2008 STARS OLYMPIAD

GREEN SCIENTISTS

ADVENTURE: *LOST*

TEAM NAME:_____

We begin our story with a young group of engineers. Their names and roles were:

Biomedical Engineer: _____

Chemical Engineer: _____

Civil Engineer: _____

Computer Engineer: _____

Electrical Engineer: _____

Environmental Engineer: _____

Industrial Engineer: _____

Mechanical Engineer: _____

Nuclear Engineer: _____

Aeronautical Engineer: _____

These engineers belonged to an organization called 'Engineers without Borders,' an organization for engineers to volunteer their time and skills to help others in need in countries all around the world. On this day, the groups of engineers were one their way to the island of Hispaniola to work in the nation of Haiti on a project to bring clean water and electricity to the people living there.

They were taking a small helicopter out of Miami, Florida, and set to land in the small city of Cap Haitien on the northern coast of the island. Let's see where their adventure takes them…

Activity 1: The Flight

ACTIVITY LEAD: Civil Engineer
CO-LEAD: Aeronautical Engineer

Our adventurers must begin by planning their flight to the island of Hispaniola. You will fly out of Miami and land in the small city of Cap Haitien on the northern coast of Haiti. Determine how much fuel you will need to make the flight using the skills you learned in the summer camp.

The team is flying a Robinson R44 Raven II with a cruise speed of 115 miles per hour and fuel mileage of 10.75 miles per gallon.

Procedure:

1. Determine how many miles it will take to fly from Miami, Florida to Cape Haitien, Haiti:
   a. Take a ruler and measure the distance from the locations in centimeters.

      _____ cm

   b. Write down the scale of the map. Remember the scale allows you to represent long distances in a fraction of the space.

      Scale _____

   c. Use the Unit Conversions and scale to convert centimeters into miles.

Unit Conversions	
5280 feet = 1 mile	12 inches = 1 foot
2.54 centimeters = 1 inch	1 meter = 100 centimeters
1 mile = 1.6 kilometers	1 kilometer = 1000 meters

2. Determine the amount of fuel required. Hint: $Gallons = \left(\frac{1}{miles \quad per \quad gallon} \right) \times (miles)$

About 60% of the way through the flight you suddenly realize you are out of fuel. Apparently there was a fuel leak! You have to find an island to land on. Go and land the helicopter on the small island. Then use the map below to figure out what island you landed on and mark it with an X. Once you know and have landed your helicopter, you can move to the next part of the challenge.

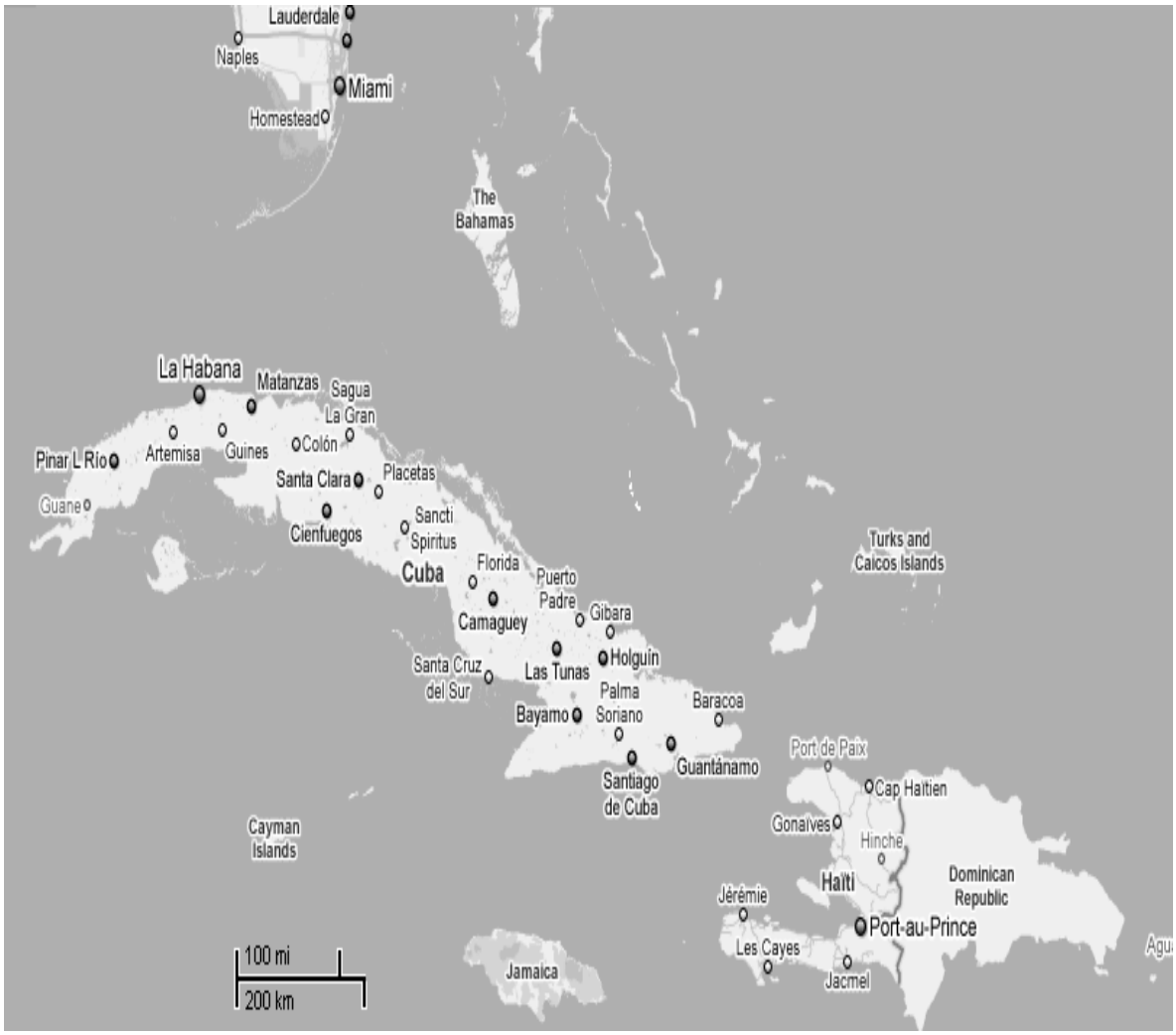
3. Determine where you are located.
    a. Take your answer from 1. a. to figure out how far you traveled.

        0.60 x _____ cm = _____ cm

    b. Now, take your ruler and place the 0 cm mark on Miami, FL. Hold the ruler down with your thumb on Miami and trace a circle on the map with a radius equal to your new distance.
    c. Mark the map below with an X where the circle intersects an island between Miami, FL and Cape Haitien, Haiti.

4. Show your answers to the Fellow or Teacher in charge.

Time in: Time out: Fellow/Teacher initials:



Activity 2: Find and Test Water

ACTIVITY LEAD: Chemical Engineer
CO-LEAD: Biomedical Engineer

After landing on the island, you find that it is extremely small and uninhabited. You have only a few supplies that you brought with you to work on your project in Haiti. The first and most important thing to do is to find fresh water so that you can survive in the hot Caribbean sun!

While searching the island, you come across a small pool of what you believe to be fresh water, but you are not sure if it is safe to drink. The water appears green and slimy. Use your test kits that you brought with you for Haiti to test the water and determine if it is safe to drink. You need to test the water for two chemicals- nitrates and phosphates.

Nitrate Test Procedure:

1. Fill the test tube to the 5 mL line.
2. Add one nitrate #1 testab.
3. Cap the tube and mix until the tablet is disintegrated.
4. Add one nitrate #2 testab.
5. Cap the tube and mix until the tablet has disintegrated.
6. Wait 5 minutes.
7. Compare the color of the sample to the Nitrate Color Chart.
8. Record the result as ppm nitrate:

Nitrate level of your water sample: _____

Phosphate Test Procedure:

1. Fill the test tube to the 5 mL line.
2. Add one phosphorus testab.
3. Cap the tube and mix until the tablet has disintegrated.
4. Wait 5 minutes.
5. Compare the color of the sample to the Phosphate Color Chart.
6. Record the result as ppm phosphate in your lab notebook.

Phosphate level of your water sample: _____

Show your answers to the Fellow or Teacher in charge.

Time in: **Time out:** **Fellow/Teacher initials:**

Activity 3: Clean The Water

ACTIVITY LEAD: Environmental Engineer
CO-LEAD: Nuclear Engineer

Its getting late in your first day on the island, and you really need some water soon for the next day. Unfortunately, after running some tests you have discovered that the water is not drinkable in its current state, and must be purified before consumption.

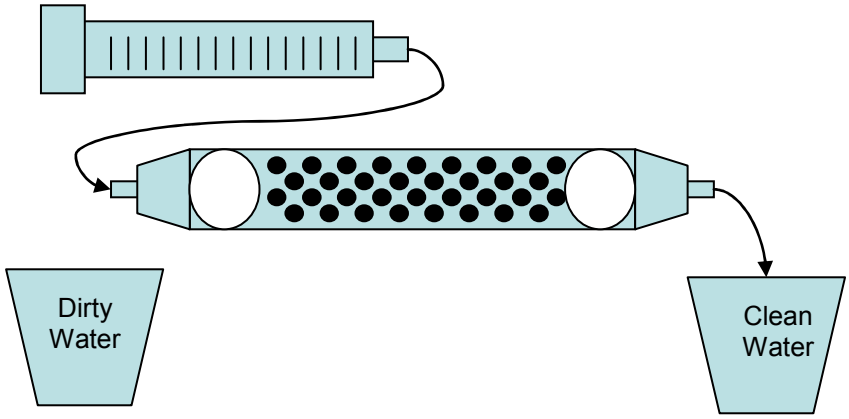
Using the activated carbon that you brought to clean the water in Haiti, make a purification system that will remove the green slime, bacteria or any other contaminants from your water to make it safe to drink.

Materials:

- Contaminated Water
- Syringe
- Tube
- Airline Tubes
- Cotton Balls
- Activated Carbon
- Cup

Procedure:

1. Assemble the carbon bed filter as shown below:



2. Use the water to pull clean water into the bed and then push it back into the cup to rinse the activated carbon with clean water. This removes any dust or dirt that might be in there. Repeat this so that you have rinsed the carbon at least three times. Dispose of any water in the clean water cup.
3. Detach the syringe from the carbon bed and suck up your dirty water. Reattach the syringe to the carbon bed.
4. SLOWLY (2 drops per second) push the dirty water through the bed until it comes out clean on the other side into the clean cup.
5. Fill the clean cup with clean purified water (repeat steps 3 and 4 as many times as needed). Bring the water to the STARS adult in charge of the station to move on to the next activity.
6. Drink the glass of purified water to move to the next activity.

Time in: **Time out:** **Fellow/Teacher initials:**

Activity 4: Grow Your Own Food

ACTIVITY LEAD: Computer Engineer
CO-LEAD: Industrial Engineer

You know that soon the food stuffs that you brought along for the trip will run out. Since you were already bringing seeds to help start a community farm in the village that you were to work with, you decide it would be best to make a garden. Unfortunately, all you see around you is desolate sand and rock. No vegetables can be grown in the soil. You decide that the best chance you have of growing a garden is to make a compost pile from the spent food products that you brought along with you. Given enough time, you will have all the fresh vegetables and fruit you need to survive.

Instructions:

1. Students should select different materials to build their own compost bin.
2. For the compost recipe it is necessary to use the above ingredients in layers to have an even mix of brown stuff and green stuff to munch on. In time you will have a good compost mix!

Draw your compost design:

List the selected materials that are going to be used by the group to make their compost bin.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

Write down the compost procedure step by step.

Step 1:
Step 2:
Step 3:
Step 4:

What is the main element of the Brown and Green Materials?

_____

_____

Show your answers to the Fellow or Teacher in charge.

Time in: **Time out:** **Fellow/Teacher initials:**

Activity 5: Build a Shelter

ACTIVITY LEAD: Mechanical Engineer
CO-LEAD: Electrical Engineer

One of the basic necessities, besides food and water, is shelter. You are beginning to realize that you may be here for an unknown length of time. You've already tried sleeping on the ground, but there are too many bugs and insects. Besides, you'd also rather not have the yellow glowing eyes of the various animals inhabiting the island watch you while you sleep. Since sleeping on the bare ground is not convenient, you will need to build a shelter.

Materials
Cardboard box kit
Solar Panel kit

Procedure
Assemble the box so that it is a model shelter. Remember that it needs to be structurally sound! Look at the example for help.
After the box has been assembled, the solar panels need to be wired through.
All boxes must be built before your team can move on to the next level.

Questions
There are three solar panels and each one powers a different thing. List what each of the solar panels are used for.

1. _____
2. _____

Show your answers to the Fellow or Teacher in charge.
Time in: **Time out:** **Fellow/Teacher initials:**

Activity 6: Make a Solar Collector

ACTIVITY LEAD: Civil Engineer
CO-LEAD: Aeronautical Engineer

It has been a long and exhausting trip, and you really need to bathe! You have found a water source, but the water feels pretty cold. You and your group would much rather use warm water. You have decided as a group that you should build a solar collector so that you can heat up water for showering.

MATERIALS:

- 1 or 2 liter clear plastic soda bottle.
- 12 oz. aluminum soda can
- Piece of corrugated cardboard 1/4" x 24" x 32"
- Aluminum foil
- Thermometer

INSTRUCTIONS:

1. Put the can filled with water into the plastic bottle bottom and insert top with tabs folded out
2. Place bottle on reflector box and place in sun. Keep the bottle shadow centered on back of solar panel
3. Heat water and record the temperature every 5 minutes. Your goal is to heat water to100°F.

Questions

1. Where do we use water heating in our households?

   _____

   _____

2. What are some energy sources that are used for heating water?

   _____

   _____

3. What are some alternative sources?

   _____

   _____

4. Why is solar power better than power generated from fossil fuels?

   _____

   _____

Show your answers to the Fellow or Teacher in charge.

Time in: **Time out:** **Fellow/Teacher initials:**

Activity 7: Generate Solar Power

ACTIVITY LEAD: Electrical Engineer
CO-LEAD: Computer Engineer

What will you do for power? You have a few electronic devices that you brought with you, but since you are on this island there is no power source. Luckily, you found some copper plates that were accidentally left on the island by previous inhabitants. You remember from you previous research that if you heat up copper to the point where it makes a "cuprous oxide" layer on it, you can use it to generate power. If you connect two plates, one with the oxide layer and one without, you can generate a voltage that can be measured with a multimeter.

Procedure:

1. Place the solar panels in a sunny location.
2. Connect the solar panels to the multimeter.
3. Measure the voltage:_____

Although it seems as if your solar panels are working, you need to double check your system to make sure that it is working correctly. Cover up the solar panels or move them to a shady area, and again measure the voltage:

4. Voltage obtained from the solar panels when they are placed in the shade:
   _____

5. If your system is working properly, the voltage measured in the shade should be lower than that in the sunny location. Is this true for your system? Circle one:

   YES NO

Show your answers to the Fellow or Teacher in charge.

Time in: **Time out:** **Fellow/Teacher initials:**

Activity 8: The Escape

ACTIVITY LEAD: Aeronautical Engineer
CO-LEAD: Civil Engineer

After long hours of work, you have made enough solar panels from the copper you found to power up your helicopter. It is finally time to say goodbye to your island home. As you and your crew take off, you can see the small community which you have built from components off the island over the course of your stay. Hopefully, you will not have to see it again for a long time! Set a course back for Florida and go home!

Time in: **Time out:** **Fellow/Teacher initials:**