Activity 1

How Long will my Shadow Grow? (Keeping a shadow tape through the year)

The purpose of the activity is to gather data throughout the year about the length of the students' shadows. Using the data, students will graph the data and can compare their results to what is learned about the Earth's orientation to the sun throughout the year and the effects of the Earth's tilt on the seasons.

Materials:

Adding machine tape
Black permanent markers
Yard or meter sticks
Graph paper
Masking tape
Pencils

Procedure:

1. Choose a date that can be used each month to go outside and record the data. Since it is not always possible because of weekends, weather and holidays to use the same day, you might find you need to be flexible and go out on a date that is as near as possible to the original. The idea is to keep the time of month as consistent as possible. You might want to consider the early 20's of the month, since the solstices and equinoxes occur 9/21, 12/21, 3/21, and 6/21.
2. Choose a time of day that you will be able to use consistently. For example, if you measure the first shadow in September at 10:00 a.m., then the other data should be collected at about the same time of day.
3. Discuss with the students what they know about shadows, seasons, and day lengths. Ask them to predict how long their shadow will be the first time before you go out. Ask them if it will get longer or shorter the next month.
4. Introduce the students to the idea of a shadow tape. Here are some important features to emphasize:
    A. Each tape is a scientific record and needs to be handled with care.
    B. Measurements need to be accurate and complete.
    C. If the data is lost, there is no way to go back and re-do it.

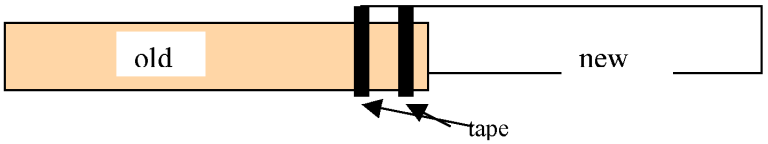
D. This is long-term data collection.

5. Ask each student to predict how long their shadow will be by tearing off a length of adding machine tape.
6. Have each record his or her name at one end of the paper. This will be the **outside**.
7. Flip the paper over. At the same end where the name is written, the student stands with a whole foot on the paper. With a permanent marker, draw a line around the toe and heel. Write f-o-o-t within this space. Each time you go out to measure, the student will line up his foot with this.
8. Head outside to a sunny place, preferably a black-top or cement area.
9. The student aligns himself with the sun so that his entire shadow falls onto the paper. (Some students need help seeing they need to either move themselves or the paper to accomplish this.)
10. Another student marks across the tape at the top of the shadow. Record the date and the time at this line. On slightly overcast days, have the student shake his head back and forth for a clearer view.

11. When rolling up the tape for storage, have the student begin at the end farthest from the foot, with the data on the inside. When he is finished, the data will be safely stored inside and his name will show at the end. The next time out, the foot will be the first thing to unroll and step down on. Close the roll shut with a small piece of tape.
12. Continue this activity monthly throughout the year.
13. At the end of the year, measure and graph the data. (You might want to do this once mid-way to make it a less daunting task.)
14. Have the students unroll their tapes and measure the length of each shadow. Remember, the shadow length **always** begins at the tip of the toe. (Some students will see that you can add the distance between a shorter and next longest to get the overall length. Some may need to measure the total distance each time.) If a student has missed a measurement or the data that he has is highly improbable, have him accept data from someone of similar height. The biggest problem seems to come from marking the shadow from the wrong end of the tape, resulting in bad data.
15. Make a record of the date and length of each shadow.
16. Transfer the data to a line graph that illustrates the changing shadow lengths throughout the year. The lines should be similar, with no regard to the height differences.

Notes for success:

1. This is a wonderful activity that allows you to get outside once a month. However, it does get cold in the winter months. Notify the students the day before you plan to go out to bring a coat and gloves for outside.
2. If the students work in groups of 4 outside, it is much more efficient. Two students unroll their tapes side by side. One student holds down the ends of both tapes. The fourth student marks the tapes. Then switch and they are done.
3. Collect the rolled tapes after each session and store them.
4. If a data tape is too short, add on more paper. Be sure to use enough masking tape for a secure hold. Overlap the old and new paper tape. Mask over each end of paper completely, around the tape.



5. Place a strip of masking tape down the back side of the paper tape to reinforce for durability.
6. Before going out each session, ask students to predict what will happen. At the end of the session ask what did happen. Make predictions for the next time.