UNIT 1:

INNER PLANETS – OUTER PLANETS

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TEACHER'S GUIDE

This unit is designed for students with no previous knowledge of trigonometry. They just have to know measurement length units. For graphical representation it would be useful an Excel worksheet (or any other similar program).

It's not expected that the student will get an equal result to the real one (understood as the most accurate magnitude value), just an acceptable approximation. It is also intended to teach them to use different computing tools for studying astronomical images.

Below we will show the results of each activity, as well as the graphs. Please note that the results provided may not match those obtained by the teacher or students in the measurements, but they serve as a reference.

In some tables a column with the real value of the magnitude to be measured is added.

ACTIVITY 1.

1st PART. VENUS SIZE

Recommendation: when enlarging the images in the *Zoom* tab, you can choose the interpolation method to be applied. We recommend the bilinear or bicubic method so that the image suffers less distortion.

Image	Date	Measure (*px*)	Scale(*km/px*)	Diameter (*km*)
902a000	19/09/2007	152.3	82.5	12565
906e000	28/09/2007	129.6	94.5	12247
918i000	27/10/2007	91.6	137.6	12604
924f000	01/11/2007	85.9	145.3	12481
934i000	16/11/2007	74.9	167.9	12576

The mean diameter obtained for Venus is 12,495 *km*, a value very close to the real one which is 12,103.6 *km*.

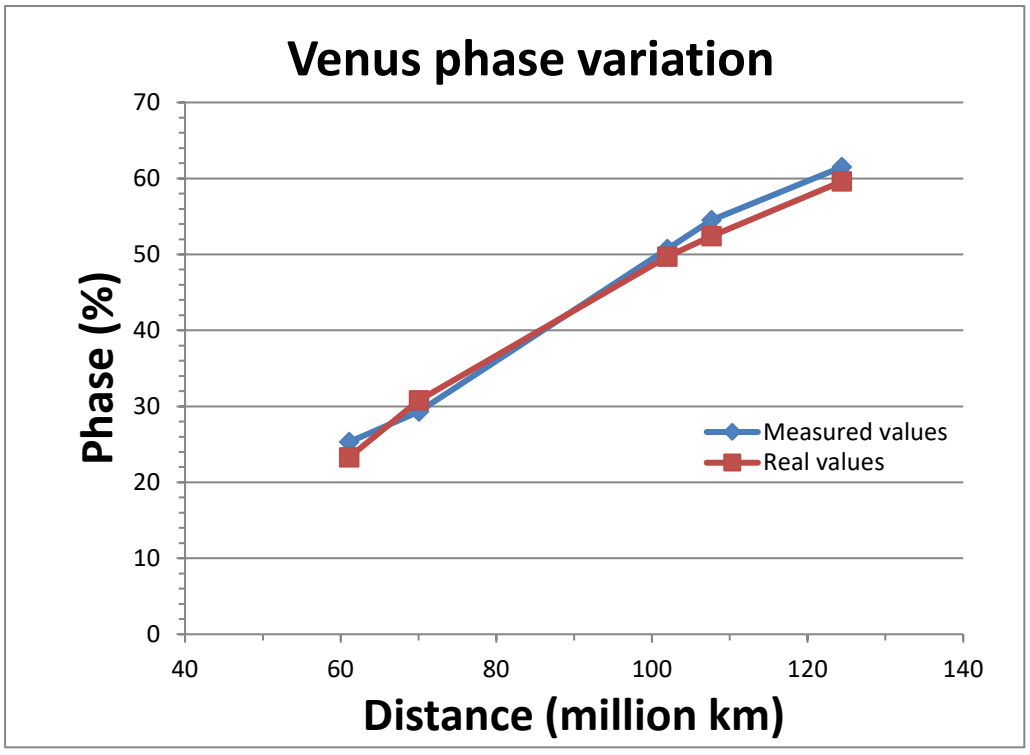
- Data obtained from the information provided on the image.
- Data obtained from the measurement made by the student.
- Data obtained from the calculations.

ACTIVITY 2. (2nd PART) VENUS PHASES

Image	A (*px*) Width measure	D (*px*) Diameter measure	A / D x 100 (%)	REAL VALUE
902a000	38.5	152.3	25.3%	23.3%
906e000	37.9	129.6	29.3%	30.8%
918i000	46.6	91.6	50.7%	49.7%
924f000	46.9	85.9	54.5%	52.4%
934i000	46.1	74.9	61.5%	59.6%

The “real” Venus phase values for each day (and for the location of La Palma, where images were taken) have been obtained by using the astronomical ephemerides application form of the Spanish National Astronomical Observatory (http://www.oan.es/servidorEfem/formulario.html).

If we plot the data obtained and the actual values of Venus' phase against the distance of the planet from us (information in the *Astro* tab), we can see how the phase increases as the planet moves away from us, going from 23% to 60% of the illuminated disc.



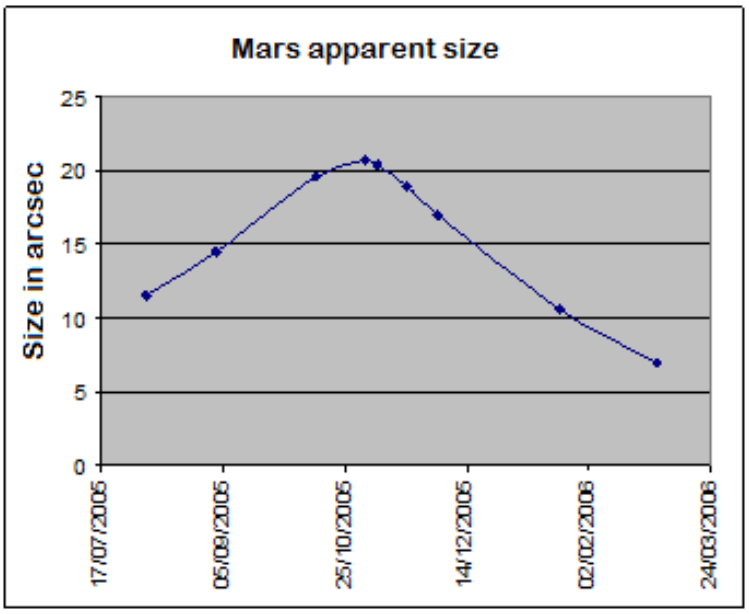
ACTIVITY 2

APPROACHING AND RECEDING FROM THE PLANET MARS. OPPOSITION.

Image	date	Size in arcsec
370j000	04/08/2005	11.5
383a000	02/09/2005	14.5
407g000	13/10/2005	19.6
430e000	02/11/2005	20.7
438c000	07/11/2005	20.4
445e000	19/11/2005	19.0
455i000	02/12/2005	17.0
470f000	21/01/2006	10.6
506g000	02/03/2006	7.0

The opposition of Mars happened on November 7th 2005, when the Sun, Earth and Mars were aligned. The closest approach of Mars to us took place 9 days before, on October 29th 2005, when Mars and our planet met at a distance of 69,422.386 *km*. Let us remember that Mars has an elliptical orbit that can cause a closer approach of our planet to the red planet a few days before or after the opposition.

On the graph we can clearly check that the biggest planet apparent size took place some days before November 2nd, date where the fourth image was taken.



For further information, visit our website: **www.iac.es/peter**

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