2.5

Reasons for the Seasons Symposium: Earth's Changing Distance to the Sun

RESEARCH TEAM ASSIGNMENT SHEET

Research Goal

Your goal is to determine what effect the changing distance of the Earth from the Sun has on Earth's seasons.

Background

You will be making a scale model of Earth's orbit around the Sun and measuring how much the intensity of the Sun's light changes from the time of Earth's closest approach to the Sun in early January to when Earth is farthest from the Sun in July. Be sure to keep a log in your astronomy lab notebook. Note the steps you follow throughout the activity and include your results and conclusions.

Procedure

1. Determine the distance from the Sun to the Earth at different times of year in your scale model using the scale of 2,000,000 mi. = 1 in. Enter your calculations in the chart below. The scale can be adjusted if necessary to make the model fit better in your research space.
2. Use the information from step 1 and the diagram on the next page to construct a scale model of Earth orbiting the Sun. Use the lamp as the Sun and the Styrofoam ball and holder as the Earth. This experiment works best if the model is in the center of

MATERIALS

- 250 W lightbulb in a short desk lamp, shade removed (*Safety note:* This lightbulb will get very hot. Be careful not to touch it.)
- Measuring tape or meterstick
- Light meter
- Chalk, masking tape, or nonpermanent marker to mark the floor
- Model Earth provided by your teacher (Styrofoam ball on stick placed in Styrofoam cube at an angle of 23.5°)
- "Reasons for the Seasons Symposium: Earth's Changing Distance to the Sun Research Team Assignment Sheet"
- Room that can be made completely dark

Date	Distance from Sun to Earth (mi.)	Distance in scale model (in.)
July 4	94,550,000 (Earth farthest from Sun)	
Oct. 4	92,970,000	
Jan. 4	91,390,000 (Earth closest to Sun)	
April 4	92,970,000	

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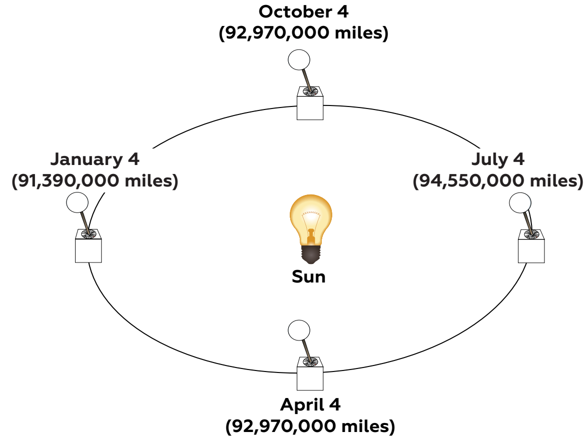
the room so that the walls of the room are at the same distance from the lamp. Mark on the floor where Earth is located for each of the dates listed. Also mark on the floor which direction north is in your model—in approximately the same direction as the January 4 location in your model.



3. Now that your model is built, place the model Earth in each of the four positions and use the light meter to measure the brightness of the Sun from that location. Be sure the model's North Pole is always pointing in the north direction when you place your model Earth at each location, and be sure the light meter is pointing directly at the model Sun when you take the reading. Record the results in your astronomy lab notebook. Be sure to go around to the four locations several times and average the results. If you find differences between the measurements, discuss with your teammates what might cause these differences.

4. To get a sense of how great an effect Earth's changing distance from the Sun really has on the seasons, it is useful to look at the percent change in Earth's distance when it is farthest from the Sun versus when it is closest the Sun. This percent change is

$$\frac{\textbf{(farthest distance to the Sun} - \textbf{closest distance to the Sun)}}{\textbf{farthest distance from the Sun}} \times 100 = \%\ \textbf{(percentage) change}$$

Include this information in your presentation to the class.

5. Using the results from your experiment, have a discussion among members of your research team to predict what effect the changing distance of Earth from the Sun has on Earth's seasons. Write your conclusions in your astronomy lab notebook.

6. Prepare a presentation for the rest of the class, using appropriate visual aids, that explains the research activity you performed and what conclusions you reached. Be sure to include the following:

- The problem you explored
- The procedure you followed
- The data you collected, including any graphs
- The conclusions you reached