tr>
<tr>
<td>04-08-09</td>
<td>23.5°C</td>
</tr>
<tr>
<td>05-08-09</td>
<td>25°C</td>
</tr>
<tr>
<td>06-08-09</td>
<td>22°C</td>
</tr>
<tr>
<td>07-08-09</td>
<td>25.5°C</td>
</tr>
<tr>
<td>08-08-09</td>
<td>23.5°C</td>
</tr>
<tr>
<td>09-08-09</td>
<td>24.4°C</td>
</tr>
</tbody>
</table>

66(i) What is the structure shown in above picture?
66(ii) Label the picture by writing the name of each layer.
66(iii) Indicate on the diagram the layer which is rich in humus by using symbol 'H'.

---

66. [Diagram of soil layers with plants]
67. Figure below shows the processing involved in water cycle. These are labeled by numbers. Match these numbers with the processes given in jumbled form.

1. rudgon rawet  
2. belta eatwr  
3. kael & trsemse  
4. vapoertioan  
5. tspratniaoinr  
6. Duclos  
7. ntciepiraipo  
8. aitfinlnronit

Reason out the following
68. Days are longer in summers and comparatively shorter in winter.
69. There is need of variety of plants and animals in a forests.
70. The tropical rainforest has a large population of animals.
71. Physical weathering increases the rate of chemical weathering
72. Loamy soil is the best for plant growth.
73. Air above the soil seems shimmer in summer days.

Explain the following
74. What would happen if green plants (producer) from the following food chain are missing?

Food Web in a Forest

[Diagram of a food web showing various animals and plants connected by arrows indicating predation and consumption relationships.]
75. There are 10 tube wells in a lane of 50 houses. What could be the long term impact on the water table?

76. How ground water is recharged?

**Differentiate**

77. Chemical weathering from physical weathering

78. Climate from weather

79. Following soil types:

<table>
<thead>
<tr>
<th>Sn</th>
<th>Property</th>
<th>Sandy soil</th>
<th>Clayey soil</th>
<th>Loamy soil</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Proportion of particles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Water holding capacity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Air spaces</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>4</td>
<td>Vegetation or growth of plants</td>
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</tr>
</tbody>
</table>

80. The incomplete statements on LHS column depicts the process involved in the formation of thunderstorm. Complete the incomplete statements by selecting the appropriate word from the RHS column.

(a) Difference in ___________ between two region

(b) Set ___________ in air

(c) Warm air rises, creating low ___________ area

(d) Cool air ___________ to the low pressure area

(e) Warm air rises, cools and the water vapor ___________ to form clouds

(f) The bigger water drops in the ___________ fall to the ground as rain or snow

(g) Falling ___________ and rising air move vigorously to produce thunderstorm.

81. Read the statements (LHS) regarding the characteristics of soil and match with various horizons on RHS

<table>
<thead>
<tr>
<th>I</th>
<th>Made up of small lumps rock with cracks and crevices</th>
<th>A Horizon</th>
</tr>
</thead>
<tbody>
<tr>
<td>ii</td>
<td>Roots of small plants embedded. Provide shelter to many living organisms and contain most dead and decayed organisms. Rich in humus and minerals. Darker in color.</td>
<td>B Horizon</td>
</tr>
<tr>
<td>iii</td>
<td>Hard and difficult to dig with spade and have solid rocks. It is parent material from which much of soil originally formed.</td>
<td>C Horizon</td>
</tr>
<tr>
<td>iv</td>
<td>Less humus, more minerals, lighter in color, compact.</td>
<td>Bed Rock</td>
</tr>
</tbody>
</table>