

Trial/Pilot Event

Contact the organizers of your tournament to find out what trial/pilot events will be held.

CLEAN WATER CHALLENGE

1. **DESCRIPTION:** Students will design a method to alter a water sample so that it meets an Environmental Protection Agency drinking water standard(s). Students will use scientific inquiry to guide them in their design and documentation of their process.

Selected Standard: TURBIDITY

A TEAM OF UP TO: 2 **IMPOUND:** No **APPROXIMATE TIME:** 50 minutes

2. **EVENT PARAMETERS/CONSTRUCTION:**

- a. Students may bring
 - i. Writing utensil
 - ii. Optional safety items (see list below)
- b. Supervisors provide all materials needed for the event
 - i. Building or design items
 - ii. Water Sample
 - iii. Testing strips or equipment
 - iv. Answer/score sheets
 - v. Writing utensils
- c. Safety items
 - i. Goggles (optional)
 - ii. Disposable gloves (optional)
- d. Parameters/guidelines for construction
 - i. Students can only use the materials provided by the supervisor. Students cannot request or use additional materials.
 - ii. Students are not restricted on how they alter the materials.
 - iii. Students are not required to use all of/every material provided.
 - iv. All design/build and testing must take place during the 30 minute design/build and test portion of the event.
 - v. Students may be limited to the number of times they test their sample. This will be outlined in the instructions given by the event supervisor or judge.
 - vi. Testing can be done at any point during the 30 minute design/build and test portion of the event.
 - vii. Judges will assist in testing the sample to assure accuracy of recorded results. Results not viewed by judges will not be scored.
- e. No impound

3. **THE COMPETITION:**

- a. How event will be administered
 - i. Students will be given a set of instructions, quiz, materials, and outline of scoring rubric at the start of the event. All instructions, questions, materials, and scoring will be the same for all teams in the competition.
 - ii. Students will have 30 minutes to design/build and test a method or process that alters the water quality to meet a specific pre-determined standard.
 - iii. Students will have 15 additional minutes to answer a set of multiple choice, fill in the blank, and true/false questions regarding water quality and the specific standard chosen for the competition. During this time any remaining written work from the previous portion of the event may be completed.

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- iv. Students must hand in all leftover materials as well as copies of the instructions, questions, and scoring rubric when time expires. They also must turn in their model or device along with their written work including documentation of their process, observations, results, and answers to the quiz. Students should leave with only the items they brought, which is limited to writing utensils, and optional safety goggles and gloves.
- b. Content areas covered
 - i. Science of Inquiry
 - ii. Earth Science
 - iii. Physical Science
 - iv. Life Science
 - v. Science and Technology
 - vi. Science in Personal and Social Perspectives
 - vii. History and Nature of Science
- c. Detailed description of sequence of the event (primary construction type events).
 - i. Set up logistics
 - (1) Teams of 1-2 will be assigned to a lab table or classroom table.
 - ii. Beginning and ending of timing
 - (1) Students will have 30 minutes to complete the design/build and test portion of the event. All water sample testing must be completed during the 30 minute period. Any sample testing or model manipulation done after time has expired will not be scored.
 - (2) Students will have 15 minutes to complete the quiz and any other written work (analyzing data, interpreting results, etc). Students may begin the quiz during the design/build, and water testing portion if they choose. Any written work done after time has expired will not be scored.
 - (3) Time will begin and end at the call of the event supervisor or judge.
- d. Other competition specific instructions
 - i. Students should document their process of design, investigation, observations, data collection, results, and reflections in a written record. This record should follow steps of the scientific inquiry process.

4. **SAMPLE QUESTIONS:**

Sample instructions:

Using the materials supplied, alter the provided water sample so that the pH is at a range which falls within the US Environmental Protection Agency water standards.

Sample questions:

- The Safe Drinking Water Act gives the EPA the authority to set _____.
- Safe Drinking Water Standards regulate control the level of contaminants in the nation's _____.
- EPA delegates responsibility for implementing drinking water standard to _____ and tribes.

5. **SCORING:**

- a. 75% of the total score is based upon the team's ability to use the scientific inquiry process. (See sample scoring rubric.) 25% of the total score is based upon the quiz (multiple choice, fill in the blank, and true/false). No partial points will be awarded.
- b. No penalties
- c. No tiers
- d. Ties will be broken by 1) water sample closest to EPA drinking water standard, 2) highest score on pre-determined questions.

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RECOMMENDED RESOURCES:

www.groundwater.org

www.epa.gov

www.usgs.gov

NATIONAL SCIENCE EDUCATION STANDARDS:

Content Standard A. Science as Inquiry: Abilities necessary to do scientific inquiry, Understanding about scientific inquiry

Content Standard B. Physical Science: Properties and changes of properties in matter

Content Standard D. Earth and Space Science: Structure of the Earth's System

Content Standard E. Science and Technology: Abilities of technological design, Understanding about science and technology

Content Standard F. Science in Personal and Social Perspectives: Personal health, Science and teaching society

Content Standard G. History and Nature of Science: Science as a human endeavor

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Clean Water Challenge Quiz

TRUE/FALSE

1. The Safe Drinking Water Act (SDWA) regulates contaminants in public and private drinking water supplies.
2. SDWA gives states the opportunity to set and enforce their own drinking water standards if the standards are at least as strong as the national standards.
3. Secondary drinking water regulations are enforceable guidelines for contaminants that may cause health risks.
4. People who are not healthy as a result of illness, age, or weakened immune systems are more likely to be at risk from certain contaminants.
5. Turbidity is caused by suspended matter or impurities that interfere with the clarity of water.
6. Excessive turbidity can cause water temperature and dissolved oxygen levels to rise.
7. Controlling turbidity is a safeguard against pathogens in drinking water.

MULTIPLE CHOICE

8. Under the SDWA _____ sets the legal limits of the levels of regulated contaminants.
 - a. Congress
 - b. Each individual state
 - c. The Environmental Protection Agency
 - d. Each public water system
9. The level of a contaminant in drinking water below which there is no known or expected health risk is the _____.
 - a. Maximum Contaminant Level Goal
 - b. Maximum Contaminant Level
 - c. Treatment Technique Level Goal
 - d. Treatment Technique Level
10. Typical sources of turbidity in drinking water include:
 - a. Waste discharge
 - b. Runoff
 - c. Algae
 - d. All of the above

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Event Guide: Clean Water Challenge

Turbidity

EVENT

Students will be asked to alter a water sample so that the turbidity of the sample decreases and is within the EPA Drinking Water Standard for turbidity which is 1 NTU.

ROOM SET-UP

Students will be in teams of up to 2 people. Enough space will be needed so that teams are spread throughout the room. A lab station classroom setup would be an ideal space for the event.

It is recommended to designate a few tables “testing stations,” allowing teams to approach the testing area when they are ready to test their water sample. All testing stations must have the same testing equipment.

TIMING THE EVENT

Students will have 30 minutes to design and test a method that alters their water sample. Students will have an additional 15 minutes to complete any written work and answer questions about water quality, drinking water standards, and the selected standard (turbidity). The event supervisor will need to keep time. A stop watch or kitchen timer is recommended. It is also helpful to give the students time updates.

TESTING THE SAMPLE

Students may not be familiar with and are not expected to be familiar with the selected testing device. Therefore it is recommended that event supervisors recruit volunteers (judges) to assist and observe students as they test their sample. Once a sample is tested, the measurement should be recorded in ink by the judge or the judge should initial the record (this ensures fairness between teams). Only results recorded or initialed by a judge will count towards the teams final score.

Every team is allowed to test their water sample at least twice during the 30 minute design/build and test phase of the event. Event supervisors may choose to allow for additional tests but this must be stated in the instructions given to the students at the start of the event.

JUDGES

It is recommended that volunteers are recruited to assist running the event. Depending on the number of students participating during each 50 minutes session, one person may find it difficult to manage testing stations, monitor the time, and monitor the room.

Judges should have knowledge about groundwater, water quality, and drinking water standards and should also be familiar with the testing method and equipment used for the event. Judges should not provide feedback, suggestions, or answer questions during the event. Suggested individuals to recruit for event support include USGS hydrologist or hydrogeologist, EPA officials, university/college professors with knowledge of water science or related field, graduate students with studies in water related fields, and extension educators.

MATERIALS

The event supervisor will need to provide all materials for the event.

Building and Design

Event supervisors will need to decide what materials to provide for the students. These materials will be used to decrease the turbidity of their water sample. Materials that may not be helpful to solve the problem can also be provided. All materials must be identical in type and quantity for each team of students.

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Suggested materials:

- plastic cups
- 2-liter pop bottle
- milk jugs
- cotton balls
- screen
- coffee filters
- cheese cloth, felt or other fabrics
- nylon hosiery
- sponges
- rubber bands
- scissors
- activated charcoal
- sand, gravel, and/or clay
- paper towels
- baking soda
- table salt
- corn meal
- sugar
- alum
- graduated cylinder
- scale
- rule
- syringe
- measuring cups
- spoons/scoops

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Water Sample

Water sample can be from a local water source (lake, pond, or river) or can be created with tap water and sand, soil, and/or other organic mater.

Testing Equipment

There are a variety of methods for testing turbidity including use of a turbidity meter, a colorimeter, and a turbidity tube. Since turbidity measurement devices and units of measurement vary, let students know what device or method will be used and what units the device measures in.

Score Sheet

Students will need blank lined paper for recording their process and answers to questions. Event supervisors will need to provide the paper. Suggest using “blue books” or essay exam books or provide staplers as a way to keep student’s work together and prevent loose or lost papers.

Writing Utensils

The event supervisor will decide what type of writing utensil to provide pens or pencils or both. Rules indicate students may bring their own writing utensil but it is not required, therefore please make them available.

HELPFUL WEBSITES:

http://water.usgs.gov/owq/FieldManual/Chapter6/6.7_contents.html

http://www.epa.gov/safewater/mdbp/pdf/turbidity/chap_07.pdf

<http://www.epa.gov/volunteer/stream/vms55.html>

<http://www.epa.gov/safewater/contaminants/index.html>

<http://www.epa.gov/safewater/standards.html>

http://health.usgs.gov/dw_contaminants/

<http://pubs.usgs.gov/fs/FS-047-97/>

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CLEAN WATER CHALLENGE SCORING RUBRIC

A. Form a Hypothesis or Question:	NO	YES
1) Did the team form a hypothesis or question?	0	2
2) Is supporting explanation or background science knowledge included?	<i>If no, also award 0 points for questions 3 and 4</i> 0	2
3) Is explanation and background clear and complete?	0	1
4) Is explanation and background relevant and appropriate to task?	0	1
5) Can hypothesis or question be answered or tested using the materials and data provided?	0	2

TOTAL (8 points possible in section A)

B. Design an Investigation:	NO	YES
6) Does team present a plan for their investigation?	<i>If no, skip to section C</i> 0	2
7) Is background science knowledge or preliminary observations used in the design of the investigation?	0	2
8) Is the plan complete?	0	1
9) Is plan safe, reasonable, and logical?	0	1
10) Is plan communicated so that the investigation can be replicated?	0	2

TOTAL (8 points possible in section B)

C. Collect and Present Data:	NO	YES
11) Do measurements include correct units?	0	1
12) Are observations recorded?	0	1
13) Are observations recorded that are appropriate to the task?	0	2

TOTAL (4 points possible in section C)

D. Analyze and Interpret Results:	NO	YES
14) Are reflections made on recorded observations?	0	1
15) Does the team communicate possible changes, or state that there are no changes needed?	<i>If no, also award 0 points for questions 16</i> 0	2
16) Are the changes for the refined model or investigation or reason(s) why no changes are necessary backed up with observations and data or explanation through scientific knowledge?	0	2
17) Is background knowledge about safe drinking water standards and water quality used in analysis of the results?	0	1
18) Does the team communicate insights that are related to the investigation and go beyond the realm of the problem presented?	0	2

TOTAL (8 points possible in section D)

E. General:	NO	YES
19) Is work presented in logical order?	0	1
20) Is data and written work presented clearly and easily followed?	0	1

TOTAL (2 points possible in section E)

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Participant Name(s): _____ Raw Score/Rank _____

School/City: _____

POINTS	Possible	Total
Quiz	10	
Section A	8	
Section B	8	
Section C	4	
Section D	8	
Section E	2	
TOTAL (quiz and sections A-E)		40
Tiebreaker A: Closest to EPA standard	.5 pt	
Tiebreaker B: Highest score on pre-selected question(s)	.01 pt	
TOTAL		

NOTES:

Judge/scorer:
