

The Laboratory

Law of Harmonies Analysis

Teacher's Guide

Topic:

Circular Motion and Satellite Motion

The following information is provided to the student:

Question:

What is the evidence which supports Kepler's third law of motion?

Purpose:

To use calculations in order to describe the evidence which supports Kepler's third law of motion.

A complete lab write-up includes a Title, a Purpose, a Data section, and a Conclusion/Discussion of Results. The Data section should include the provided sheet. At least one sample calculation should be shown. The Conclusion/Discussion should include a discussion of how the evidence from planetary data support Kepler's law of harmonies.

Materials Required:

Calculator; the provided table of planetary data.

Description of Procedure:

Students receive data for the period of the planets and the mean distance from the sun. The data is analyzed in order to develop the evidence for Kepler's third law of planetary motion.

Alternative Materials and Procedure:

Many alternative (or additional) data analysis exercises can be done. Those who are looking for a more authentic exercise which not only involves the analysis of data but also the collection of data might investigate [Project CLEA](http://www3.gettysburg.edu/~marschal/clea/CLEAhome.html) (<http://www3.gettysburg.edu/~marschal/clea/CLEAhome.html>).

Safety Concern:

There is always a higher than usual level of risk associated with working in a science lab. Teachers should be aware of this and take the necessary precautions to insure that the working environment is as safe as possible. Student *horseplay* and off-task behaviors should not be tolerated.

Suggestions, Precautions, Notes:

1. The provided data express the period and the radius of the planets relative to Earth's period and radius. An astronomical unit is a unit of distance which corresponds to the Earth's distance from the Sun.
2. The last column in the provided table is blank in order for students to calculate the ration of T^2/R^3 for all the planets.

Auxiliary Materials:

The Laboratory

The following page is provided to the student for completion and inclusion in the Data section of their lab notebook.

Planet	Period (Earth years)	Ave. Radius (astron. units)	
Mercury	0.241	0.39	
Venus	0.615	0.72	
Earth	1.00	1.00	
Mars	1.88	1.52	
Jupiter	11.8	5.20	
Saturn	29.5	9.54	
Uranus	84.0	19.18	
Neptune	165	30.06	
Pluto	248	39.44	

Scoring Rubric:

CG7. Law of Harmonies Analysis	Score
<ul style="list-style-type: none">___ Included, labeled and organized all parts of the lab report.___ Data section includes the provided table with the last column completed; units are indicated; at least one sample calculation is clearly shown and labeled.___ Conclusion/Discussion answers the <i>question</i> posed in the Purpose and describes the supporting evidence.	___/___

Connections to The Physics Classroom Tutorial:

The following reading is a suitable accompaniment to this lab:

<http://www.physicsclassroom.com/Class/circles/u6l4a.cfm>

Connections to Minds on Physics Internet Modules:

Sublevel 10 of the Circular and Satellite Motion module is a suitable accompaniment to this lab:

<http://www.physicsclassroom.com/mop/module.cfm>