

Teacher Tips and Tricks

Day 1- Soil coring:

When having your students complete the coring activity only give them candy bars that do not have extremely hard centers (stay away from a Twix bar. Use a clear straw and have them use pieces that are about 1 ½ - 2 inches long. You can pre-cut them as that saves time. When they core have them hold their thumb over the end of the straw and press down until they get all the way through to the other side of the candy bar.



Photo by Carol Unterreiner



Pictures by science buddies

Below is a short video from science buddies that shows the coring activity in more detail.

Candy Core Samples | STEM Activity

Day 2 - Here are a few Youtube videos about porosity and permeability that will help with background information or lab set up if needed:

- Porosity and Permeability Demo
- Porosity of Gravel, Sand & Clay Lab

Day 3 -

Helpful tips - Cloud Dough:

The ratio of flour to baby oil can vary depending on humidity. Start with the suggested measurements and have students stir with spoons and with hands until the dough is able to hold together and be compressed into a solid.

- If it is too dry, add a little more oil as needed. Too wet, a little more oil.
- Creating a sample ahead of time will help students identify if their soil is the right consistency for their tests.

See images below of:

:Sample containers used for this experiment:



Uncompressed soil (cloud dough) being compressed by hand after first test

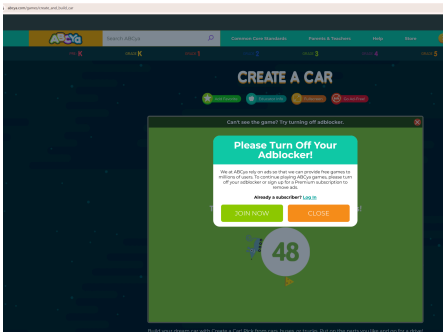
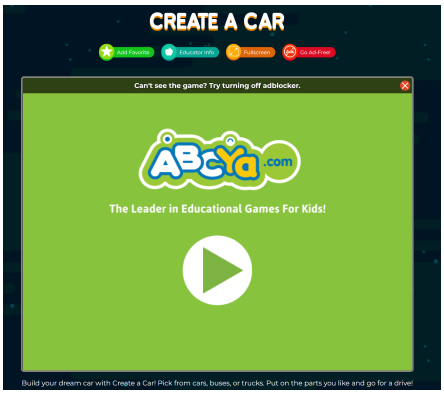
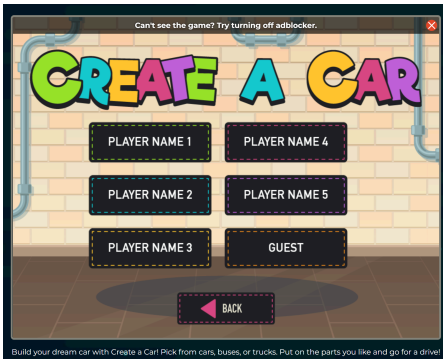


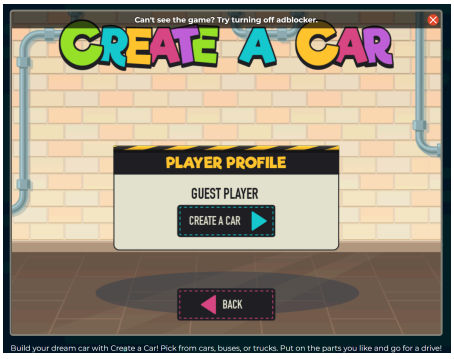
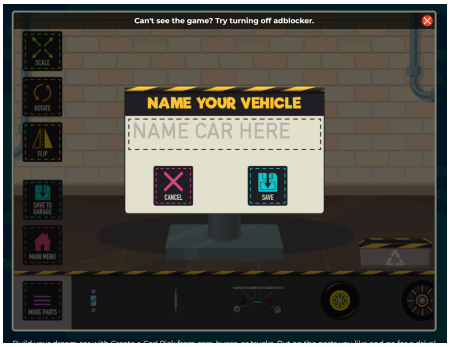
Car driven over compacted cloud dough (1st compaction)

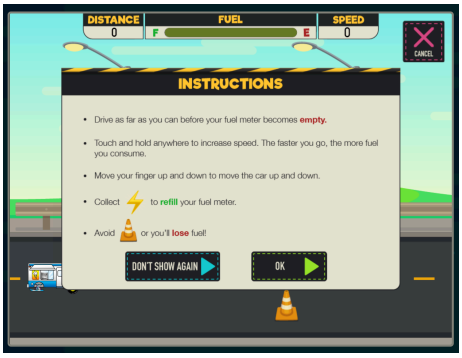


Car driven over cloud dough, (2nd compaction)



Day 4 - Game tips	
	When you click on the website, you'll see this. Click close.
	Click play
	Click go
	Students can choose to enter their name or click guest - student information is not saved. If they chose to enter their name, then they can pick an avatar.

	If they enter their name, then they will see this page.
	Next, all students will create a vehicle
	Students will pick a body then front and back wheels. Then click “save to garage”
	Students will name their vehicle and click save.

	Students will next click “drive”
	Students will need to be aware to watch for their final distance and top speed. Students will click “go”. They will drive their vehicles.

Day 4 - Science meets Math: KEY

Engineers designing vehicles for varying terrains must consider the pressure a vehicle exerts on the ground. Pressure is calculated as Force/Area. The force exerted by a vehicle is its weight.

Vehicle A (e.g., a truck) has a mass of 5000 kg and its tires have a total contact area with the ground of 2 m2.

Vehicle B (e.g., a tracked bulldozer) has a mass of 10000 kg but its tracks have a total contact area of 10 m2.

1. Assuming the force of gravity is approximately 9.8 N/kg, calculate the weight (force) each vehicle exerts on the ground in Newtons (F=m×g).

   Mass (m) = 5000 kg
   Total contact area (A) = 2 m2
   Force of gravity (g) = 9.8 N/kg

   Vehicle A:

   $Force = mass\ x\ gravity$

$$Force = 5000\ x\ 9.8 = 49,000\ Newtons$$

Vehicle B:

$$Force = mass\ x\ gravity$$

$$Force = 10000\ x\ 9.8 = 98,000\ Newtons$$

2. Calculate the pressure (in Pascals, or N/m2) each vehicle exerts on the ground.
   Mass (m) = 5000 kg
   Total contact area (A) = $2m^2$
   Force of gravity (g) = 9.8 N/kg

   Vehicle A

$$Pressure = \frac{49{,}000\ Newtons}{2m^2}$$

$$Pressure = 24,500\ N/m^2 = 24,500\ Pascals$$

   Vehicle B

$$Pressure = \frac{98{,}000\ Newtons}{10m^2}$$

$$Pressure = 9,800\ N/m^2 = 9,800\ Pascals$$

3. Based on your calculations, which vehicle would likely cause more compaction on soft soil? Explain why using the concept of pressure.

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   _____

   _____

4. How does this relate to the engineering challenge of designing vehicles for different soil conditions?

   _____

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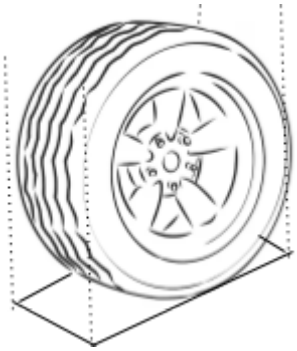
Day 5 -

For the test ramp we used a piece of pressboard. You could use a rain gutter or even a piece of foam board. Then, place the board so there is a gentle curve and place your test soil on top of the board. Finally, allow the students several test runs to iterate their vehicle. (If time permits.)

sample car test video

Today you will use the same math from yesterday to apply it to your vehicle.

1. The name of your vehicle: _____
2. What is the mass of your vehicle? _____
3. Trace your wheel base, measure the length and width in centimeters, then calculate the contact area.

Example: 	Students sketch their wheel base in the area. This will vary depending on student measurements. Length:_____cm divide by 100 = _____m Width:_____cm divide by 100 = _____m Calculate your contact area ($length \times width$): Student work shown in this area.

4. Assuming the force of gravity is approximately 9.8 N/kg, calculate the weight (force) each vehicle exerts on the ground in Newtons (F=m×g).

   Students will follow the exact same steps they did on Day 4. Use a ballpark or average your top students to have a ballpark of the approximate answer.

5. Calculate the pressure (in Pascals, or N/m2) your vehicle exerts on the ground.

   Students will follow the exact same steps they did on Day 4. Use a ballpark or average your top students to have a ballpark of the approximate answer.

6. Based on your calculations and knowledge, hypothesis if you think your vehicle will be able to cross all three soils in the experiment to come.

   _____
   _____
   _____
   _____

7. How does this relate to the engineering challenge of designing vehicles for different soil conditions?

   _____
   _____
   _____