ENGINEERS & GEOSCIENTISTS BRITISH COLUMBIA

2018

SCIENCE GAMES

SATURDAY, MARCH 10, 2018

DIVISION 1 TAKE HOME ACTIVITY
THESE SHOES WERE MADE FOR HIKING

Engineers and earth scientists are explorers. Their work takes them all over the world! Earth scientists often have to go on site visits to see and explore what is in the area. Engineers sometimes visit construction sites to see how a new building is progressing or to make sure that an old building is still safe for people to use.

The places that engineers and geoscientists go can be anywhere from a far away mountaintop to a local hospital. No matter where they go, engineers and geoscientists need the right shoes for the job.

In this activity, Division 1 teams will create and build their own shoes and learn more about how exploration impacts the environment. Your hiking shoe will be tested through different Terrain Stations at the Science Games that are similar to the ground that an engineer or geoscientist might walk through in BC.

Please note: only the shoe that fits on the right foot will be tested for each team member.

Teams will be awarded points based on how well your shoe works on different terrain (does it protect your foot), shoe design, knowledge of the impact of exploration on the environment, teamwork, and creativity.

THINGS TO CONSIDER:

- Are the shoes:

Affordable?	Waterproof?
Comfortable?	Do they have traction?

INSTRUCTIONS

1. **Research:** How does exploration change the environment?
   a. Go online or to your local library to learn more about exploration and how it impacts the environment. Can you find out:
      i. What is soil erosion?
      ii. What impact does hiking have on soil erosion and the ground beneath our feet?
      iii. A few interesting facts about the impact people have on the environment?

2. **Design your shoe:** Each team member will create their own right shoe to test at the Science Games. Work together as a team and consider the following when creating your shoe design:
   a. Is your design waterproof? What will happen if you had to wear it while walking through a puddle of water or mud?
   b. Is it comfortable to wear?
   c. Does it have traction (can you walk in the shoes easily without slipping on a smooth floor)?
   d. Is it affordable?
   e. How does it look? Try to design a shoe that looks good enough for someone to buy.

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Team members can build a pair of shoes. If team members build only one shoe, the shoe must fit on the right foot.

3. **Choose your materials:** Think about what materials you can use to build your right shoe. How can you use them to protect your foot from things that you might walk through like mud, water, or gravel?

4. **Build your shoe:** Now it's time to build your shoe. Make sure your team builds enough right shoes so that each of your team members has one to wear at the Science Games.

   a. Make sure to leave enough room so team members can wear a sock inside your shoe. **This is very important!**

Before the event, test your shoes. Can you walk in them? Are they comfortable to wear?

5. **Bring your shoes to the Science Games:** Make sure to bring all of your hiking shoes to the Science Games. Each team member will be given a plain white sock at the Science Games to put on inside their hiking shoe. Team members will then walk through each Terrain Station and hand the sock back to judges to mark.

   a. **Please note:** Your hiking shoes may get dirty/wet/damaged during the judging portion of this activity. Only the right shoe will be tested in the Terrain Stations.

   b. Team leaders should ensure that all team members are wearing pants/leggings that can be rolled up easily so they don't get dirty when students go through the Terrain Stations in their hiking shoes.

RULES:

- Team members must be able to wear their shoes with socks on underneath.
- Materials used to create your shoes must be available for purchase at a dollarstore, or common household items.
- Teams are not allowed to use 3D printers for this activity.
- Shoes should be built so you can wear them more than once (e.g., you must be able to put on and take off your shoe without breaking it).
- Shoes should protect feet from exposure to terrain stations that could be as deep as 5 inches.
- Team Members should build a shoe that fits on their right foot. If your team members decide to build pairs of shoes instead of a single shoe, only the right shoe will be tested.
- Shoes should be easy to clean.
- Each team member should create at least one shoe to wear on the day of the Science Games. Example 4 team members = 4 right shoes (doesn't have to be a pair but can just be a shoe for one foot).
- Shoes from the same team do not have to be the same design.

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- After hiking through the Terrain Stations, team members must submit their white sock and hiking shoe for judging.
- Shoes should be made up of a minimum of 5 different materials.
- No single material can make up more than 50% of an entire shoe.
- Shoes must be primarily designed and built by your students team members (adult help is permitted where appropriate, e.g., use of hot glue guns).
- Your Science Games hiking shoes should be brought to the event.
  - All team members should wear a pair of regular shoes to the Science Games. Your Science Games hiking shoes should only be worn during the Take Home Activity, not throughout the entire event.

QUESTIONS ABOUT THIS ACTIVITY?

Please contact Chelsea Smith, Communications Coordinator
Direct: 604.412.4892
Email: sciencegames@egbc.ca

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SCIENCE GAMES

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DIVISION 1 MYSTERY ACTIVITY
MAP DETECTIVE

Maps are a useful tool that give people information. Some maps help people get from one place to another. Other maps, like geological maps can tell people more about the ground beneath their feet. Earth scientists, also called geoscientists, use their knowledge of the Earth to create maps that tell people what materials can be found where. They can figure out what type of rocks or minerals are in an area based on its characteristics, how it looks, and how it reacts to different things.

In this activity, Division 1 teams will work as map detectives. You'll need to make and record observations about your samples to figure out which samples are which. Use your Detective Kit (rock/mineral samples, clue sheet, and observation sheet) to figure out which sample came from which area on your map. Teams will be awarded points based on how many rocks/minerals you correctly identify, your observations, and teamwork.

INSTRUCTIONS

1. Fill in the Base Map: As a team work together to figure out what items are identified in the base map. Fill in the blanks to identify what items are listed on your map.

2. Review Geological Map: Six of the rocks/minerals in your sample kit are from areas on your geological map. As a team you need to work together to record observations about your samples and figure out which ones represent the areas on your geological map.

3. Make a Plan: How will your team work together to test the samples and review the clues without getting things mixed up? Make a plan for how your team will work through each clue, test each mineral, and record your results. What can each member of your team do? Here are some ideas on what each member of your team can help with:

- Reading the clues
- Making observations (Your team will need to make a lot of observations about your samples. This could be a job for two people.)
- Doing the Scratch Test on the ceramic tile
- Recording observations

4. Test your Samples: Use your Map Detective Clue Sheet to help your team figure out which samples match which rock or mineral. A Science Games judge will work with your team to go through each clue one by one. Make sure to test your samples in the following way:

Observation: What does your sample look like? What colour is it? How does it feel, rough or smooth? What happens when you test it on a scratch plate? What happens when you put it in water? Is there anything else your team notices about this sample?

5. Identify your Samples: On your Observation Sheet identify which sample is which rock or mineral. Make sure to list all of your observations about each sample on the sheet.

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DIVISION 1 MYSTERY ACTIVITY

MAP DETECTIVE

RULES:

- Teams must decide on one rock/mineral only per map area (e.g., teams cannot say that two rocks/minerals are from the same area of the map).
- Teams must record their observations about the samples.
- Teams should not guess which rock/mineral is which. You must use the clues and what you can see or test from the samples to make a decision.
- Teams should leave their area tidy after the activity.

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DIVISION 1 MYSTERY ACTIVITY
USED CAR SAILS

Look at the car at your station. It has four wheels but no engine! There are many different forms of energy in the world, and we can use them to complete different tasks. In this activity, teams will build a sailing car using the materials provided. Teams will be given points based on the number of gusts it takes your sailboat to complete its trip, sailing car design, teamwork , creativity, and the state of your station at the end of the activity.

INSTRUCTIONS

1. Design your Car Sail: Use the sheets of white paper provided in your kit to design your sail. Make sure to look at all the materials in your kit to see what you can use in your design.

2. Build your Car Sail: Use the wheel base in your activity kit as the starting point for your car sail. Each team will have the same base to start.

3. First Sail: Place your car sail on the start line and record your first sail. Make sure a judge is available to record your gusts.

4. Update your Team's Design: How did your car sail do on its first run? Are there changes that you can make to improve your sail design? Can you change the way you use the pumps to move your car faster or further? Try to test out different ideas.

5. Second Sail: Place your car sail on the start line and record your second sail. Make sure a judge is available to record your gusts.

6. Final Update: Are there any other adjustments that you can make to improve your sail? You want to try to reduce the number of gusts you need to cross the finish line.

7. Final Sail: Last chance to impress the judges! Place your car sail on the start line and record your final sail. Make sure a judge is available to record your gusts.

8. Clean Up Station: Don't forget to clean up your station. Some materials may be recyclable. Sort them before you go to the next activity.

RULES:

- Your team's sail must fit on the wheel base.
- Team members cannot touch the wheel base or sails with your hands or the pump while you record your sail.
- No additional material will be provided to teams so use your materials wisely.
- Teams can test their sails as much as they want with the available time.
- Each team will have the chance to record three sailing trips for scoring.
- The front of your car base should be positioned with the back touching the start line before recording your gusts.
- Your sail is complete and your score is recorded when your car base has fully passed the finish line.
- A judge must be present for you team to record your sail.

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DIVISION 2 TAKE HOME ACTIVITY
EARTHQUAKE RECOVERY

The island City of Lemore has been hit by a major earthquake. The good news is that most of the buildings in Lemore are seismically retrofitted. That means the buildings were designed to be resistant to damage from earthquakes. The bad news is that the only bridge into the city was taken out by the earthquake. Supplies are running low. The river is too choppy to use ships to transport supplies to the town and there is no airstrip on Lemore to fly supplies in.

Your team was contacted by Lemore's Mayor—the town needs your help to deliver supplies to the people in her town.

In this activity, Division 2 teams will have to create a 'Supply Launcher' and successfully deliver supplies to the island City of Lemore. Teams will also create a paper with more information about earthquakes that they hand in at the Science Games. Teams will be awarded points based on the accuracy of their 'Supply Launcher', device design, earthquake paper, teamwork, and creativity.

INSTRUCTIONS

1. **Research:** Teams will research earthquakes and write a short 1-page paper answering the following questions:

   What is an earthquake? How are earthquakes caused? Where do earthquakes typically occur?

Remember to cite your sources in your earthquake paper. Team members may be asked these questions at the Science Games.

2. **Review the Design Specifications:** To ensure supplies are successfully transported to the island City of Lemore there are several things you need to take into consideration with your team's design. Make sure to design your 'Supply Launcher(s)' to the specifications listed below:

   Fits in a 2.5 ft x 2.5 ft launching area (if you create multiple devices all devices must fit within this area).

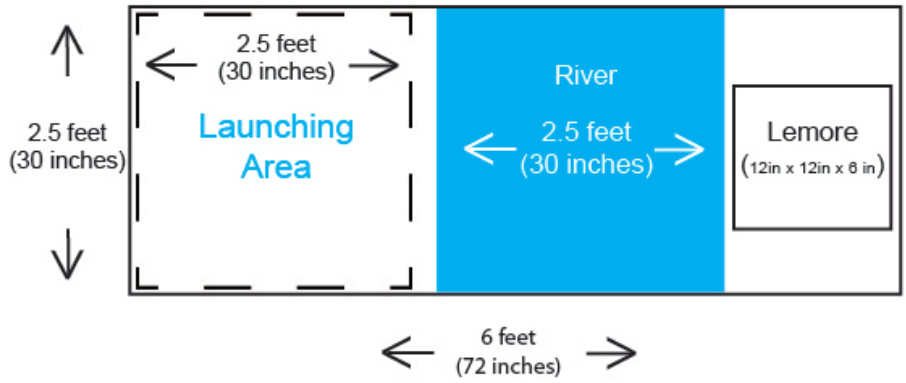
Your device must be able to move supply packages (e.g., ping pong balls) across the river, a distance of 2.5 feet, into the City of Lemore (e.g., the box that will be sent with your activity instructions).

Boxes will be 12″ x 12″ x 6″. The box will be padded with crumpled paper (marsh) to help prevent the supply packages from bouncing out.

The diagram on page 2 depicts what your launch stations will look like at the Science Games. Each team will be set up on a table with the following layout:

DIVISION 2 TAKE HOME ACTIVITY
EARTHQUAKE RECOVERY

Earthquake Recovery Table Set Up



Teams will have 3 minutes to transport supplies (ping pong balls) at the Science Games. Keep in mind, your device (or devices) should be designed so it doesn't matter which team member operates it.

3. **Design and Build your Supply Launcher:** How will you transport these supplies to Lemore? Slingshot? Catapult? Launching ramp? Your team can design anything that will consistently launch supplies (e.g., ping pong balls) across the river. Work together to design your supply launcher. What materials will you use to build your device (or devices)?

At the Science Games, teams will be given a number of ping pong balls. Each unsuccessful ping pong ball launch that is not retrieved by your team will impact your score.

4. **Test your Supply Launcher:** Are there changes that you can make to your original design so that the launcher is more accurate? How can you improve the accuracy of your supply deliveries?

5. **Bring your Supply Launcher(s) and earthquake papers to the Science Games:** Make sure to bring your device or devices) to the Science Games along with your 1-page Earthquake Paper for judging. At the Science Games teams will be given 2 minutes to set up and test their devices, followed by 3 minutes of recorded launches. Teams will also be interviewed by our judges about their 'Supply Launcher' device (or devices), and Earthquake Paper.

Supply Launchers will be tested outside. Teams should keep this in mind when designing your launcher.

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DIVISION 2 TAKE HOME ACTIVITY
EARTHQUAKE RECOVERY

RULES:

- Your team's device (or devices) must be at least 2.5 feet from the City of Lemore (box).
- The device or devices must not extend past the 2.5 ft x 2.5 ft launching area.
- Devices must be primarily created by the students (adult help is permitted where appropriate, e.g., use of hot glue guns).
- **Multiple devices can be created as long as they fit within the 2.5 ft x 2.5 ft launching area.**
- The device (or devices) must be operated from a tabletop.
- Materials used to create your device (or devices) must be available for purchase at a dollarstore, or common household items. Use of recycled materials is encouraged.
  - Teams must work together to operate the device.
- Every team member must participate equally during the event. Team members should rotate who launches the supplies.
- Your team's device (or devices) must be stable enough to be transported to the Science Games without damage.
- Your team's device (or devices) should not weigh more than 5 pounds.
- **Team members who are not actively launching supplies should be catching any supply launches that do not successfully reach Lemore (e.g., retrieve stray ping pong balls).**

QUESTIONS ABOUT THIS ACTIVITY?

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Direct: 604.412.4892
Email: sciencegames@egbc.ca

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DIVISION 2 TAKE HOME ACTIVITY
EARTHQUAKE RECOVERY

BACKGROUNDER

A few months before the earthquake hit the City of Lemore, your team had visited the Ann Jaymore, Mayor of Lemore, to deliver a presentation about your new technology called 'Supply Launcher' for emergency preparedness.

After the presentation the Mayor said she liked your technology, but was not interested in purchasing at the time. She never thought that this scale of an emergency would happen to Lemore and at the time she was dealing with budgets related to a new zip line connecting Lemore to the mainland.

Your team is a startup running on a government grant working out of one of your parents' garage. Now that Ann Jaymore has called, you have a great opportunity to showcase your Supply Launcher technology to potential investors like, Rohin Jepp. Rohin Jepp is a clean technology guru, who said they would invest in your company if you could demonstrate that the technology would work. This is your chance to secure funding and take your Supply Launcher technology to the next level.

You've called Rohin to tell him about how your Supply Launcher technology will be used to help the island City of Lemore. He's decided to travel to the launch site on his solar plane to see your technology in action. Rohin wants things to work but he also wants things to look good so that he can sell your technology to his other partners.

Work as a team to design your supply launcher and impress potential investors at the Science Games.

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DIVISION 2 MYSTERY ACTIVITY
CUPCAKE CORES

Have you ever wondered what happened on this very spot hundreds or thousands of years ago?

Throughout the years the Earth beneath your feet has been shaped by many different factors. For example, roughly 12,000 years ago if you were here at the Telus World of Science, you would be frozen solid in a glacier! If you were standing here roughly 100 years ago you would be swimming in False Creek. Geoscientists, also known as Earth scientists, use their knowledge of the Earth to figure out what geological events, like earthquakes or volcanic eruptions, happened many years ago.

These geological events have left their mark on the ground, quite literally. They leave behind sediments which are solid pieces of material that have been broken up into smaller pieces. Sediment, like sand or gravel, moves from one place to another through a process called erosion. To find out what happened many years ago, geoscientists take core samples. These core samples help them to analyze these sediments and learn more about what happened many years ago. Core samples also help geoscientists predict what else might be hidden below our feet.

Each team has been given one cupcake that represents the ground underneath the Telus World of Science. In this activity, teams will work together to take core samples, record your core samples and create a cross section for this activity. Teams will be awarded points based on your core drawings, cross section drawing, external drawing prediction, teamwork, and creativity.

INSTRUCTIONS

1. Decide where to Core your Cupcake: Each team will take a minimum of three cores. Your cores can be placed anywhere as long as all three are in a straight line. Make sure to think about how much space you want to leave between your cores and what you are trying to achieve by coring.

2. Predict what you will Find: Mark your core locations on the sheet and draw a prediction of what you expect to find below the Telus World of Science. Teams should draw what they think the inside of the cupcake will look like. Use the information provided in the activity instructions to help you make an educated guess about what you will find in your cupcake core.

Things to consider: Is sediment different in different areas of the cupcake? What would you typically find in this area? Make sure to look at your Sediment Info Sheet for clues.

3. Start Coring: Take your first cupcake core. Use the clear straws provided to take your first cupcake core. Make sure it matches where your team placed your first core on your drawing.

Remember to use the straw like a drill and rotate it as you push into the cupcake.

4. Draw your Cores: Look at the layers in your first core. Try to match each core layer to a description on your Sediment Info Sheet. Use the drawing description on the Sediment Info Sheet to draw out each layer of your core. Make sure to keep your first core together with your first core drawing and label them with your team name.

Repeat these steps to take your second and third cores.

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DIVISION 2 MYSTERY ACTIVITY
CUPCAKE CORES

5. Create the Cross Section: Use your individual core drawings to create the cross section. Make sure to draw out your cross section and answer the question at the bottom.

6. Check your Prediction: Cut the cupcake in half along your core lines to see if your predictions and drawings were accurate. Do the layers in the cupcake match the layers in your cross section?

7. Submit your Data for Judging: Give your core, core drawings, and cross section to your judge (if you haven't done so already) so they can mark your team.

8. Tidy your Team Station: This activity might cause a mess. Make sure to tidy up your work station before you go to your next activity.

RULES:

- Teams can only use the materials provided for the activity.
- Teams must provide drawings and cores with their team names.
- Core drawings must be submitted to Science Games judges with your core samples.
- Core samples must be collected in a straight line—teams will cut along this line at the end of their activity to see if their predictions were accurate.

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DIVISION 2 MYSTERY ACTIVITY
MAZE RUNNER

Engineers use technology to do a lot of different things. Some engineers build life saving medical technology. Other engineers create technology that we use everyday in various devices like mobile phones. This technology needs to be programmed to do the right thing at the right time.

In this activity, Division 2 teams will work like engineers and program a robot to move through a set of maze routes ranging in difficulty. Teams will be awarded points based on the number of maze routes successfully completed, teamwork, and creativity.

INSTRUCTIONS

1. Learn how to Program your Robot: Review the instructions for your robot. Test out inputting commands. Make sure your team understands how to program the robot before moving on to the next step.

2. Select your Maze Route: Pick a maze route to run through with your robot. Each maze sheet has letters and boundary lines. The letters are start or end points for different mazes routes. You must navigate your robot from the Starting Letter Sheet to the Finish Letter Sheet to complete your maze route. Teams will be awarded points based on the difficulty level of your completed mazes.

We recommend teams start with route #1.

3. Measure your Maze Map: Pick your maze and start measuring out the layout. You will need to create a path based on those measurements that your robot can travel without crossing a boundary line.

4. Plan your Robot Route: Use the measurements you took from the maze to select your robot route. Make sure to figure out how far the robot will need to travel through each section of the maze and the angles it will need to make.

5. Map your Maze on a Piece of Paper: Record your robot route on a piece of paper. List out the measurements and angles so that you can change them later if you need to.

6. Program in your Instructions for the Robot: Using your map maze, program the instructions for your robot.

7. Run the Robot through the Maze: Did your robot make it through the maze completely? If not, adjust your map route, update your robot instructions and try the maze again.

8. Repeat Steps 2–7: for as many mazes as possible until your team's time is up.

PROGRAMMING YOUR ROBOT:

Your robot can be programmed to move with two simple types of instructions.

- **Move Forward/Backward:** You will need to tell the robot how far to move in feet/inches. For example: Move forward 10 inches
- **Turn Left or Turn Right:** You will need to tell the robot the degree of the turn that it should make. Degrees can be listed in 45°, 90°. For example: Turn 45° right.

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DIVISION 2 MYSTERY ACTIVITY

MAZE RUNNER

RULES:

- Teams will only be awarded points for the maze routes they are able to complete within the activity time.
- Teams have unlimited attempts at a route but must always start at the starting position.
- Teams will only be awarded points for the first successful completion of a maze.
- The robot must start completely within the Starting Letter Sheet.
- To complete the maze, any part of the robot must touch anywhere on the Finishing Letter Sheet.
- If any part of the robot touches a boundary line or goes off the maze, the attempt is considered a fail.