

# CLIMBING LIZARDS AND OTHER STICKY THINGS

## An Elementary Science Lesson Plan Designed for Group Inquiry Based on the 5E Inquiry Model

**GRADE LEVEL:** This lesson is intended for a 4<sup>th</sup> grade classroom.

**SCIENCE CONCEPT:** The main idea of this lesson is how electrically charged objects attract or repel each other. This lesson will explore this concept through an open inquiry as defined by the four-level model of inquiry instruction (Bell, Smetana & Binns, 2005). The connection to lizards is made after students explore electrically charged materials at various centers. Direct observations of geckos or showing the video Gecko Toes elaborates on the center discoveries.

### RELATIONSHIP TO THE CALIFORNIA SCIENCE CONTENT STANDARDS

4<sup>th</sup> Grade Physical Sciences:

1. Electricity and magnetism are related effects that have many useful applications in everyday life. As a basis for understanding this concept, students know:
  - e. electrically charged objects attract or repel each other.

**LEARNING OBJECTIVE:** Students will investigate how electrically charged objects attract or repel each other by exploring materials provided in different centers.

### EVALUATION IDEAS:

1. Formative: Observe student explorations. Circulate among the centers and ask students questions about their investigations. Assess student inquiry skills through observations and discussion.
2. Summative: Review any completed Lizard Observation and Center Exploration sheets to assess student observation and questioning skills. Review the Center Passport index cards to ensure that all students visited at least four centers in their inquiry.

### CONCEPTUAL BACKGROUND

Bass, Contant and Carin, (2009, A-106) describe the key concepts and principles of static electricity as follows:

- There are two kinds of electric charges in all materials: positive and negative charges.
- In ordinary substances, positive charges and negative charges are balanced. These substances are electrically neutral.
- When some materials are rubbed together, the friction causes the materials to acquire electrical charges.

- Two electrically charged substances can interact.
- Electrically charged objects attract or repel each other.

The mystery of the gecko’s great climbing ability was finally uncovered in 2002. Scientists found that geckos use electrostatic forces in order to keep a firm grip when climbing on smooth walls and across ceilings. Each gecko toe has tiny hairs that branch out into hundreds of tiny endings. Each branch of the hair (also called setae) attach to the surface by a weak electrostatic attraction. Geckos have hundreds of thousands – even up to millions of setae - that each branch into hundreds of ends. Together these setae create enough electrostatic attraction to support their weight (and much more). Gecko toes can detach in milliseconds, and don't have any residue. (Retrieved July 20 2012, from <http://www.pbs.org/teachers/wildkratts/lessonplans/lizards/>).

## **LESSON IMPLEMENTATION PLAN**

**ENGAGE:** Explain to students that today in class we get to be scientists and will do an inquiry about electrical charges. (Rub a balloon on your hair and then put it on the wall.) As part of the inquiry process, scientists ask questions, and then make observations which may lead them to even more questions. This is all part of the inquiry process and learning about how things work.

**EXPLORE:** Gather the listed materials below and set them up at the following centers:

1. Plastic (or acetate) sheets with coarse restroom paper towels. Bowls with bits of paper, bits of aluminum foil and wood shavings from a pencil sharpener.
2. Plastic (or acetate) sheets with coarse restroom paper towels, small bowls of flour and salt, cotton and nylon thread.
3. Hard rubber comb and resin rod with wool cloths and small bowls of flour.
4. Balloons with a blackboard, a flat piece of wood and a large handheld mirror.
5. Hanging balloon station – Suspend two balloons by their strings from a support (see model below in Materials). Leave a couple of wool cloths on the support/table.
6. Scotch Magnetic Tape – Tape two 4 inch pieces of Scotch magnetic tape with two inches hanging off each side of a table or desk.

Number each center. Leave a few Center Exploration sheets and pencils at each center. Leave it up to the students to decide if they want to use these Center Exploration sheets. Have students go to at least four of the six centers in the room. Students should stamp their Center Passport index cards after visiting a center (see model in Materials).

Circulate among the centers as students are exploring. Ask open-ended questions such as “What are you noticing about how these materials are attracted to each other?” “I noticed that you rubbed more vigorously with the wool cloth, why did you decide to do that?” At the end of the exploration have students turn in their Center Passports.

**EXPLAIN:** Ask students “What did you notice when you visited the centers?” Ask, “What else besides that...” Have students explain in their own words how the objects became

electrically charged. Ask guiding questions to help students explain the concepts of positive and negative electrical charges and electrical forces in their own words. Help students relate these explanations to some part of their investigations.

**ELABORATE:** Ask students what questions they wrote down from the Center Exploration sheets. How would you investigate these questions? Have students pick one of the questions and write the next steps for an experiment they would design to find the answer in a quick write or science journal.

To further elaborate and connect this lesson to lizards, you can have students do observations of geckos and other climbing lizards (see Materials). Give students the Observation Worksheet to record their observations and questions they want answered.

If you cannot get access to a gecko, show the PBS Kids Dragonfly TV, *Gecko Toes* video (see Materials). This video shows two girl scientists exploring lizards both outside and in the Lawrence Hall of Science. They create an experiment at the Lawrence Hall of Science to see which lizard is the best climber. Stop the video after the student scientists ask, “Is there something special about a gecko’s toes?” (about four minutes of the eight minute video). Ask students if they have any ideas about how geckos stick? After some discussion, show the second half of video that explains how geckos are able to stick to smooth walls and across ceilings using electrostatic forces.

This video also explains how by studying gecko toe technology that scientists are applying what they learned from gecko toes to create new tape technology. You can also elaborate on this lesson by asking students to write about, “What are other features of lizards that scientists could research and possibly use for people?”

## **EVALUATE**

- (a) Formative: Observe student explorations. Circulate among the centers and ask students questions about their investigations. Assess student inquiry skills through observations and discussion.
- (b) Summative: Review any completed Lizard Observation and Center Exploration sheets to assess student observation and questioning skills. Review the Center Passport index cards to ensure that all students visited at least four centers in their inquiry.

## **DIFFERENTIATION PLANS**

**Behavioral for Student A:** For a student on the Autism spectrum, it will be helpful to have frequent contact to provide feedback. Provide cues to the student when it might be a good time to transition to another center. Have the student show you when they have completed two of the four required centers on their Center Passport. Give the student a visual cue towards the end of the center activity so they can prepare for the transition.

**Cognitive for Student B:** Centers are a beneficial teaching strategy for students with all levels of cognitive abilities. Students with lower cognitive skills are able to explore the centers at their own pace and design their own investigations. They can also benefit from the parallel play of their peers at each center. The note format of the optional Center Exploration Sheets should make the activity less intimidating for struggling writers.

**Cognitive for Student C:** Centers allow students with higher cognitive skills to design more sophisticated investigations. Review the Center Exploration Sheets of students with higher cognitive skills, ask them questions about what happened and why they think that happened to encourage them to go deeper into their explorations. This activity also allows these students to visit all six centers if they move quickly through the centers

**Affective for Student D:** For a student who demands more teacher attention, try to have frequent contact with them as they explore the centers. If teacher attention is needed elsewhere, have the student use the Center Exploration Sheets to share more about their favorite explorations (maybe add stars and explain why they liked it). If they need feedback, set the expectation about when you can give them feedback on the Center Exploration Sheets.

**Language Demands for Students E, F, G:** This open inquiry does not have high language demands. Check to make sure that students with limited English skills understand how to use the Observation Worksheet, Center Passport and Center Exploration Sheets. Explain vocabulary as needed. Student parallel play at the centers should also assist students with limited English skills.

## **MATERIALS**

Center materials:

Plastic (or acetate) sheets, plastic rulers, hard rubber comb, resin rod, wool cloths, balloons, hanger, Scotch Tape, coarse restroom paper towels, paper clips, flour, salt, thread, bits of paper. Index cards and stamps for Center Passports.

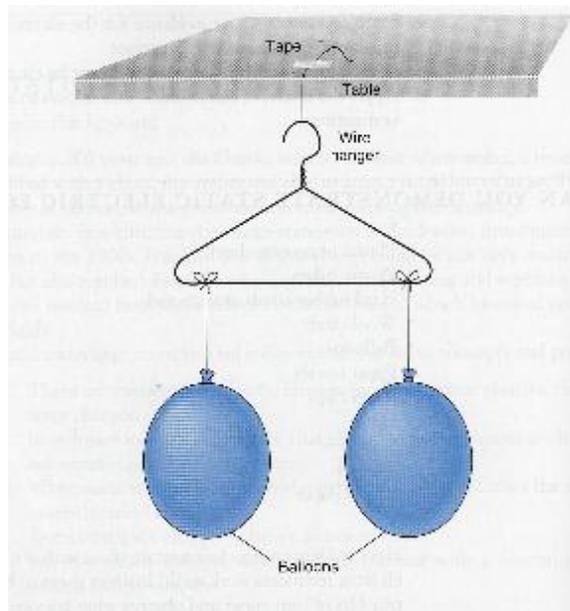
Lizards:

- Alligator Lizard and Schneider's Skink lizards from the San Jose State's Science Education Research Center (SERC). <http://www.science.sjsu.edu/serc/index.htm>
- Gecko – SERC does not have geckos. As of July, 2012 Happy Hollow Zoo does offer geckos and other lizards for a 50 minute in-class education program for \$140. You can also borrow a pet gecko or take a field trip to the Lawrence Hall of Science to observe lizards in the animal room.

### Center Passport Model (on index cards)

Center Passport		
Scientist Name _____		
<b>1</b>	<b>2</b>	<b>3</b>
<b>4</b>	<b>5</b>	<b>6</b>
Visit at least four centers. Stamp the number after you explore the materials at that center.		

### Center #5 Model ( Bass, et. al., 2009, A-108)



#### Videos:

PBS Kids Dragonfly TV. (2012). Gecko Toes. Retrieved from <http://pbskids.org/dragonflytv/show/geckofeet.html>

PBS Kids GO! (2012). Wild Kratts: Gecko Toes. Retrieved from <http://pbskids.org/go/video/?category=Wild%20Kratts&pid=4CdOMz6IszAcoXNH5IAGOVTTXftKVhNg>.

Lesson adapted from “How can you demonstrate static electric forces?” (Bass et al., 2009, A-107).

## **SUGGESTED READINGS**

Bell, R.L., Smetana, L. & Binns, I. (2005, October). Simplifying Inquiry Instruction: Assessing the Inquiry Level of Classroom Activities. *The Science Teacher*, 30-33.

This article discusses the meaning of inquiry instruction and provides a helpful overview for understanding the four-level model of inquiry. These levels range based on how much information is given to the student. In a Level 4 activity (open inquiry) the research question, methods and solutions are all left up to the student. Students will likely need experience with lower levels of inquiry before being prepared to take on an open inquiry. This article provides examples to help understand the differences between the levels.

Craats, R. (2010). *My Pet Gecko*. New York, NY: Weigl Publishers.

While the information on geckos as pets in this book should be used carefully, there is enough good general information about geckos that it is still a helpful resource. This book profiles different kinds of geckos, describes their life cycle, the essential parts of the gecko, their behavior, and includes some fun gecko stories/lore. This book has very engaging photographs of geckos.

**Center Explorations (optional)**

<p>Name _____</p> <p>Center Number _____</p> <p>What I did</p>    <p>What happened</p>    <p>What I want to know more about</p>	<p>Name _____</p> <p>Center Number _____</p> <p>What I did</p>    <p>What happened</p>    <p>What I want to know more about</p>
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### Lizard Observation Worksheet

Name of Lizard	What I observed	Questions I want answered

