# Water Watchers

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|---|---|
| Primary Curriculum | Grade 3 |
| Supplemental Curriculum | Grades 1–5 |
| Notes | This single unit covers all the science content other companies typically split into two units. Standard unit/refill kit comes with enough materials for 30 students. |

## Description

### How do we ensure everyone has the water they need?

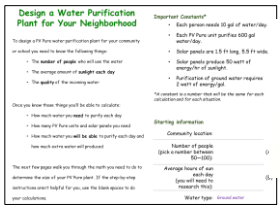
Having access to clean drinking water is a basic need for every living creature, but for so many people knowing if they'll have clean drinking water each day is far from certain. That's where Huda and her team at PV Pure come in. Learn how they are working to make flexible small-scale water purification plants that can be used in rural and hard-to-reach communities around the world. These plants don't need a lot of infrastructure or expertise to run and have the potential to change millions of lives.

Using the question of "How do we ensure everyone has the water they need?" as the overarching phenomenon, students will explore the various aspects of purification, water availability, weather, and engineering as they ask themselves: *"How can we provide safe water to rural and hard to reach communities?"*

## Main Investigations

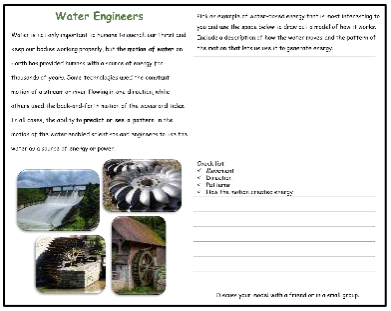
### Water Filtration Design Project


### Sizing/Designing a Water Purification Plant




*(Lego and other building eqpt. not included)*

### Water-based Energy Model




## Number of Lessons*

**Full unit** – 25 lessons
**Supplemental program** – minimum 5 lessons

**Lesson = 30–40 min. block, 50% of full unit lessons can be delivered in non-science classes*

## Best Suited For

- Classroom science instruction

**Overarching Enduring Understanding**

**The value of water.**

**How can we provide safe drinking water to rural and hard-to-reach communities?**

**Number of Lessons***

Full unit – 28 lessons

Supplemental program – minimum 5 lessons

**Lesson = 30 – 40 min block, 50% of full unit lessons can be delivered in non-science classes*

## FLOW OF INSTRUCTION

### Investigation: Separation Strategies (hands-on investigation, occurs during weeks 1–2)

In this introductory activity students have number of tools at their disposal (magnets, balloons, etc.) for use to separate a pile of different materials.

Students revisit this investigation after learning a bit about industrial separation strategies that use magnets, air, electricity, and flotation to separate materials.

Throughout the investigations students will:

- Describe what is happening by asking questions to determine cause and effect relationships that are enabling materials to be separated.
- Define how magnets can be used to solve separation problems.
- Develop improved separation strategies based on their results.

### Investigation: Becoming a Water Washer (hands-on investigations, occur during weeks 3–4)

In this investigation students will design, build, evaluate, redesign, rebuild, and reevaluate their own water filters.

Throughout the investigation they will:

- Describe the relevant design and success criteria.
- Generate and test out various designs.
- Compare results and discuss differences with various commercial water filters.

### Investigation: Water Engineers (mini-research project, weeks 5–6)

Students will study a number of water-based energy generation strategies. They will then pick a single technology and make observations of that technology in action to create a model that describes how the motion of the technology follows a predictable pattern. The model must also include how the predictable nature of the motion can be used to generate energy.

### Investigation: Design Your PV Pure Water Purification Plant (research/math project, weeks 5–8)

After learning about the modular water purification plants designed by Huda and PV Pure, students will have an opportunity to design their own plant. The activity starts with a general discussion around global climates and regions. Students must then pick a community and gather and organize information about population size, water sources, and seasonal weather conditions. All this data will be used to pick and size components for their water purification plant.

### Investigation: Nature's Water Watchers (summative challenge, occurs during weeks 8–12)

In this summative challenge students will use the information they have gathered throughout the unit to investigate nature's water watchers:

- For a given location describe seasonal or ongoing water availability changes, how that change in water availability has affected the animals in that area, and their response. Be sure to include any group behavior that supports their response.
- Many plants and animals have developed strategies to obtain water during times of low water availability. Describe one such situation and what the water collection strategy of the plant or animal is.
- Design a water collection strategy that incorporates something from one of nature's water watchers.

**The extent to which this standard is addressed will be dependent on the water collection strategy chosen.*

## Parts List

### Full Unit

#### Printed Materials

- Educator Guide
- Individual *My STEM Explorer Notes™* notebooks
- Individual *My STEM Stories™* notebooks
- Timeline sheets
- Introductory investigation sheets

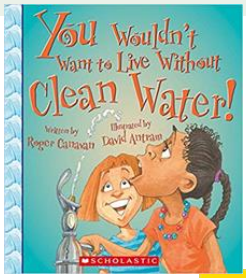
#### Provided Equipment & Materials

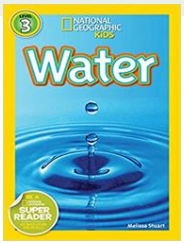
- Modified filter holder containers (6)
- Filter materials (sand, activated carbon-granular, filter pads, paper filter cups)
- Separation Strategies tools and objects (6 sets)
- Large Magnets
- Scoops
- pH paper
- Commercial filter

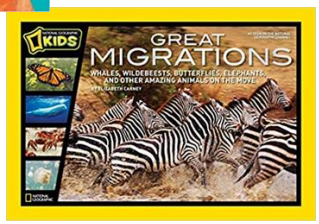
#### Common Equipment & Materials Needed but NOT Provided

- Contaminants (e.g., dirt, leaves, paper, oil, vinegar, food coloring)
- Large jug/mixing bowl/tub for contaminated water
- Tap water
- Clean and contaminated water containers (e.g., plastic cups) (~20)

#### Trade Books




- *You Wouldn't Want to Live Without Clean Water! (You Wouldn't Want to Live Without…) by Roger Canavan (Author), David Antram (Illustrator)*
- *Great Migrations: Whales, Wildebeests, Butterflies, Elephants, and Other Amazing Animals on the Move (National Geographic Kids) by Elizabeth Carney*
- *National Geographic Readers: Water by Melissa Stewart*

#### Digital Resources

- Electronic copies of printed materials1
- How-To videos for investigations1
- Easy-to-use links to publicly available videos and other information.

## Supplemental Unit

### Printed Materials

- Educator Guide
- Individual *My STEM Explorer Notes™* notebooks
- Individual *My STEM Stories™* notebooks
- Timeline sheets
- Introductory investigation sheets

### Provided Equipment & Materials

- Modified filter holder containers (6)
- Filter materials (sand, activated carbon-granular, filter pads, paper filter cups)
- Separation Strategies tools and objects (6 sets)
- Scoops
- pH paper
- Commercial filter

### Common Equipment & Materials Needed but NOT Provided

- Contaminants (e.g., dirt, leaves, paper, oil, vinegar, food coloring)
- Large jug/mixing bowl/tub for contaminated water
- Tap water
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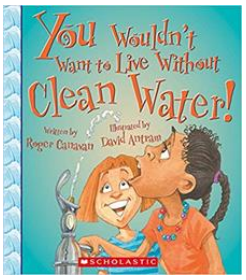
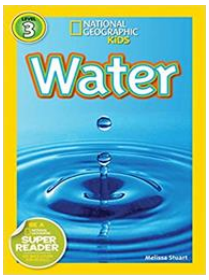
### Trade Books

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- *National Geographic Readers: Water by Melissa Stewart*

### Digital Resources

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## Refill Kit

### Printed Materials

- Educator Guide
- Individual *My STEM Explorer Notes™* notebooks
- Individual *My STEM Stories™* notebooks
- Timeline sheets
- Introductory investigation sheets

### Provided Equipment & Materials

- Modified filter holder containers (1)
- Filter materials (sand, activated carbon-granular, filter pads, paper filter cups)
- Separation Strategies tools and objects (6 sets)
- pH paper

### Digital Resources

- Electronic copies of printed materials1
- How-To videos for investigations1
- Easy-to-use links to publicly available videos and other information.

Grade 3

*(NGSS Standards:3-PS2-1,2,3,4; 3-ESS2-1,2,3; 3-LS2-1, 3-LS4-4; 3-5-ETS1-1,2,3)*

**Overarching Enduring Understanding**

**The value of water.**
**How can we provide safe drinking water to rural and hard-to-reach communities?**

**Number of Lessons***

Full unit – 28 lessons
Supplemental program – minimum 5 lessons
**Lesson = 30 – 40 min block, 50% of full unit lessons can be delivered in non-science classes*

**FLOW OF INSTRUCTION**

**3-PS2-3**
Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.

**3-PS2-4**
Define a simple design problem that can be solved by applying scientific ideas about magnets.

**3-PS2-1**
Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.

**3-5-ETS1-1**
Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

**3-5-ETS1-2**
Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

**3-5-ETS1-3**
Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

**3-PS2-2**
Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.

**3-ESS2-1**
Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.

**3-ESS2-2**
Obtain and combine information to describe climates in different regions of the world.

**3-ESS2-3**
Plan and conduct an investigation to determine the connections between weather and water processes in Earth systems (NYSSLS only).

**3-LS2-1**
Construct an argument that some animals form groups that help members survive.

**3-LS4-4**
Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.

**Investigation: Separation Strategies (hands-on investigation, occurs during weeks 1–2)**
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Students revisit this investigation after learning a bit about industrial separation strategies that use magnets, air, electricity, and flotation to separate materials. Throughout the investigations students will:

- Describe what is happening by asking questions to determine cause and effect relationships that are enabling materials to be separated. (3-PS2-3)
- Define how magnets can be used to solve separation problems. (3-PS2-4)
- Develop improved separation strategies based on their results. (3-5-ETS1-2,3)

**Investigation: Becoming a Water Washer (hands-on investigations, occur during weeks 3–4)**
In this investigation students will design, build, evaluate, redesign, rebuild, and reevaluate their own water filters. Throughout the investigation they will:

- Describe the relevant design and success criteria. (3-PS2-1, 3-5-ETS1-1)
- Generate and test out various designs. (3-5-ETS1-2,3)
- Compare results and discuss differences with various commercial water filters. (3-5-ETS1-2)

**Investigation: Water Engineers (mini-research project, weeks 5–6)**
Students will study a number of water-based energy generation strategies. They will then pick a single technology and make observations of that technology in action to create a model that describes how the motion of the technology follows a predictable pattern. The model must also include how the predictable nature of the motion can be used to generate energy. (3-PS2-2)

**Investigation: Design Your PV Pure Water Purification Plant (research/math project, weeks 5–8)**
After learning about the modular water purification plants designed by Huda and PV Pure, students will have an opportunity to design their own plant. The activity starts with a general discussion around global climates and regions (2-ESS2-2). Students must then pick a community and gather and organize information about population size, water sources, and seasonal weather conditions. All this data will be used to pick and size components for their water purification plant. (3-ESS2-1, 3-ESS2-2)

**Investigation: Nature's Water Watchers (summative challenge, occurs during weeks 8–12)**
In this summative challenge students will use the information they have gathered throughout the unit to investigate nature's water watchers:

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- Many plants and animals have developed strategies to obtain water during times of low water availability. Describe one such situation (3-ESS2-3) and what the water collection strategy of the plant or animal is. (3-LS2-1*, 3-LS4-4*)
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