ACCESS TO CLEAN WATER

Student Workbook
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Getting to Know the Topic

Access to Clean Water: Globally

Clean water isn’t a luxury, it’s a basic human right, and it’s the fastest way to change a life. However, more than 840 million people around the world live without access to safe water and sanitation. In 2015, the UN acknowledged the human right to clean water with Sustainable Development Goal 6—aimed at ensuring the availability and sustainable management of water and sanitation for all—calling upon all countries to support this goal.

Without access to clean water, girls and women waste hours a day fetching water from unsafe, distant sources instead of going to school or earning a livelihood. Families lack access to healthy food sources because their farms fail from droughts. And communities are trapped in the cycle of chronic illness from drinking and using contaminated water. When we tackle the water crisis, we’re also tackling the barriers to education, health care, nutritious food and opportunity.

Fast facts

► Every year, students miss 443 million school days because of water-related illnesses.
► Women and girls around the world spend over 200 million hours every day collecting water.
► 40% of the world’s population are affected by water scarcity.

Taking Action Globally

How can students take action at school and in their community to improve global access to clean water? Here are some ideas to get them started:

► Host a fundraiser and raise money to help build improved water systems and provide clean water education and water projects.
► Carry out an awareness-raising campaign to educate others about the water crisis.
► Contact government leaders to push efforts for improving access to clean water in developing communities.

Another option is to support and fundraise for the WE Villages program. Students can support this program by visiting WE.org/we-schools/program/campaigns to get ideas and resources for taking action on global water issues.

MORE THAN 840 MILLION PEOPLE AROUND THE WORLD CANNOT ACCESS SAFE DRINKING WATER.

Take your research to the next level!

Check out more info, resources, and stats on global access to clean water at WE.org/ap/global-clean-water.
Access to Clean Water: Locally

Water scarcity and water sustainability issues are indeed a global concern, but they also affect us locally. In the U.S., water sources are slowly disappearing.

There are many factors that contribute to the growing scarcity of our water sources, such as climate change and growing populations. Low rainfall also means that aboveground lakes are falling to low levels and even drying up. Almost half of the country’s water basins that supply water to communities are being affected, including the ones that cover the central and southern Great Plains, the Southwest, central Rocky Mountain states and parts of California, the South and the Midwest.

One example is Lake Mead in Nevada, which supplies 90 percent of Las Vegas’s drinking water. It is expected to dry up by 2021. Once depleted, these water sources cannot be replenished.

Fast facts

- Irrigation for farming uses more than 75% of water in the U.S.
- By 2071, 96 out of the 204 water basins supplying most of the U.S. with freshwater could fail to meet monthly demand.
- 14 million U.S. households report that their water bills are too expensive.

Taking Action Locally

Within their local or national community, students can:

- Work with local governments and organizations to learn the reasons for rising water costs and how to make clean water accessible to all.
- Raise funds that support organizations in improving access to clean water.
- Raise awareness through workshops or campaigns to educate others on reducing wasteful water usage.

With both their global and local actions, encourage students to be creative with the ideas they develop through their action plans.

21 MILLION AMERICANS ARE GETTING WATER FROM SYSTEMS THAT VIOLATE HEALTH STANDARDS.
**Personal Water Use Chart**

In the U.S., we are lucky to have easy access to some of the safest treated water in the world. This is not the case in other parts of the world, where clean water is not as easy as turning on the tap. Water is an important part of our daily lives and we use it for a wide variety of purposes, but do we really understand how much we use?

In this activity, you will track your water use for one week. We will then calculate the average water use in the class and the community in general.

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<th>ACTIVITY</th>
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<th>W</th>
<th>TH</th>
<th>F</th>
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<th>TOTAL # OF TIMES</th>
<th>ESTIMATED WATER USED (GALLONS)</th>
<th>TOTAL WEEKLY WATER USE (GALLONS)</th>
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<tr>
<td>Washing face/hands</td>
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<td>Taking a shower</td>
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<td>Taking a bath</td>
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<td>Flushing a toilet</td>
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<tr>
<td>Brushing teeth</td>
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<td>Drinking water</td>
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<td>Cooking a meal</td>
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<tr>
<td>Washing dishes by hand</td>
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<tr>
<td>Washing dishes using dishwasher</td>
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<td>15</td>
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<tr>
<td>Washing a load of laundry</td>
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<td>30</td>
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<tr>
<td>Washing car</td>
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<td>Watering lawn</td>
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Average Weekly Water Use Class _________________

Average Daily Water Use Class _________________

Average Daily Water Use Town _________________

In some parts of the world, water is not readily available and you would have to walk miles to a well to retrieve water to use in your home. Would you be willing to walk to a well and carry all the water you would need for a day back to your home?
**Clean Water Crisis**

As you complete your research, complete the charts below. You will be able to fill in the rest of the chart as groups share the information they have gathered. Be sure to cite your sources.

What are the major pollutants that effect the clean water source?

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<thead>
<tr>
<th>Ground Water</th>
<th>Surface Water</th>
<th>Polar Region</th>
</tr>
</thead>
<tbody>
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What effects do these pollutants have on human health?

<table>
<thead>
<tr>
<th>Ground Water</th>
<th>Surface Water</th>
<th>Polar Region</th>
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</thead>
<tbody>
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</table>

What are the sources of these pollutants? (Industry, agriculture, natural minerals, etc.)

<table>
<thead>
<tr>
<th>Ground Water</th>
<th>Surface Water</th>
<th>Polar Region</th>
</tr>
</thead>
<tbody>
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</table>

What factors limit the access to clean water in this region?

<table>
<thead>
<tr>
<th>Ground Water</th>
<th>Surface Water</th>
<th>Polar Region</th>
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Problem Tree

In your Problem Tree graphic organizer, start by writing the problem at the center of the tree, and then look at the causes and effects of an issue. Keep digging to go deeper on the issue to find its supporting and root causes. Use this as one tool to explore the causes and effects of food insecurity.

**LEAVES/BRANCHES: EFFECTS**

These are the results created by the problem. At first, this part of the issue appears easy to tackle, but when leaves and branches are trimmed, they grow back quickly. Consider the multi-layered effects, or “effects of effects,” that can arise when a problem goes unaddressed. Always ask: “Then what happens?”

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**TRUNK: PROBLEM**

This is the key issue that is being studied. Because it is not as apparent as the leaves, the core problem itself sometimes takes a little longer to identify.

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**ROOTS: CAUSES**

These are the situations or factors that have led to the problem. When exploring the root causes of a problem, ask yourself “Why does this problem exist?” Dig deeper to consider the “causes of causes” — the multiple layers of factors that contribute to a problem.
Distillation of Ocean Water

A majority of water on the earth is undrinkable for humans since it is found in the oceans. Humans cannot drink salt water, but saline water can be made into freshwater. The process is called “desalination.” Desalination uses a separation technique known as distillation. Distillation is as simple as boiling the salt water mixture, collecting the steam, and cooling it to return it to its liquid state.

This procedure sounds simple enough, but is it really? And is it a good procedure to create a reliable and cost effective clean water source?

In this activity, you will set up a simple distillation apparatus to purify a sample of sea water and to collect data to determine if this procedure is an effective means of purifying water.

Before beginning the procedure, determine with your lab group what data you want to collect to determine the effectiveness of the cleaning procedure of the water. Keep in mind that you are trying to determine if this is effective on a large scale to provide clean water to parts of the world that do not have a source. Get your teacher’s approval of your data collection plan before beginning the procedure.

MATERIALS: 250mL Erlenmeyer flask, rubber stopper fitted with rubber tubing, 600mL beaker, test tube or other collect container for the “clean” water, ring stand (tripod), wire gauze, Bunsen burner, boiling stones, sample of sea water

Procedure:

1. Create a data table to record data in a clear manner.
2. Obtain a sample of sea water and pour it into a 250mL Erlenmeyer flask and add several boiling chips. Stopper the flask with a 1-holed stopper fixed with a glass tube. Attach a rubber hose to the glass tube.
3. Place the flask on the wire gauze that is supported on a ring stand. Place a Bunsen Burner under the platform.
4. Place the test tube or other collection container in the 600mL flask that is filled with an ice water bath.
5. Place the end of the rubber tubing into the collection container.
6. Light the Bunsen Burner and GENTLY heat the flask with the sea water inside. Make sure you watch so that the flask does not overflow and to be sure that pressure does not build up in the collection container.
7. Continue to heat the flask until the desired amount of water has been collected.
8. When finished heating, turn off the burner and allow all materials to cool before taking any measurements.
9. Gather data and calculate results. Share results with the class.

Conclusion Questions:

1. What methods of desalinization are used throughout the world today?

2. Is this process an effective means of purifying sea water? Support your answer with data.
Treatment of Dirty Water

In the space below describe the polluted water as thoroughly as possible.

Draw your filter system in the space provided.

List the materials used in the filter and their use.

<table>
<thead>
<tr>
<th>MATERIALS</th>
<th>USE IN FILTRATION PROCESS</th>
</tr>
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<tbody>
<tr>
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</tbody>
</table>
In the space below describe the filtered water as thoroughly as possible.

How would you modify your filter for better results? Draw the new filter below.
Conclusion Questions:

1. Did the filter work as well as you expected? Explain why or why not.

2. Is the filtered water clean enough to use for bathing? Explain why or why not.

3. Is the filtered water clean enough to drink or use to cook with? Explain why or why not.

4. What would need to be done to make the water “cleaner”?
Needs Assessment

The following series of questions helps you to analyze and identify ongoing areas of need within organizations addressing your issue.

1. Identify three organizations working on issues related to the issue your team is working on.

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

2. What does each organization do well in response to the issue and/or related issues locally?

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

3. What does each organization do in response to the issue and/or related issues globally?

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

4. Compare each organization’s approach to tackling the issue and assess the effectiveness of each approach.

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

5. Identify a criticism of or what’s lacking in each organization’s approach. Site the source and share their argument.

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

6. What could all three organizations do better?

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
Solution Tree

In your Solution Tree graphic organizer, start by rewriting the problem from your Problem Tree, and reframing it as a goal at the center of the tree. Then consider the different solutions (the roots) and possible outcomes of the solutions (the branches).

LEAVES/BRANCHES: OUTCOMES

These are the results created by the solution. Results may appear as straightforward as having achieved goals, but when you consider the ripple effects and outcomes of sustainable results, the impact is far-reaching and long-lasting. Always ask: “Then what happens?”

ROOTS: SOLUTIONS

These are the actions needed to solve the problem and achieve the goal stated at the center of the solution tree. When exploring solutions, ask yourself “How will this solve the problem?” Dig deeper to think holistically, so that you are looking beyond the short-term and addressing not only the symptoms of the problem but the root causes as well.
Reflect: Investigate and Learn

Now that you have investigated problems and potential solutions associated with access to clean water, think back over what you have learned: How can what you are learning in your AP® Chemistry class support solutions that improve access to clean water?

Record your thoughts on the lines below. If you run out of room on this page, use additional paper to write a lengthier response. As you write, think about the following questions to help shape your reflection:

- What are the social impacts of lack of access to clean water?
- As you investigated existing programs addressing water access, what did you feel these programs do well, and what did you feel they could do better?
- Who should be responsible for improving water access both locally and globally? What role do you think you could play in addressing water access, both locally and globally?
- Based on what you learned about your local and global issue and the actions others are already taking, what are five areas of need that you could address?
- What attracts you to these areas?
- What are some actions that you could take to address this issue?
- What excites you about these actions and the impact you can have?

How can what you are learning in your AP® Chemistry class support solutions that improve access to clean water?
Summarizing Your Investigation

Summarize what you have learned from your investigation. Your work may be supported by multimedia or print materials that synthesize and analyze the topic and issue on local and global levels.

When summarizing your investigation, keep the following in mind:

- What are the key takeaways from your investigation of the issue of access to clean water?
- How are the problems you investigated similar at local and global levels? How are they different?
- How are the solutions you investigated similar at local and global levels? How are they different?
- Why may your investigation be important to other AP Chemistry students?
Activity: Working Independently

A student investigates various dyes using paper chromatography. The student has samples of three pure dyes labeled A, B, and C, and an unknown sample that contains one of the three dyes. The student prepares the chromatography chamber shown below on the left by putting a drop of each dye in the identical position on the chromatography paper (polar material) and standing the paper in a non-polar solvent. The developed chromatographs are shown above on the right.

a. Which dye (A, B, or C) is the least polar? Justify your answer in terms of interactions between the dyes and the solvent or the dyes and the paper.

b. Which dye is present in the unknown sample? Justify your answer.
### DIRECT SERVICE

**WHAT IS IT?** Personally engaging with and providing hands-on service to those in need (usually in conjunction with an organization).

**EXAMPLE GOAL** Participate in a local waterway cleaning event to remove trash and organic debris.

**ACTIONS**
- Reach out to local organizations to volunteer for local cleanup days.
- Invite other student groups (Environmental Club, Science Club, Student Government) in the school to attend as well.
- Once the date has been set, make sure all students have signed permission forms.

### INDIRECT SERVICE

**WHAT IS IT?** Channeling resources to the needs of a community—locally, nationally, or internationally.

**EXAMPLE GOAL** Organize a Water Walk. Have students at the school calculate their water usage for one day and carry that amount of water weight for a 3-mile route to raise awareness of water usage and the hardships others face in gaining access to clean water. Students will raise money to donate to an organization specializing in providing water wells to areas that need them.

**ACTIONS**
- Research organizations that dig wells in remote areas.
- Gain permission from the school administration to hold the event around the school track.
- Plan time and place.
- Publicize the event in the school to encourage participants.
- Distribute and collect pledge forms and monies.
- Set the track with markers for distance.
- Gather weights to carry, and backpacks or similar carrying containers.
- Organize volunteers to help with the start and finish.

### ADVOCACY

**WHAT IS IT?** Educating others about an issue to increase visibility and following up with an action that focuses on enacting change. Actions around advocacy often look like raising awareness, but without a strong call to action within the initiative as a whole. Educating others is not considered service in and of itself.

**EXAMPLE GOAL** Educate the community about the Clean Water Act, Safe Drinking Water Act, or other legislative acts involving clean water on the local level, and sponsor a letter writing campaign to members of congress to continue to support these acts and the funding to maintain compliance.

**ACTIONS**
- Research important aspects of the legislative acts, including the level of funding.
- Create educational materials to inform people of these acts or reach out to organizations that could provide the needed materials.
- Set date and secure permission from local businesses to set up an informational table in front of their business or at your school.
- Write sample letters for people to complete and sign.
- Send letters to the proper legislature.
Creating the Action Plan

This outline serves as a basic template for your action plan. Use additional space and resources to help you build out each part with the right amount of detail and flow to ensure you have the strongest action plan that you and your team can implement with ease. Remember, this is your road map for your service project!

Team Goal:

Measures of Success:

Required Network and Resources
In order to complete this goal, our team will need to develop the following network and access the following resources:

Network:

Resources:

Roles and Responsibilities
Each team member will take on the following roles and associated responsibilities:

Timeline
Our team will use the following timeline to complete tasks and successfully carry out the action to meet our goal(s):
Once your team has completed the major components of your action plan (creating your teams and setting goals, timeline, and network), review the five action planning pitfalls provided below to ensure these have been avoided. Review your plans—individually first, then together as a team. After the review, rework your action plans, if necessary.

1. **Setting an unclear goal**
   The first and most important part of any action plan is defining the goal, or what you want to achieve. It should be clear and easy to understand, for example, “we want to collect 500 cans of food,” or “we want 200 people to learn about WE Villages.” If the goal is not clearly defined, proper planning will be difficult if not impossible. As a best practice, have a peer from another team review your goal to ensure it is as clear as you hope.

2. **Planning unrealistic actions**
   After the goal is set, begin planning the actions necessary to achieve it. It is important that the steps make sense and are achievable. Do not plan unrealistic actions such as working at times that will interfere with schoolwork, overestimating how many people can help out, or planning to go to places that would be difficult for you to reach. Consider each team member’s school and community schedule, such as work and extracurricular activities. Before planning an action, ask yourself, “Is this action realistic?”

3. **Rushing the process**
   Do not be too hasty in planning actions. While you may be excited to start, proper planning takes time. The better the planning and organization, the more success you will achieve. Even if it means slowing down to figure out details, do not rush and leave out important steps.

4. **Not asking for help**
   Do not be afraid to ask for help. When a network is created, bigger goals can be achieved faster. Reach out to friends, parents and mentors. People generally enjoy helping, especially if it is for a worthy cause.

5. **Not learning from mistakes and giving up too quickly**
   We all make mistakes—it is normal and healthy. Mistakes allow us an opportunity to learn and grow. So, learn from the mistakes. Ask, “Why did this happen?” and “How can I avoid this problem next time?” Actively think about the mistakes and how it will be better the second time around. If something does not go as planned, do not stop!
Reflect: Action Plan

Your team now has a plan for taking action globally and locally. Think back over what you have learned: What problems associated with access to clean water does your team’s action plan address? How does your individual role in the plan support your team’s action?

As you write, think about the following questions to help shape your reflection. Begin at the “Start Here” bubble and go clockwise to record your thoughts on the lines below. Use additional paper to write a lengthier response.

NAME: ____________________________

TEAM MEMBERS: ____________________
# Student Log Sheet

<table>
<thead>
<tr>
<th>DATE / TIME SPENT</th>
<th>ACTIVITY, DESCRIPTION, AND REFLECTION</th>
<th>VERIFIED BY (NAME, ORGANIZATION)</th>
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