# Heat & Changes in Materials

## Projects and Activities

1. Make a 3-D model of the water cycle. Be creative in your presentation! Label each physical process, such as evaporation.

2. With permission, conduct an ice cube melting race. Give each person or team an ice cube in a Ziploc bag. Then see which person or group can melt the ice cube fastest. Encourage groups to be creative, but appropriate, in their strategies.

3. Develop a cooking project that shows the difference between a physical and a chemical change. Explain the difference between these scientific concepts using your food preparation!

4. What is heat in scientific terms? There are many ways to make heat, but they all involve the same thing. What do they have in common?

5. In your home, find and list heat sources. Be careful, but look in unusual places for heat. For example, does your TV generate heat after it has been on for a while?

6. Heat always moves in a predictable way. In what direction does heat move and why?

7. There are three ways that heat can move: conduction, convection, and radiation. Create a way to show and explain each one.

8. Construct one of these projects. You might need help from an adult to get materials and to build:

    - Solar air heater
    - Solar hot dog cooker
    - Solar oven
    - Solar water heater
    - Steam-powered boat

9. Does the color of your hair affect its ability to keep your head warm? How would you conduct an experiment to determine the answer to this question? Explain your results.

10. Does wind increase the rate of evaporation? How would you conduct an experiment to determine the answer to this question? Explain your results.

11. If "geo" means earth and "thermal" means heat, what is geothermal energy? Diagram and label the layers of the earth.

12. Give some examples of geothermal features and where they are found in the United States. How were these important to early Native Americans?

13. How might geothermal energy sources be more widely used today? Is this cost-efficient? What are the pros and cons of geothermal power plants? How do they work?

14. Read more about how the ancient Romans and Icelanders used (or continue to use) hydrothermal energy.

15. Research a volcano famous for its activity and, perhaps, for its eruption(s).

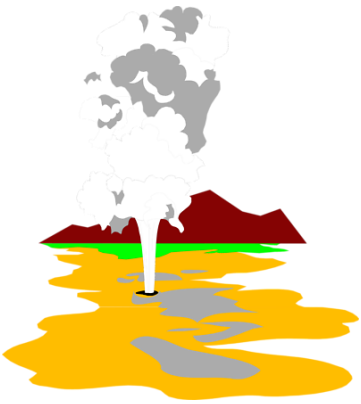
16. **Ask an adult to help you** create a fumarole in your kitchen.

    - Using a hammer and nail, poke a hole in the middle of an aluminum pie pan.
    - Fill a large pot halfway with water and set it on the stove on high heat.
    - When the water begins to steam, use oven mitts to set the pie pan upside down on top of the pan. STAND AWAY FROM THE POT. The steam will come shooting out of the hole, creating your fumarole.
    - Lift the back of the pie pan up letting out the steam and shielding you from it.
    - Poke another hole in the pie pan and return it to the pot.

    ***What happens when you add more fumarole holes?***

17. Yellowstone National Park has a number of great videos about the geothermal features in the park. Go to http://www.windowsintowonderland.org/index.htm

    - Getting into Hot Water
    - Geyser Quest
    - On the Scene of the Yellowstone Hotspot
    - Hot Colors ~ Windows into Hidden Worlds



18. Check out these websites:

- http://www.neok12.com/Heat-Temperature.htm
- http://www.learninggamesforkids.com/heat-energy-games.html
- http://www.exploratorium.edu/xref/phenomena/heat.html
- http://www.uen.org/core/displayLessonPlans.do?courseNumber=3060&standardId=1258&objectiveId=1259

19. Do an experiment that shows that water expands when it freezes. Create a model or a movie that shows **why** water expands when it freezes.

20. Most liquids contract when they are cooled. Water is one of the few exceptions. Create a way to compare the behavior of water when it is cooled to the behavior of other liquids. Make sure that you explain why these liquids act so differently.

21. Why does ice float in water? Devise a way to show others what you have found out about the density of ice and water.

22. How many drops of water can fit on one side of a penny?

    Before you try this, make a prediction on how many drops of water you can drop onto one side of a penny.

    Rinse a penny in tap water and dry completely. Place the penny on a paper towel. Use an eye dropper to place drops of WATER on the penny (one at a time) until ANY amount of water runs over the edge of the penny. Record the number of drops. Repeat those steps three more times and record your results. Find the average of your four trials.

Predict what might happen if you added a drop of soap into the water. Then repeat the same test as above with SOAPY WATER. Record the number of drops. Repeat those steps three more times and record your results. Find the average of your four trials.

What happened and why? Explain your results in terms of cohesion and surface tension.

- Did the penny hold as many drops as you first thought?
- How could this be applied to your daily life? Why is this information important to know?

23. How does temperature affect evaporation? How would you conduct an experiment to determine the answer to this question? Explain your results.

24. How does surface area affect evaporation? How would you conduct an experiment to determine the answer to this question? Explain your results.

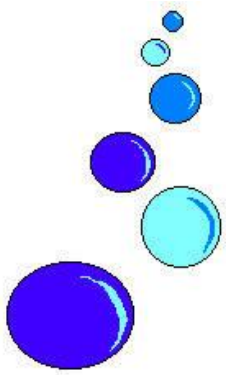
25. How does the temperature of water effects the solubility of Epsom salts? Kosher salt? Sugar? Conduct an experiment to determine the answer to this question. Explain your results.

26. Will Epsom salts, kosher salt, and sugar dissolve in alcohol? In vinegar? Conduct an experiment to determine the answer to this question. Explain your results.

27. Gases can be made by heating liquids until they boil, but you also can make gases by mixing certain SAFE chemicals.

    Pour 2 ounces of water into an 8 ounce bottle (with a small opening). Break 2 Alka Seltzer tablets into the bottle and quickly pull the opening of a balloon over the top of the bottle. What happens and why? What kind of gas do you think was made?

28. The gas produced in #27 is found in many fire extinguishers. Research fire extinguishers and report on how they work.



29. **If an adult can work with you**, try to create an experiment that proves that carbon dioxide is heavier than air. Explain your results.

30. Can you find a way to make soap bubble float on carbon dioxide?

31. **If an adult can work with you**, do an experiment that shows that carbon dioxide expands and contracts. Explain your results.

32. Do different liquids have different densities? Create an experiment that demonstrates the answer!

33. Create or find an experiment to measure conduction in different materials (such as metal, wood, plastic). Record and explain your results. **Ask an adult to help you when you use hot water.**

34. Show how insulation works by making a homemade thermos.

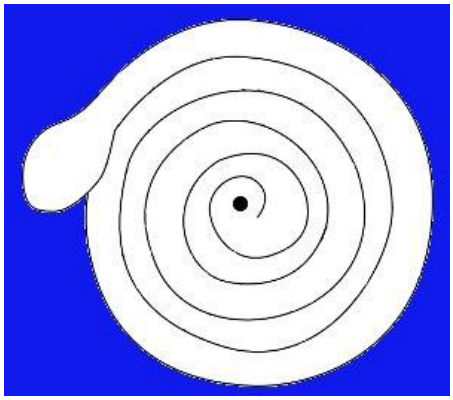
35. Look in books or on the Internet to find out how to make ice cream in a Ziploc bag. Describe how you were able to make ice cream without a freezer or an ice cream maker. What is the science behind your scrumptious treat?

36. Why does steam cause more painful scalding then boiling water?

37. The amount of solar energy that reaches the Earth in two weeks is equal to the world's production of energy from oil, coal, and gas in a year! So, why don't we use this form of renewable energy more?

38. What is Fourier's Law? Can you create an experiment to prove this law? Explain.

39. Use the following experiment to show how temperature changes create convection currents.



- Cut a spiral out of paper or use a paper plate cut into a spiral. A 6cm diameter spiral should be sufficient.
- Make a whole in the exact center of the spiral and thread the string through it. Tie a knot in the end of the string to hold the spiral in place.
- Ask an adult to help you with a safe heat source. You can use a toaster, desk lamp, or toaster oven. DO NOT USE AN OPEN FLAME.
- Dangle the spiral 10cm above the heat source. DO NOT LET THE PAPER TOUCH THE HEAT SOURCE. What happens and why?

40. Use the experiment above to explain why it rains.

41. Go to http://theexplorationstation.wordpress.com/2009/11/21/convection-of-heat/ to see the movement of heat. Try to replicate this experiment with an adult's permission and help.

42. Do you have other ideas? See your teacher!