ENGINEERING!

Dear Teacher,

Thank you for having the *Engineering* van visit your school. We hope you enjoyed investigating engineering with your students during this Science On Wheels experience. This flier is intended to help continue the enthusiasm generated by our visit and extend your students' learning.

The following activities have been selected because they encourage creativity and problem-solving skills, both important components in engineering. Please feel free to adapt them to suit your needs. The one page insert is written for your students, with activities you may choose to do as a class, or copy for home use.

Thank you again for having the *Engineering* van visit your classroom and remember, have fun!

~Science On Wheels Teachers

Oil Spill Clean Up

Materials

(per student or team)

- large tub or flat container
- vegetable oil
- water
- food coloring
- straws
- paper towels
- cotton balls
- feathers
- sand

Each technology has effects that affect the earth. Some developments help the earth, while some harm it. Environmental engineers try to design techniques to minimize harm done to our environment.

Design

Begin by filling the tub halfway with water. Measure the water level and write it down. You may wish to use food coloring to color the water blue. Now spill a few teaspoons of oil into the water. Observe the amount of oil on the surface of the water.

Test

Different teams can experiment with different methods and materials for cleaning the spill while leaving the water intact. Measure the water level. Look at how much oil remains. Which were the best techniques for cleaning the oil spill without removing too much water?

Re–Design

As a class, design the best way to clean the oil spill based on your previous designs. Are there other materials that would make it work better?

Challenge

What will you do with the oil-covered clean-up material so it won't become its own clean-up problem? Each year oil spilled in oceans, lakes and streams harms wildlife and the environment. Oil floats on the top of the water and spreads over a large area. One pint of oil spilled on water can create a one-acre oil slick! As a class, research technologies that work to avoid oil spills and clean them up.

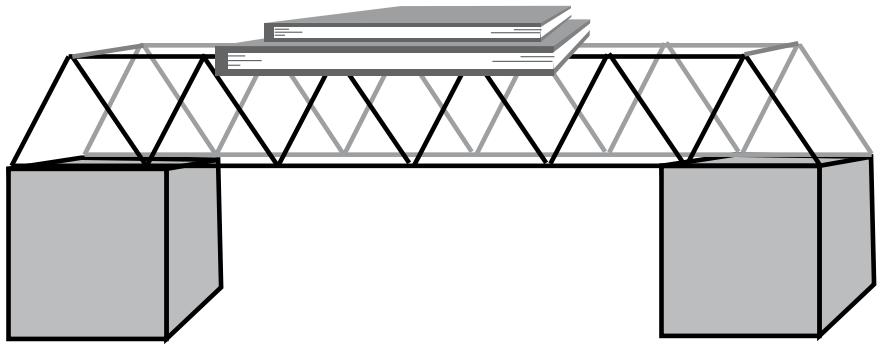
Toothpick Bridge Building

Materials
(per student or team)
- round toothpicks
- glue
- paper
- books

Design
Using only toothpicks, glue and one sheet of paper, build a bridge at least twelve inches long and no more than five inches wide which will support the greatest possible weight.

Test
Place the books on the bridge one at a time to test its strength. How many books can your bridge hold before it breaks?

Re-Design
Discuss as a class which shapes worked best to help support the weight. What were the strongest parts of your bridges?



Hovercraft

Materials
(per student or team)
- one paper plate or cup
- scissors

Students can create hovercrafts, vehicles that "float" on a cushion of air over water, mud, snow, pavement or their desk tops!

Design
Cut a small hole about the size of a dime in the bottom of the cup. Place the cup upside down on a smooth table or counter.

Test
Blow gently into the hole to make the cup move.

Re-Design
Try different types of containers. For example, you could try a cardboard box or an old styrofoam tray or perhaps an orange juice container. How well do these compare to the cup? What advantages do you think a hovercraft would have over a vehicle that comes in contact with the ground (or water, ice or mud)? What can you do to make your hovercraft move more predictably?

"Radioactive" Ping Pong Ball Competition

Materials

For the Teacher:

- stopwatch or clock
- gloves (protective gear)

For each team:

- 2 brown paper bags (labeled Bag #1 and Bag #2)

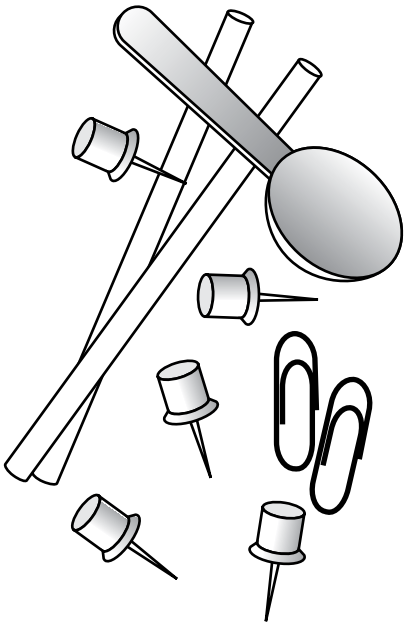
In Bag #1:

- 6 "radioactive" ping pong balls (per team)

In Bag #2:
(Keep contents hidden from students until the start of the game!)

- 2 paper clips
- 3 straws
- 4 – 3"x3" pieces of paper
- 5 rubber bands
- 6 tongue depressors
- 7 push pins
- 8 plastic spoons
- 9 pieces of 6" string
- 10 pieces of tape

(You may vary the materials – use things you already have in your classroom, but limit the amount of materials that the students can use.)



Work together in teams to solve a problem. The object of this game is to be the first team to successfully move all "radioactive" ping pong balls from one of their brown paper bags to another.

Design

Without letting them look at the contents, have each group place the two bags on the floor, approximately eight feet apart. The bags are to remain upright and are not to be moved or tipped. Once they have set up the materials, have them sit back and listen to the rules.

Rules of the game

1. There are six ping pong balls in Bag #1. When you hear the word "Go," the ping pong balls will be considered radioactive waste. Each team's job is to move the radioactive waste from Bag #1 to Bag #2 in 15 minutes or less.
2. The radioactive waste can be transported from Bag #1 to Bag #2 using only the supplies provided.
3. The radioactive waste can only touch the paper bags or the supplies – it must not touch the humans or the floor.
4. If a person or piece of clothing touches the radioactive waste, or if it gets dropped, there is a contamination leak! The teacher will put on protective gear (gloves) and return the ball to Bag #1 and the team will get a 15 second penalty.
5. The team may alter the supplies in any way necessary, but once a supply has been used to move the radioactive waste, it is contaminated and must be dropped into Bag #2 with the rest of the radioactive waste.

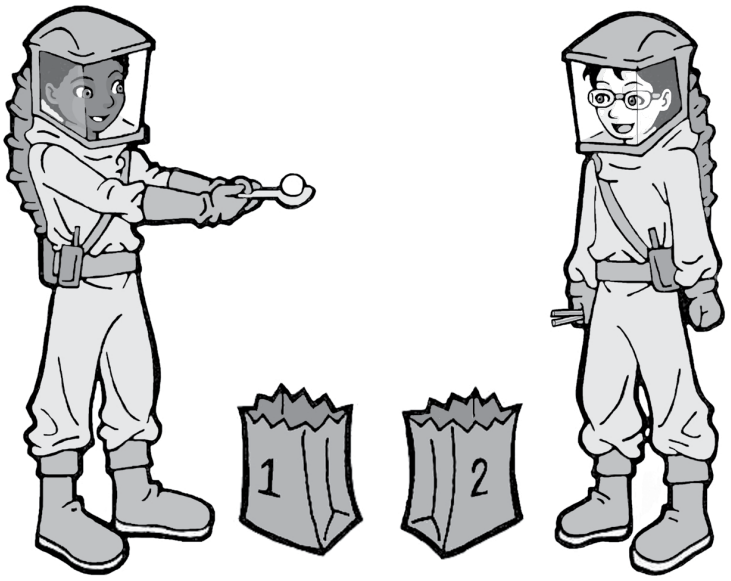
Test

Once the students know the rules, start the timer. Each team will have 15 minutes to decide as a group how to transport the radioactive waste and implement their plan. Encourage creativity. Help them consider all ideas.

The goal is to move all of the radioactive waste in the 15-minute time limit. Remember to add 15-second penalties for contamination leaks. Try to enforce the time limit, but you may need to let them have extra time to complete the task. After all the teams have completed the challenge, tally up the times and go around the room to have the teams share ideas and comments.

Re–Design

Discuss as a class what worked well and what was frustrating. If they were going to do it again, how would they improve their method? What would they do the same? Emphasize that there is no correct way to do this, and that many methods will work.



Slime

Procedure

1. Mix 1 cup hot water and 1 ½ tsp. of borax until dissolved. Set aside.
2. Mix 2 cups of white glue and 2 cups of warm water together in a plastic bowl.
3. Using a metal spoon, slowly pour the borax mixture into glue mixture while stirring quickly. Stir until the mixture comes off the side of the bowl. The slime will be sticky.
4. Knead until slime is not sticky. The more you work with it, the easier it will be.

Test

Materials science engineers perform tests to see what a new material could be used for. What is a use for your slime? For example, if you think it might be good for sticking posters to a wall, the test you design might involve sticking a piece of paper to the wall or to the side of your desk with the slime and timing how long it will stay up there.

Other uses:	Tests you could perform:
Bouncy ball (toy)	Use a ruler to see how high it will bounce.
Seal for leaks	Put some water in your cup, stretch the slime across the top, invert the cup over the sink, and time how long it will hold the water.

Leave it out to dry for a week or put it in your freezer and try to bounce it.

Be creative!

Materials

(makes about 4 cups)

- 1 cup hot water
- 1 ½ tsp. borax (non-toxic)
- 2 cups white glue (Elmer's)
- 2 cups warm water
- 1 tsp. liquid watercolor or food coloring

Resources

Here are some of the titles you might wish to add to your classroom library or your bookmarks on your computer:

Gee Whiz! How to Mix Art and Science or The Art of Thinking Scientifically, by Linda Allison, 1974

Science for all Cultures, compiled by Shelley J. Carey, 1993

Options for Girls, A Door to the Future, edited by Jmeg Wilson, 1992

Connections: Science by Writing, by Robin Lee harris Freedman

Multiculturalism in Mathematics, Science and technology: Readings and Activities, by Addison Welsey, 1933

Science On Wheels website: www.pacificsciencecenter.org/education/sow

Engineering Insights web site: www.engineeringsights.org

Society of Women Engineers web site: www.swe.org

Discover Engineering web site: www.discoverengineering.org

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