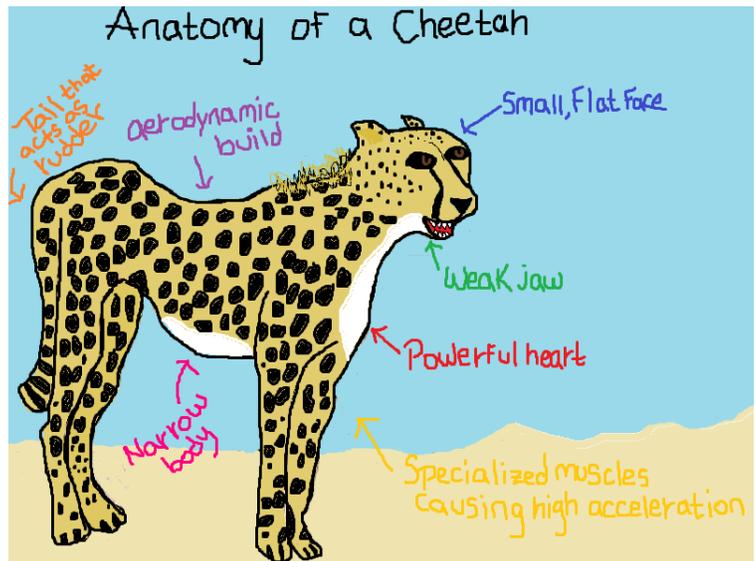


# PRE-VISIT ACTIVITY

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

## Name that Science!

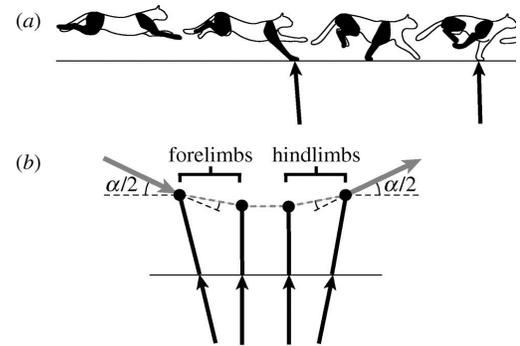
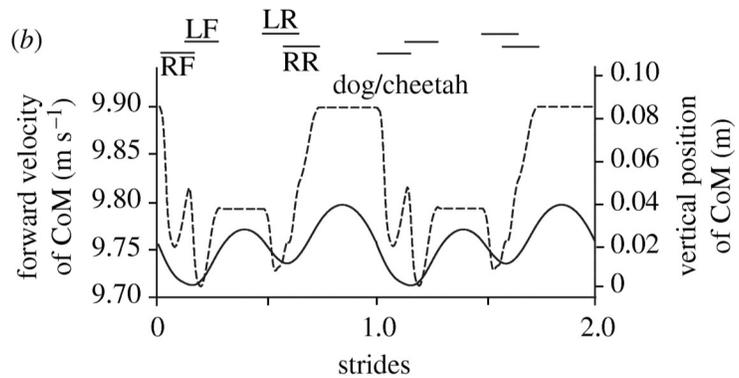
Three main areas of science are biology (study of living things), chemistry (study of matter), and physics (study of motion and forces). In the imaginary study below, identify which area of science would apply to the questions.



Brandon has been fascinated by cheetahs since he was a young child. As a graduate student in college, he goes to Africa and sets up several experiments.

**Question 1:** Cheetahs are faster than other large cats that look similar (leopards and jaguars). Brandon wants to find out what differences allow cheetahs to run faster than their feline cousins. He builds models of each of the 3 types of cats with moveable joints. He takes into account the average mass of each animal, the angles at which their legs move when running,

and the aerodynamics of each animal. He needs to find the formulas to make his calculations. What area of science applies to this study? (Circle one): **Biology**      **Chemistry**      **Physics**



(Source: rsif.royalsocietypublishing.org)

# PRE-VISIT ACTIVITY

## Name that Science! continued

**Question 2:** Cheetah populations have been declining due to habitat loss, hunting, the illegal pet trade and competition from other predators. Brandon discovers that in one area of western Africa, a population of cheetahs has reclaimed an area that used to be part of their range. He finds that a higher percentage of cubs survive to adulthood than in other parts of Africa. The number of prey animals, amount of water, and climate are the same as for other cheetah populations. Brandon realizes that the new cheetah group has less competition from other predators. He wants to submit his findings to a science journal. In what area of science does he list his study?

**Biology**

**Chemistry**

**Physics**

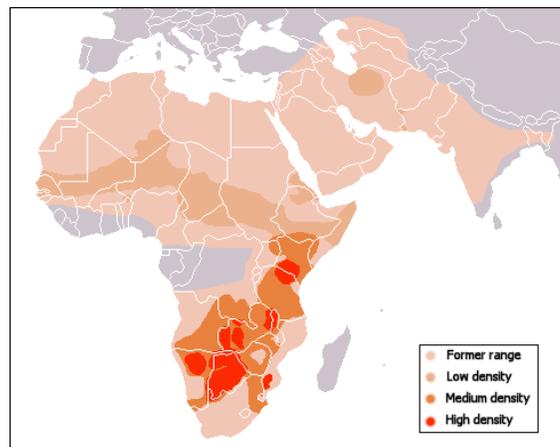
**Question 3:** In Northwestern Tanzania, Brandon discovers that the male cheetahs are fighting much more than before. It appears that they are no longer respecting the borders of their territories, which they mark by spraying urine on trees and termite mounds. A large volcano recently erupted, sending a lot of ash into the air. Brandon suspects that the eruption has somehow affected the ability of the male

cheetahs to smell the urine. He rules out that their sense of smell has changed, and believes that the ash is affecting the urine scent-marks. He enlists the help of another scientist to help him understand how the rainfall since the volcanic eruption has changed the urine marks. His colleague takes samples of the rain and tests it for pH, and also combines the rain samples with cheetah urine to find out what changes occur. This area of science is:

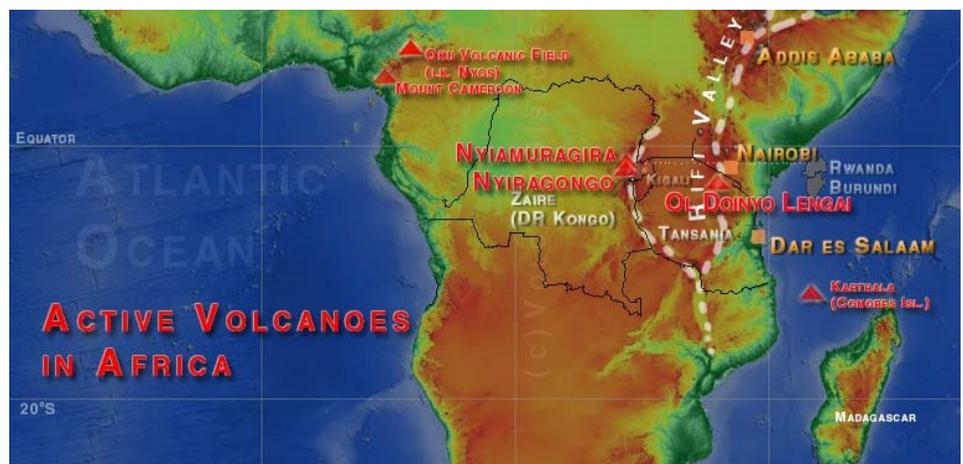
**Biology**

**Chemistry**

**Physics**



Source: <https://en.wikipedia.org/wiki/Cheetah>



Source: <http://www.volcanodiscovery.com/africa.html>

## AFTER-VISIT ACTIVITY

### “Magic” Water Trick—Physics

#### Materials:

Paper or plastic cups

Pieces of cardboard or cardstock, slightly larger than the top of the cup

Water

A sink or large bowl.



#### Steps:

- 1.) Fill the cup with water.
- 2.) Place the piece of cardboard over the top, so it completely covers the top of the cup.
- 3.) Over the sink/bowl, keep your fingers on the cardboard and turn the cup upside down quickly, keeping the cardboard in place.
- 4.) Let go of the cardboard (but not the cup!).

**What happens?** Why does the cardboard stay on the cup, holding the water inside?

It's because of physics. There are two concepts at work.

- 1.) The pressure of the air outside the cup is greater than the pressure of the air trapped inside. The pressure of the air, called **atmospheric pressure**, is helping to hold the water and cardboard in place.
- 2.) The other reason is because of the **forces** of the water molecules. Water is made of tiny little things called molecules (actually, everything is made of molecules!) Each water molecule acts like a tiny magnet, with like charges repelling each other and unlike charges attracting. Where the water molecules stick together through this attractive force, it is called **surface tension**. Water molecules are also attracted to other materials, such as the cardboard. We call this **adhesion**. In the “Magic” water trick experiment, the water molecules are attracted to the cardboard, and adhere to it, while also being attracted to each other through surface tension. This keeps the cardboard in place.

Reference: <http://www.physicscentral.com/experiment/physicsathome/magicwaterglass.cfm>

# AFTER-VISIT ACTIVITY

## Penny Experiment—Chemistry

### Materials:

10 pennies that were made before 1982

Salt

Vinegar or Lemon Juice

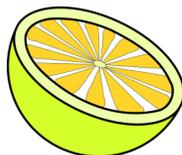
Ketchup

Cola (Coke or a generic brand)

Bowls

Warm water

Clock/watch



### Steps:

1. In one bowl, mix 1 tsp of salt with 1/2 cup of vinegar or lemon juice, and stir until the salt dissolves. Add a penny or two and let sit for 5 minutes, then rinse them with water.
2. Place a couple pennies in a bowl and cover them with ketchup. Wait 5 minutes, then rinse them.
3. Place a couple pennies in a bowl and cover them with cola. Wait 5 minutes, then rinse them.

Which material cleaned the pennies the best? What happens if you don't rinse the pennies after cleaning them? What happens if you leave the pennies in the cola for longer?

**What's going on?** Pennies made before 1982 are composed of 95% copper. When exposed to air, the copper atoms combine with oxygen to form copper oxide, which is what makes the pennies appear dark and dull.

Copper oxide dissolves when in contact with a weak acid and salt. By using the vinegar/salt or ketchup, which contains both, the copper oxide is dissolved. When the pennies are rinsed, the copper oxide is removed. If the pennies are not rinsed with water, the now free copper atoms join oxygen from the air and chlorine from the salt to make a blue-green compound called malachite.

References: [http://www.exploratorium.edu/science\\_explorer/copper\\_caper.html](http://www.exploratorium.edu/science_explorer/copper_caper.html)

<http://www.wikihow.com/Clean-Pennies>

[http://www.usmint.gov/about\\_the\\_mint/fun\\_facts/?action=fun\\_facts2](http://www.usmint.gov/about_the_mint/fun_facts/?action=fun_facts2)

# AFTER-VISIT ACTIVITY

## Worm Survey—Biology

### Materials:

A container of Superworms (available at most pet stores)

Shoeboxes or deep trays with lids or cover

Aluminum foil

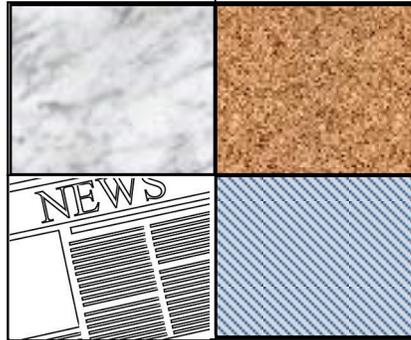
Newspaper

Cling wrap

Sandpaper

Tape

Clock/watch



### Steps:

Superworms are the larval stage of the darkling beetle. They eat fruits and vegetables, not students or teachers. They prefer to be in the dark (presumably to avoid being seen and eaten by predators). This experiment allows students to determine on which kind of material superworms prefer to be.

1. Measure the bottom of the box or tray. Divide the area (length x width) by four. Use the measurement to cut out equal size pieces of the foil, newspaper, cling wrap and sandpaper.
2. Secure the four pieces on the bottom of the tray. Superworms love to hide under things so they will burrow under the materials if there are gaps.
3. Choose the parameters of the experiment: How long will the superworms have to pick their preferred flooring? Will you conduct the experiment using one or more superworms at a time? How many times will you repeat the experiment? Ask your students to make a hypothesis.
4. Remove the superworms from the container and place them in the center of the tray. Cover the tray and start the experiment. When time is up, lift the lid and have students write down the results. This step could be done using the superworms one at a time or en masse. Which material did the superworms prefer? Was there more than one result?