SCIENCE·3D

RATTLESNAKES

In this packet, sample student answers are provided in red and notes to teachers are in blue.

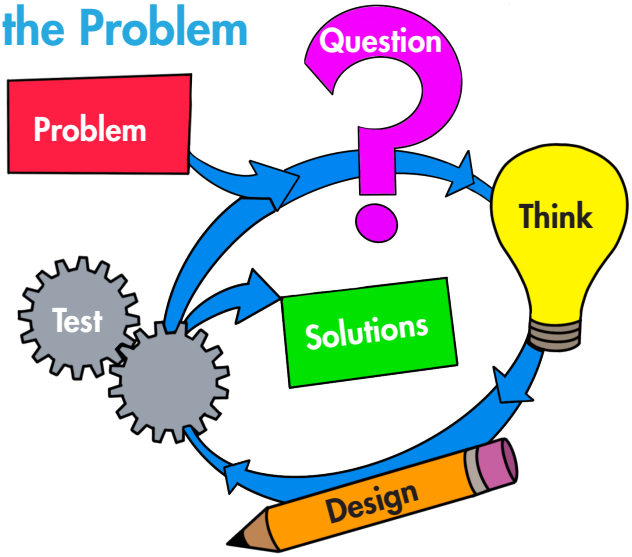
In this **STEM Project**, students will use the engineering design process, and what they know about animal adaptations, to design solutions for staying cool and getting enough water in the desert. An additional activity provides students with an opportunity to construct, test, and improve their own designs for creating shade.

Desert Engineering: Stay Cool and Get Enough Water

Rattlesnakes and other desert animals have to be able to survive very hot temperatures. They have to avoid drying out. But, it sometimes is months between rains! People living in the desert have the same problems! Let's try to design some solutions. Imagine that you and a science team are going to try to live in the desert for a year. You aren't going to be living in a house and don't have running water. What can we do to start our designs?

Activity 1: Define the Problem

We need to follow the engineering design process!



1. What are two problems that people living in the desert face? **Write** your answers in the table below.

2. What are some possible solutions to these problems? **Write** your answers in the table below.

Problem 1: Staying cool	Problem 2: Getting enough water or always having enough water
Solution 1: Answers should include ways to cool off, including creating shelter/shade or generating a breeze.	Solution 2: Answers may include creating a barrel or some way to capture water, or ways to move water from one place to another.

3. **Draw** a diagram of the solution you are most excited to test. Label the diagram to **describe** how the designs help people stay cool or get enough water.

Accept all reasonable answers. Complete answers will have at least two elements that help a person in the desert stay cool (e.g. shade, windows aligned to allow wind to flow through) or conserve/collect water (e.g. storing water in rain barrels, irrigation, reusing water).

4. **Write** a paragraph to describe how you would test your design. How would you know whether or not it works. What would you do if your design failed the test?

Accept reasonable answers. Complete answers include some sort of test, such as measuring the temperature before and after the solution was implemented. They might also include a test to measure the inside and outside temperatures of their design. If the test fails, they should suggest a specific redesign and test again.

Optional Activity: Testing Different Structures

This activity could be completed before or after the initial activity. If before, provide students with a single design for a shade and have them test it.

If after the activity above, give students multiple materials and have them construct different types of shades. Have them measure their effectiveness, compare the impact of different designs, and suggest improvements to their design.

Materials:

- Desk lamp with standard bulb (LED and compact florescent bulbs will not work as well because they give off less heat).
- Building materials (e.g. construction paper of different colors, craft sticks, glue, tape, pipe cleaners, cloth)
- Thermometer

Procedure:

1. Have students form teams of two to four.
2. Tell the students that they need to design a structure to keep the temperature on the thermometer as cool as possible when their lamp is turned on.
3. Give the students building materials. Different groups can be given different amounts or types of materials to ensure not all structures are too similar.
4. Have students build a small (approximately 8”x8”) structure that can provide shade for a thermometer. **Extend the lesson:** Have groups build more than one structure and hypothesize about which will best keep the temperature of the thermometer cool.
5. Have students draw a diagram of their structure.

6. Make sure that the lamp is off to start. Have students put the thermometer under the lamp and record the temperature.

7. Have students put their structure over the thermometer.

8. Then have the students turn on the lamp.

9. Wait until the temperature of the thermometer stops changing.

10. Record the temperature.

11. Remove the structure.

12. Wait until the temperature of the thermometer stops changing.

13. Record the temperature.

14. If groups have multiple structures, have them move the lamp to a new location and test the second structure.

15. Have the class share their designs and the data they recorded.

16. Lead a discussion on why certain designs worked and why others didn't. Ask students how they would improve their designs based on what they learned from their experiment and the designs of other groups.