

Steep Fire, Flat Fire

Time: 30 minutes for activity, 20 minutes of inquiry and data collection.

Materials:

three sticks of non-combustible kid's clay (not modeling clay, it combusts)
large strike-on-box stick matches (the little box matches do not work)
spray water bottle
metal tray
stopwatch
book or objects to angle the tray.

The results vary depending on the type of matches used. Strike anywhere matches are more dramatic. Make sure the matches have not been exposed to moisture.

Introduction

When referring to a wildland fire, conduction is the physical spread of a flame—the blade of grass burns and lights the blade next to it. Radiation from the heat of those two blades dries out a mountain mahogany and a spark catches it on fire.

Directions

Matches represent trees.

1. Fill the spray bottle with water and place it close to work space.
2. Designate someone to run the stopwatch.
3. Designate someone to record the official data to share with the class.
4. Have anyone with long hair, including spectators, tie it back.
5. Stick three matches in a clump (touching) in a stick of clay. Evenly space five more matches starting an inch away from the clump. Space the rest a half an inch apart.
6. Put eight matches in a straight line in the second stick of clay. Space them about a half of an inch apart. Do the same for the third stick of clay.
7. Place all three in the metal tray.
8. Let the students know you will be angling the tray (45 degrees) for the third burn.
9. Have the students, one per science notebook page, write or draw the three arrangements of matches.
10. Ask the students to write down their predictions of what will happen with each set of matches.
11. Light the clump of matches on the first strip of clay.
 - a. Start the stopwatch when the first match is lit. (Put out the match used to light the demonstration matches.)

- b. Let the demonstration burn out.
- c. Stop the timer when the active burning is complete.
- d. Document the time.
12. Light the first match in the straight line of matches on the second strip of clay,
 - a. Start the stopwatch when you light the first match in the row, do not light the rest.
 - b. Allow those that burn to burn out.
 - c. Stop the timer when the active burning is complete.
 - d. Document the time.
13. Tilt the tray to a 45 degree angle, and then light the first match in the straight line of matches on the third strip of clay.
 - a. Start the stopwatch when you light the first match.
 - b. Let it burn.
 - c. Stop the timer when the active burning is complete.
 - d. Document the time.
14. Spray all of the matches with water to cool off.
15. Have the students draw the results.
16. Have the students compare their prediction to the results.

Extension

If there is sufficient time and materials, set up several more clay strips with matches in the same formation as with the third tray. Start by angling the tray 15 degrees, light the first match, and record burn pattern and speed. Repeat the process several more times with the different clay strips, but increase the angle of the slope by ~15 degrees each time. Observe the effect of increasing slope on burn pattern and speed.

Science Notebook Questions: Answer these questions for each demonstration.

Q1) What percent of the matches burned?

$$\frac{\text{is}}{\text{of}} = \frac{\%}{100} \text{ or } \frac{\text{part}}{\text{whole}} = \frac{\%}{100}$$

Percentage formula

Q2) What is the relationship between the percent of matches burned and the match configuration?

Q3) What method or methods of energy transfer was used to ignite the other matches?

Q4) How could you alter the arrangement of matches in model two, the straight flat line of matches, to demonstrate conduction? Radiation?

Q5) How does slope affect convection?

Q6) Is there a correlation between the time it took to burn and the depth of the burn (severity)?