

Name: \_\_\_\_\_

Period: \_\_\_\_\_

# The Great Filtration Competition

Congratulations you and your team of engineers have made it to the final round of the Great Filtration Competition!

Your goal in this competition is develop a creative filtration system that your engineering team will use to assist areas with poor water quality and/or limited water resources. In this competition you will be judged on water clarity and filtration speed.

Planning is everything! First, on your own, brainstorm and draw which provided materials you think will filter water best and fastest. You can choose any number of materials for this part. Inside the outline below draw how you are going to stack these materials inside your filter. Be sure to label each portion of your drawing. Remember that different stacking combinations will have different results. When finished share your ideas with your team.

## MATERIALS

MODELING CLAY

SAND

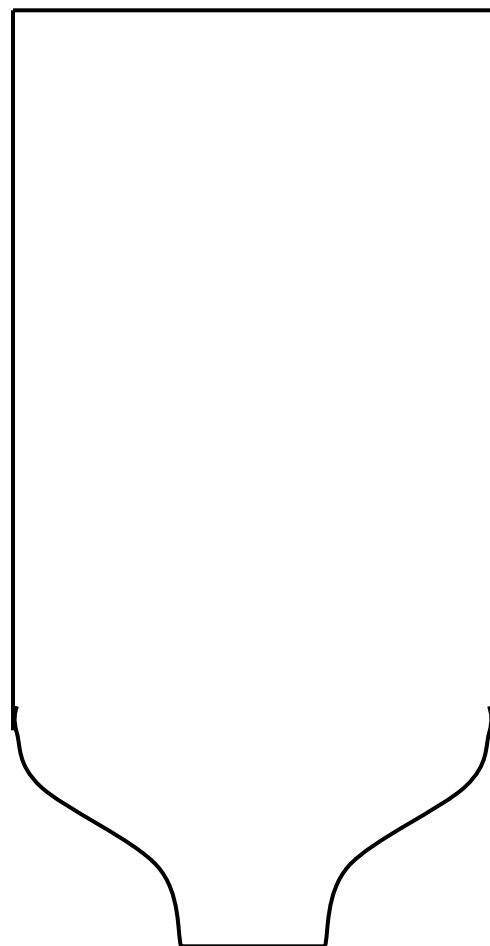
GRAVEL

CHARCOAL

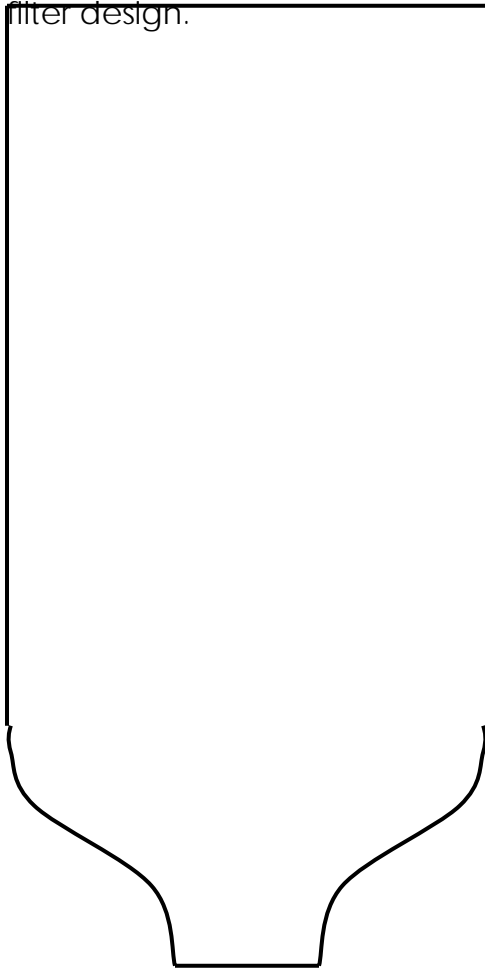
COTTON BALLS

MINI MARSHMELLOWS

SHREDDED LETTUCE



Now that you have shared your ideas with your team, work with your team and figure out the best filtering strategy **USING ONLY 3 PROVIDED MATERIALS!** Be sure to label each portion of your drawing. Below draw your team's filter, each member of the team should have the same drawing. Remember every engineer on your team must agree on the filter design.



----- Layer A

----- Layer B

----- Layer C

When you have finished drawing your team designed filter, it is time to build it! Collect the three materials you are going to use and, with your team, begin to carefully layer selected materials one on top of the other. A pencil can be used to push materials inside the bottle down. Follow your team's design!

# OFFICIAL JUDGING FORM

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## BEFORE JUDGING

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Which team do you think will have the purest filtered water and why?

Which team will filter water fastest and why?

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## WATER PURITY/CLARITY

Rate the amount of each pollutant in the filtered water.

POLLUTANT	1	2	3	4
1. Orange Sand	MUCH	SOME	LITTLE	NONE
2. Food Color	MUCH	SOME	LITTLE	NONE
3. Crisp Rice Cereal	MUCH	SOME	LITTLE	NONE

## FILTRATION SPEED

How long did it take to collect 150 mL of purified water?

TIME	VALUE
Less than 1 minute	4
1 minute – 1 minute 30 seconds	3
1 minute 30 seconds – 2 minutes	2
Greater than 2 minutes	1

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## AFTER JUDGING

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Which team had the purest filtered water and why?

Which team filtered the water fastest and why?

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INSTRUCTOR USE

# The Great Filtration Competition

**KEY QUESTION:**      **HOW CAN WE DESALINATE, OR REMOVE SALT FROM, WATER?**

## **Objective:**

Through designing their own filtration systems, students will begin to understand how unwanted materials are removed from water. Furthermore, students will first hand experience the amount of work required to filter water in order to meet the increasing demands of population growth. The importance of water conservation is an underlying theme for this activity.

## **Materials:**

20 fl oz. plastic bottles (1 per group)

scissors

non-rigid mesh screen (to cover bottle opening)

rubber bands (to tightly hold non rigid mesh screen over opening)

rigid mesh screens (large enough to separate layers of material)

stopwatches

250 ml beakers (2 per group)

“contaminant” materials of your choice (i.e. crisp rice cereal, food coloring, aquarium sand, etc.)

filtration materials – be creative with your choice (i.e., soil, clay, sand, gravel, potting soil, cotton balls, metal scrap, woodchips, sawdust, packing peanuts, charcoal, coffee filters, vegetation [i.e., shredded lettuce], etc.)

lots of paper towels

## **Procedures:**

Students will first design their own water filtration system with the option to use as many filtering materials as they want. Next, students will discuss their filtration system in a group and work together to determine the best (purest water in the fastest time) filtration system using only 3 materials [more materials can be utilized if interest arises].

Students will then answer pre-judging questions from the activity. After answering pre-judgment questions students will time and evaluate clarity of water from filters created by other groups and score them according to criteria on the Official Judge's Form. If food coloring is used as a "contaminant" have students compare the filtered color to a separate container with the initial color or hold it up against a white piece of paper. Upon completion of judging students will answer post-activity questions while points are tallied.

## **References:**

This laboratory was adapted from:

Ruez, Dennis, Jr., 2007. Water Filtration Competition. Environmental Science Institute, University of Texas, Austin.

<http://www.esi.utexas.edu/outreach/groundwater/resources.php>

Where Do We Get Clean Water? 12 April 2007. Environmental Science Institute, University of Texas, Austin.

<http://www.esi.utexas.edu/outreach/gk12/docs/lessons/clean1.pdf>

Clean Water...Where Does It Come From? 12 April 2007, National Aeronautics and Space Administration

[http://nasaexplores.nasa.gov/show\\_k4\\_teacher\\_st.php?id=021123154706](http://nasaexplores.nasa.gov/show_k4_teacher_st.php?id=021123154706)

Clean Water...Where Does It Come From? Environmental Protection Agency—Ground Water Quality: Contamination Menu

<http://www.epa.gov/seahome/groundwater/src/quality2.htm>