First Day of Fall

by Marna Lehnert

NOTE: The directions for this lab are long, but this lab can be done on the First Day of Winter, Spring and Summer too, and it really helps the students understand the angle the sun's rays make with the horizon here in New York! (i.e. it's WORTH it!)

Purpose:

1. To construct a diagram depicting the sun's rays as they hit the Earth on the first day of fall.
2. To draw, label and measure the angles made from the light of the sun striking the horizons of the various latitudes, and correlate that to the angles of latitude on Earth.

Materials:

1. plain white non-lined paper
2. protractors
3. pencils
4. large protractor (for teacher to use on board)
5. meter stick (for teacher to use on board)
6. colored and white chalk (for teacher to use on board)

Directions:

Teacher should demonstrate each of the following steps at the board. See Figure 1 to see what the finished product looks like.

1. Fold the paper in half lengthwise, and open to full size again.
2. Estimate the center point of the fold line, and put a dot there.
3. Put the hole of the protractor over the dot, and outline the protractor to make a full circle. *(Hint: make sure the students have made a circle and not an 'egg').* A drafting compass can also be used to make the circle.
4. Put the hole of the protractor over the dot, and line up the straight edge on the fold of the paper. Mark off 23.5° . Draw a line through that mark and the center dot in the fold, making sure to continue the line to the other side of the circle. This represents the Earth's axis. Label the North and South Poles.
5. Put the hole of the protractor over the dot, and line up the straight edge on the Earth's axis. Mark off 90° . Draw a line through that mark and the center dot in the fold, making sure to continue the line to the other side of the circle. This represents the Equator. Label it on the left side.
6. Put the hole of the protractor over the dot, and line up the straight edge on the Equator. Mark off 23.5° NORTH of the Equator on both sides of the protractor (right and left). Connect the marks, checking first to see that this will make a line parallel to the Equator. This represents the Tropic of Cancer. Label it on the left side.
7. Repeat Step 6 for the SOUTHERN hemisphere - the Tropic of Capricorn, and label it on the left side.
8. Put the hole of the protractor over the dot, and line up the straight edge on the Equator. Mark off

43° (or whatever your latitude happens to be) NORTH of the Equator on both sides of the protractor (right and left). Connect the marks, checking first to see that this will make a line parallel to the Equator. This represents your line of latitude. Label it on the left side.

9. Extend the lines of latitude (use a different chalk color). These lines represent the sun's rays of light. Draw arrows on the lines to show the light traveling *to* the Earth *from* the sun. At this point an explanation of how the sun's light reaches us (parallel) would be a good idea.
10. Draw a radius from the center point to each latitude along the right side of the diagram (90°S, 23.5°S, 0°, 23.5°N, 43°N, and 90°N). Now draw a horizon for each latitude (this line is tangent to the circle, and perpendicular to the radius line at each latitude).
11. Measure the angle between the sun ray and the horizon. *(Note: the angle flip-flops when going across the Equator, so be careful!)*
12. Make a table for the data as in Table 1.

Figure 1.

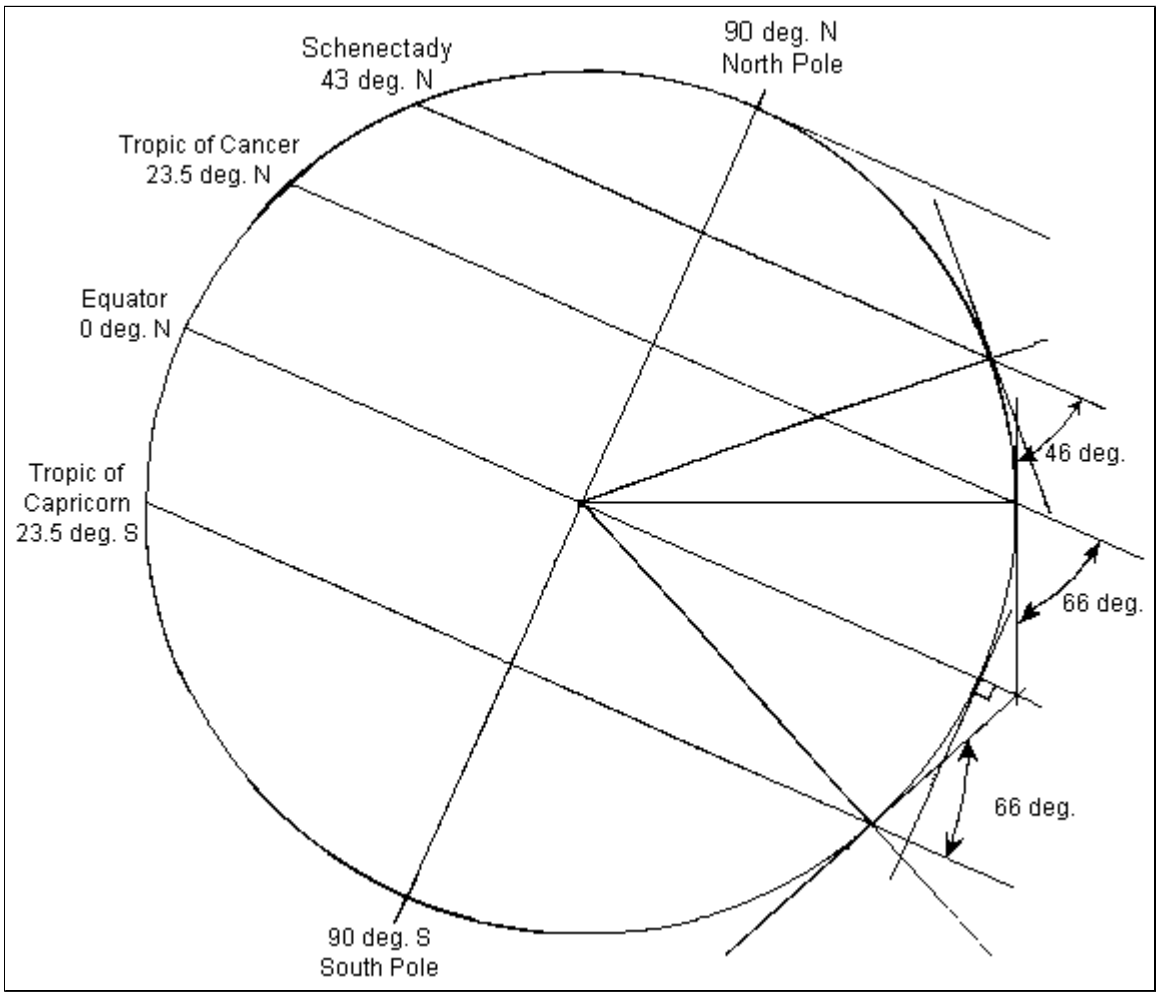

Table 1.		
Place	**Latitude**	**Angle of the sun with the horizon**
North Pole	90°N	0°
Schenectady	43°N	47°

Tropic of Cancer	23.5°N	66.5°
Equator	0°	90°
Tropic of Capricorn	23.5°S	66.5°
South Pole	90°S	0°

Summary:

This lab is great for illustrating the angle of the sun on the first day of each season, as well as a tool for describing the intensityof the sun on these days.

Web Links that might be useful:

- A Solar/Terrestrial Tutorial
- Why do we have seasons?

Science labs web page
Pedagogy web page

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