



Survival Chemistry Unit: Water Filtration Challenge

Grade Range: 8th–12th Grade

Total Duration: 8 Days

Theme: Survive by Filtering Dirty Water

Performance Task: Build and test a soda bottle water filtration system using natural materials

Phenomenon (Module Launch - Day 1)

Scenario: A group of hikers is stranded after an earthquake. Their only water source is a muddy stream. How can they filter the water using only found natural materials?

Activity: Show a video of dirty water sources around the world and how people filter water in survival scenarios. Students examine the "Universal Dirty Water Solution" sample and observe its properties.

Driving Question: How can we clean dirty water using our knowledge of matter?

3D Focus:

- **DCI:** PS1.A Structure and Properties of Matter
- **SEP:** Asking Questions and Defining Problems
- **CCC:** Cause and Effect

Survival Extension: Students are grouped into survival teams. They sketch a first version of a filter using only what they know now. They will update and improve this sketch with each new lesson.

Lesson 1: Properties of Matter (Day 2)

Objective: Identify and classify physical and chemical properties of matter

Engage: Mystery substance bag challenge (describe, classify, and identify by properties)

Explore: Stations of solids, liquids, gases – observe, record, classify

Explain: Discuss key vocabulary – mass, volume, density, conductivity, magnetism, solubility

Elaborate: Apply knowledge to materials usable in water filters (sand, charcoal, gravel, etc.)

Evaluate: Quick quiz + Exit ticket: Which properties are most important for filtration materials?

Survival Extension: Teams test and record physical properties of different filter materials and determine which to include in their next sketch. They update their filter blueprint.

3D Focus:

- **DCI:** PS1.A
 - **SEP:** Planning and Carrying Out Investigations
 - **CCC:** Structure and Function
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Lesson 2: Changes of Matter (Day 3)

Objective: Distinguish between physical and chemical changes

Engage: Demo: Boil water vs. Vinegar + Baking Soda Reaction

Explore: Students perform several small-scale changes and classify them

Explain: Physical change vs. chemical change in real-world applications (e.g., boiling water, filtering)

Elaborate: Are any water purification methods chemical changes?

Evaluate: Worksheet + Class discussion on types of changes involved in filtration

Survival Extension: Students evaluate their materials: do any create chemical changes? Do they want to purify or just filter? Update design accordingly.

3D Focus:

- **DCI:** PS1.B Chemical Reactions
 - **SEP:** Analyzing and Interpreting Data
 - **CCC:** Energy and Matter
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Lesson 3: Elements and Compounds (Days 4–5)

Objective: Differentiate between elements, compounds, and mixtures

Day 1:

- **Engage:** Periodic Table sorting activity
- **Explore:** Build element and compound models with manipulatives
- **Explain:** Definition and examples of elements and compounds
- **Evaluate:** Card sort + formative quiz

Day 2:

- **Elaborate:** Discuss how compounds like activated charcoal are used in real filters
- **Extend:** Research stations on natural compounds used in water purification (e.g., Moringa seeds, charcoal)

Survival Extension (Both Days): Teams identify the elements and compounds in their filter materials (e.g., Carbon in charcoal). They research new possible materials and revise their filter design again.

3D Focus:

- **DCI:** PS1.A
- **SEP:** Constructing Explanations
- **CCC:** Patterns

Lesson 4: Mixtures of Matter (Days 6–7)

Objective: Classify and separate mixtures

Day 1:

- **Engage:** Mystery mix challenge – separate using tools (sieves, magnets, filters)
- **Explore:** Make your own heterogeneous and homogeneous mixtures
- **Explain:** Vocabulary: solution, suspension, colloid

Day 2:

- **Elaborate:** Investigate real-world filtering methods: boiling, filtering, UV, charcoal
- **Evaluate:** Mixture classification lab and filtration method comparison sheet

Survival Extension (Both Days): Teams classify their Universal Dirty Water sample and test single-layer versions of their filters. They use observations to inform their final blueprint.

3D Focus:

- **DCI:** PS1.A
 - **SEP:** Developing and Using Models
 - **CCC:** Systems and System Models
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Day 8: Survival Challenge and Wrap Up

Objective: Apply chemistry knowledge to build and test a filtration system

Task: Groups build a soda bottle filter using natural materials. Each group tests it against the Universal Dirty Water Solution. Water clarity and particle removal will be judged.

Bonus: Teams earn the **Clean Water Survival Badge** based on performance.

Assessment: Rubric-based group performance, individual reflection journal, and peer feedback

3D Focus:

- **DCI:** PS1.A & PS1.B
 - **SEP:** Designing Solutions
 - **CCC:** Stability and Change
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Materials Needed:

- Soda bottles, sand, gravel, activated charcoal, cheesecloth, cotton, dirt, food coloring, beakers, funnels, etc.

Standards Alignment:

- NGSS MS-PS1-1, MS-PS1-2, MS-ETS1-1, HS-PS1-2

Extension Options:

- Research modern water filtration systems
- Engineering redesign day
- Cross-curricular connection with geography or social studies on global water crisis