



## How to make pie charts comparing the atmospheres of Venus, Earth, and Mars

The composition of Earth's atmosphere is approximately 78.1% nitrogen, 20.9% oxygen, 0.9% argon, and small amounts of other gases. First among these other gases is carbon dioxide, present at less than 0.04%.

The pie chart (also called circle graph) is a practical way to display information of this type, where the idea is to show percentages, or parts of the whole. All that's required is to make each "slice" of the pie proportional to its component part.

The major limitation of pie charts is that very small parts – anything less than about 1 percent – are hard to draw because they are so small. For this reason, when making a pie chart for Earth's atmosphere, carbon dioxide and the other minor gases cannot easily be shown. A simple solution to this problem is to mention them in a side note to the chart.

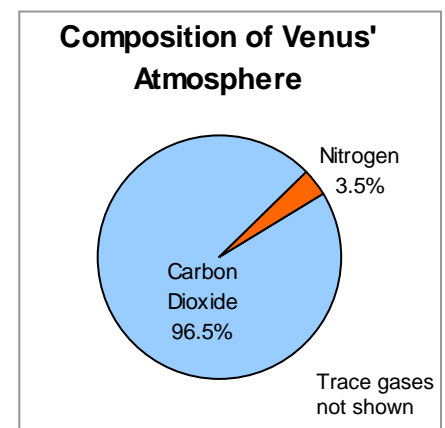
**Materials:** Calculator, protractor, pencil, activity sheets

**Procedure:** Follow these steps to make any pie chart:

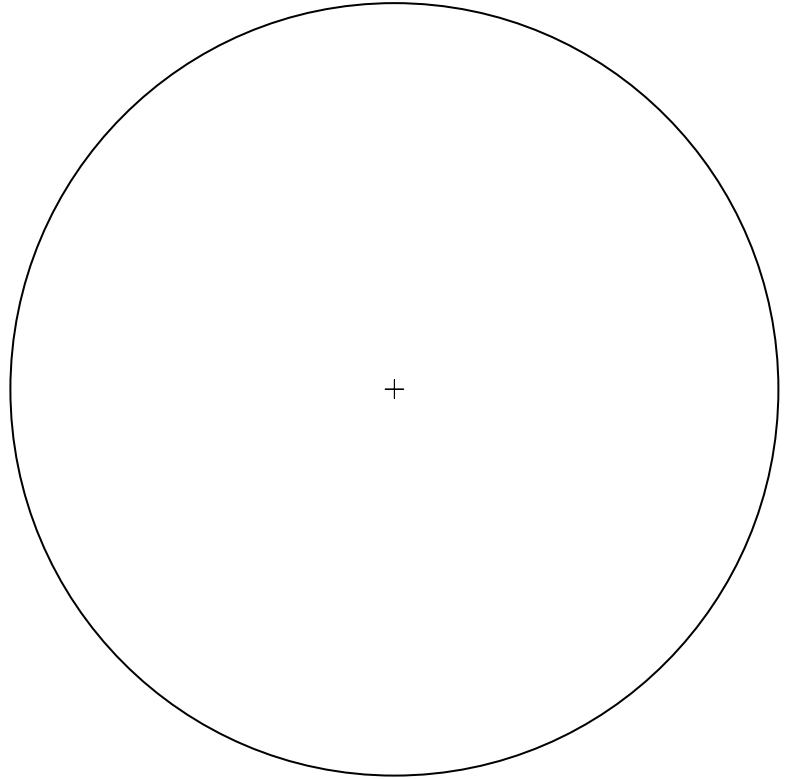
1. Calculate the percentage of the total that each part represents. In many cases this information will already be available (as it is in this activity).
2. Change the percentage to decimal form and multiply by 360, the number of degrees in a circle. The result is the number of degrees in the pie slice for the part in question.
3. Repeat the above for each component part.  
*Note: Steps 1, 2, and 3 are most easily done by setting up a table.*
4. Check your calculations. The sum of all the angles should be 360 degrees (or very close to it, after consideration of rounding effects).
5. Using a protractor, measure and draw each angle from the center point of the circle.
6. Label each slice of the pie with its name and percentage. Use color or shading for clarity.
7. Give the chart an accurate title that tells the reader what information is presented.

The example given here shows the composition of Venus' atmosphere, which has only two major components.

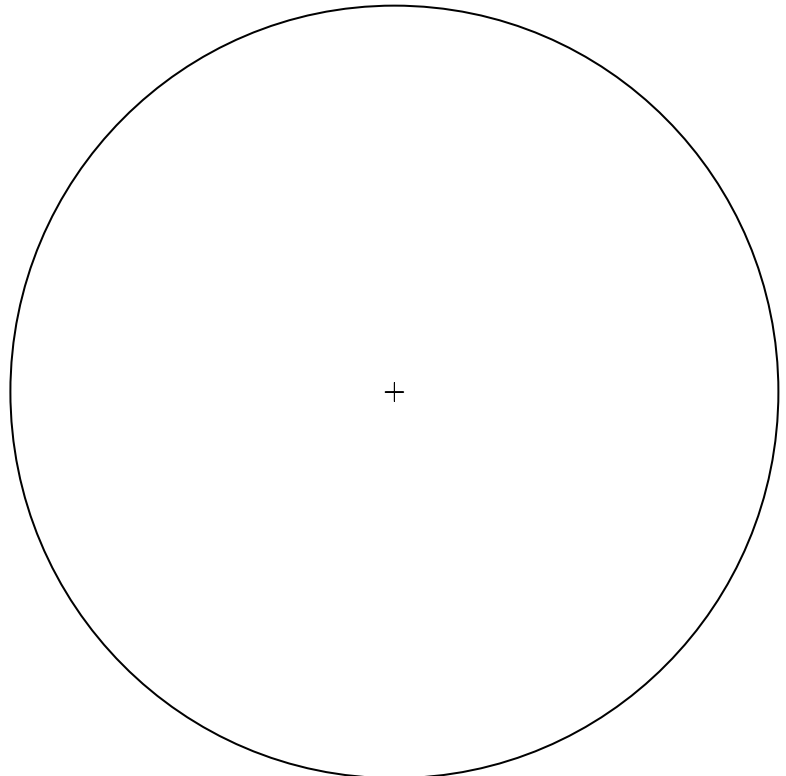
Component	Percentage	Degrees of Circle*
Carbon Dioxide	96.5	$0.965 \times 360 = 347$
Nitrogen	3.5	$0.035 \times 360 = 13$
Other	Trace	--
		*rounded to nearest degree



Use the same procedure to create a pie chart for the composition of Earth's atmosphere. Again, its components are 78.1% nitrogen, 20.9% oxygen, 0.9% argon, and trace amounts of other gases.



Do the same for the atmosphere of Mars, which is made up of 95.3% carbon dioxide, 2.7% nitrogen, 1.6% argon, and traces of other gases.





## Teachers' Notes

Objective: Students will create pie charts describing the atmospheric composition of Earth and Mars.

Grade Level: Middle

NSES: A3, A4, D4

NHSCF: 1a, 2c, 4b, 6a

### Key Concepts

Pie charts (also called circle graphs) are a useful graphic tool for showing parts of the whole. The size of each “slice”, or wedge, of the pie is proportional to each component’s percentage of the total.

To make a pie chart, the data to be graphed are initially converted to percentages and then to degrees of a circle. The calculation of degrees is made by multiplying the percentage of each component by 360, the number of degrees in a circle. This task is most easily done in a table, especially if there are more than a few data points to be charted.

The computed percentages may be rounded to the nearest degree, as it is generally not possible to draw angles with greater precision than that amount. Students may be confused as to how to handle small percentages when displaying the data. Since a one-degree angle is a practical limit for drawing angles, it makes little sense to try to display anything of lesser size on the chart. Components that have small percentages may be grouped together as “other” for the purposes of graphing. A note may be added to the chart to explain the presence of small quantities not displayed.

This pie chart activity is an opportunity for students to practice making decisions of the sort just described. It is also a lesson in how to present data with accuracy and clarity. Neatness, choice of title, proper labeling, and use of color and shading are important aspects of this process.

Many of these same considerations apply when students use graphing application software such as found in Microsoft Excel. However, the present activity has the advantage of requiring students to perform manual calculations and make real measurements with protractors. A note on this last point: Students who are not familiar with protractors will require instruction in use of same before attempting this activity. Students who have some prior experience with protractors may still exhibit confusion about where to start drawing angles inside the circle of the pie chart.

With regard to the data in this activity, students will find general similarities between the planets because each of their atmospheres is characterized by one or two major components. However, the compositions of the atmospheres of Venus and Mars differ markedly from Earth’s. Such differences might form the basis of a discussion about the formation, history, and eventual fate of the three planets. Students might generate a list of questions and conduct research to answer them.