Water Spotters

Water Cycle Journey

http://cires.colorado.edu/education/outreach/waterspotters/
GIFT Workshop Goals

• Give overview of Lesson Suite Resources
• Experience two activities
• Preview Elementary Curriculum
Preparing Citizen Scientists

Image: Young voices on climate change

Water Spotters
Rain, Weather and Change
A curriculum to explore Colorado’s water cycle and weather.

An Educator’s Guide

MESA
Mathematics
Engineering
Science
Achievement

CIRES
Education & Outreach
Preparing Citizen Scientists

Module 1: Water Cycle Foundation
  Diorama
  Water Spotters protocol
  (Build a precipitation Collector)

Module 2: Watersheds and Water Budget
  Local watershed
  School yard water budget

Module 3: Tracking Weather
  Track weather in different location
  Factors that Influence Temperature

Module 4: Water Chemistry
  Atoms, Elements and Isotopes
  Water Isotope Journey
Water Cycle Journey
Water Cycle Probing
Water Cycle Probing
Water Cycle
Water Cycle Journey

Groundwater and Land Use
in the Water Cycle

Water Conservation Tips

- Turn off the water while brushing your teeth.
- Take shorter showers, turn off the water while shaving.
- Wash only full loads of clothes.
- Water is a valuable resource. Use it wisely.
- Wash dishes at the sink, which is a more efficient method.
- Collect rainwater in barrels to use for washing clothes.

Tips for Preventing Water Pollution

- Plant trees. Trees act as natural filters of pollution.
- When taking your dog for a walk, scoop the poop.
- Do not pour chemicals down the drain or on the ground.
- Use non-toxic, biodegradable cleaners.
- Do not flush chemicals down the drain or on the ground.
- Avoid using cleaning chemicals that contain chlorine.
- Never pour chemicals down the drain or on the ground.

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Water Cycle Journey

Ocean

Atmosphere

Soil / Surface

Plant

Groundwater

Ice / Glacier

Water Cycle Processes Worksheet

Name ___________________________ Date ___________________________

Instructions: You are a water molecule about to embark on a water cycle journey. Write the name of the reservoir you start in on line #1. You will move from reservoir to reservoir by rolling dice. Record each reservoir you visit every time you roll the dice, even if you are instructed to stay at the same reservoir for repeated rolls. Continue to roll until you have filled in the left column of your worksheet. After you have completed your water cycle journey, your teacher will ask you to fill in the right column of your worksheet by naming the processes by which you moved from one reservoir to another. An example is shown below.

Example

Reservoir | Process
---|---
1. ocean | A. start
2. ocean | B. storage
3. atmosphere | C. evaporation
4. glacier | D. precipitation (snow)

Your Journey

Reservoir | Process
---|---
1. | A. start
2. | B. 
3. | C. 
4. | D. 
5. | E. 
6. | F. 

CIRES
Education & Outreach
Residence Times

1. Did you travel to all six of the reservoirs?
2. Rank the six reservoirs according to the longest amount of time you spent in each one.
3. At which reservoir was your longest stay?
4. At which reservoir was your shortest stay?

Here are typical residence times of water on planet Earth:

<table>
<thead>
<tr>
<th>Reservoir</th>
<th>Average Residence Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocean</td>
<td>~3,000 years</td>
</tr>
<tr>
<td>Groundwater</td>
<td>100s to 1000s of years (depending on depth)</td>
</tr>
<tr>
<td>Ice/Glacier</td>
<td>10s of years</td>
</tr>
<tr>
<td>Soil/Surface</td>
<td>months (soil, rivers); 10s of years (lakes)</td>
</tr>
<tr>
<td>Plant (biomass)</td>
<td>weeks</td>
</tr>
<tr>
<td>Atmosphere</td>
<td>days</td>
</tr>
</tbody>
</table>

5. Was your journey typical of an average water molecule? Make an argument for or against.
Heavy and Light Water

Heavy Water Worksheet

Name ____________________________ Date ________________

Instructions: You are a heavy water molecule (HDO or H$_2$O$_2$) about to cycle amongst the ocean (liquid), the atmosphere (vapor), and clouds (liquid). You will evaporate, condense, re-evaporate, or precipitate as you move from one reservoir to another. Your journey will be determined by rolling a die with your partner and following the directions below. Your goal is to keep track of your journey by drawing arrows and circling reservoirs. See the other side of the worksheet for an example.

Rolling Directions (only one person should roll)

<table>
<thead>
<tr>
<th>If you roll...</th>
<th>If you are at OCEAN...</th>
<th>If you are at AIR...</th>
<th>If you are at CLOUD...</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Draw an arrow</td>
<td>Draw an arrow</td>
<td>Draw an arrow</td>
</tr>
<tr>
<td>2</td>
<td>Draw an arrow</td>
<td>Draw an arrow</td>
<td>Draw an arrow</td>
</tr>
<tr>
<td>3</td>
<td>Draw an arrow</td>
<td>Draw an arrow</td>
<td>Draw an arrow</td>
</tr>
<tr>
<td>4</td>
<td>Circle ocean</td>
<td>Draw an arrow</td>
<td>Draw an arrow</td>
</tr>
<tr>
<td>5</td>
<td>Circle ocean</td>
<td>Draw an arrow</td>
<td>Draw an arrow</td>
</tr>
<tr>
<td>6</td>
<td>Circle ocean</td>
<td>Circle air</td>
<td>Draw an arrow</td>
</tr>
</tbody>
</table>

Your Journey
Start in the ocean!

Light Water Worksheet

Name ____________________________ Date ________________

Instructions: You are a light water molecule (H$_2$O) about to cycle amongst the ocean (liquid), the atmosphere (vapor), and clouds (liquid). You will evaporate, condense, re-evaporate, or precipitate as you move from one reservoir to another. Your journey will be determined by rolling a die with your partner and following the directions below. Your goal is to keep track of your journey by drawing arrows and circling reservoirs. See the other side of the worksheet for an example.

Rolling Directions (only one person should roll)

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<th>If you are at OCEAN...</th>
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<tbody>
<tr>
<td>1</td>
<td>Draw an arrow</td>
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<td>Draw an arrow</td>
<td>Draw an arrow</td>
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<td>3</td>
<td>Draw an arrow</td>
<td>Draw an arrow</td>
<td>Draw an arrow</td>
</tr>
<tr>
<td>4</td>
<td>Circle air</td>
<td>Draw an arrow</td>
<td>Draw an arrow</td>
</tr>
<tr>
<td>5</td>
<td>Circle air</td>
<td>Draw an arrow</td>
<td>Draw an arrow</td>
</tr>
<tr>
<td>6</td>
<td>Circle air</td>
<td>Circle air</td>
<td>Draw an arrow</td>
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Your Journey
Start in the ocean!
Heavy and Light Water

Air

Cloud

Ocean

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<th>If you are at AIR...</th>
<th>If you are at CLOUD...</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Draw an arrow ocean→air</td>
<td>Draw an arrow air→cloud</td>
<td>Draw an arrow cloud→ocean</td>
</tr>
<tr>
<td>2</td>
<td>Draw an arrow ocean→air</td>
<td>Draw an arrow air→cloud</td>
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<td>Draw an arrow ocean→air</td>
<td>Circle air</td>
<td>Draw an arrow air←cloud</td>
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</table>
Water Cycle Journey with Isotopes

Image GNS Science
Water Spotters in the MESA Classroom:

Rain, weather, and change

The Water SpottersMiddle school lesson suite was developed by teachers and scientists. It includes new lessons that have been developed in coordination with science teachers that emphasize both core scientific standards and application learning about the water cycle. The modules include original lessons and lessons with expanded original material to teach about water and water isotopes.

The Water Spotters program uses video to teach collection protocols and give background on the project. Weather station data from schools are disseminated online alongside the rainwater collection protocols.

Dr. David Noone’s Water Spotters Program

from CIRES Education & Outreach

http://cires.colorado.edu/education/outreach/waterspotters/
CIRES Education Outreach

K-12 Projects: Classroom Resources

MESA Water Spotters
Water Spotters is a network of students who observe rain, snow, and weather along Colorado's northern Front Range. The Water Spotters program has middle school and elementary lessons developed by teachers and scientists. The modules include original lessons and lessons that expand on basic lessons about the water cycle to teach about water and water isotopes.

Geomagnetism in the MESA Classroom: An Essential Science for Modern Society:
Geomagnetism in the MESA Classroom is a four-part after-school module sponsored by NASA that allows students to explore geomagnetism. Students will use compasses, perform navigation exercises, complete a caching activity, and attend a field trip to NOAA's David Skaggs Research Center in Boulder.
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