Exploring the Sun & Earth using hands-on activities – Part 2

In an attempt to make science learning fun, engaging and interesting, students of Class IX of Indira Gandhi Government High School, Katterikuppam, Puducherry, guided by S.Rajkumar (TGT) had undertaken a project of exploring and knowing facts about the sun and earth. Part one of the article was published in the June 2017 issue of Thisaimaani. This article is a continuation of their project report.

Experiments:

1. Finding the angular size of the Sun

The angular size or the angular diameter of the sun is a measurement that describes how large the sun appears at different points. The solar projector (A setup with a ball and mirror instrument over a mug) is used to focus the sun's image on the wall. The distance between the solar projector and the wall is 'L'. The diameter of the sun's image is 'd'. The angular diameter is calculated by substituting the known values in the formula

$$\Theta = \frac{360° \times d}{2 \pi L}$$

Distance L (in m)	Diameter of the Sun's image (in cm)	Angular Distance (in degrees)
15	13.5	0.51
20	19	0.54
25	22.5	0.51
30	30	0.57

2. Sunrise and Sunset

The time of sunrise and sunset were noted every day from 1st March 2017 to 21st April 2017. The time-period of the sunlight was calculated using the formula.
Sunlight time = Sunset time – Sunrise time

Date	Sunrise	Sunset	Day length
01-Mar	06:26	18:20	11.54
:	:	:	:
19-Mar	06:15	18:21	12.05
:	:	:	:
30-Mar	06:08	18:21	12.13
:	:	:	:
07-Apr	06:03	18:22	12.18
:	:	:	:
15-Apr	05:58	18:22	12.23
:	:	:	:
21-Apr	05:55	18:23	12.27

It was experimentally verified that the length of the day increases during summer.

3. Calculating the time period of the Earth's rotation

The image of the sun captured on the screen using the solar projector is traced. As time progresses the image shifts and it is traced again after a one-minute interval. The distance between the trace marking of the two images is measured. The shift of the image is due to the rotation of the earth in 1 minute.

The distance between the screen and the solar projector is considered as radius (r) and the circumference is calculated. The distance moved in 1 minute is used to calculate the time taken for a complete rotation. This is approximately 1440 minutes. i.e. 24 hours.

Calculation example :

Distance between solar projector and screen (r) = 15 m = 1500 cm

Movement of image (Distance moved) in 1 minute = 6.5 cm

Time taken to complete one rotation = Circumference (2πr) / Distance moved

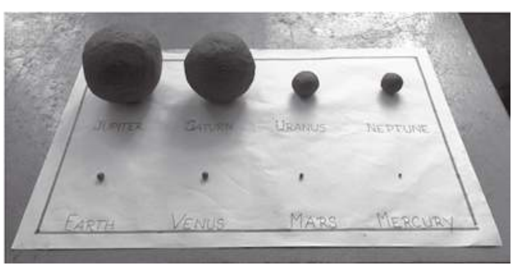
= 2 x 3.14 x 1500 / 6.5

= 1449 minutes

Multiple readings are recorded by varying the distance between the solar projector and the screen. The shift of image is measured each time and tabulated.

Distance (in m)	Circumference of the circle (2πr) (in cm)	Distance moved in 1 minute (in cm)	Time taken to complete one rotation (in minutes) (Circumference / Distance moved)
20	12560	8.8	1427
25	15700	11	1427
30	18840	13	1449

4. Nano Solar System



	Diameter (in km)	Nano Diameter (in cm)	Nano distance from Sun (in m)
Sun	1392000	139.2	0
Mercury	4880	0.488	58
Venus	12100	1.21	107
Earth	12756	1.28	150
Mars	6794	0.68	227
Jupiter	143200	14.32	777
Saturn	120000	12	1426
Uranus	51800	5.18	2870
Neptune	49500	4.95	4496

The size of the planets and distance between them was depicted at the nano scale using clay models. Nano size is 10^{-9} times the original size, which is 100 crore times smaller than the real one.

The length of our school ground is 110m. The nano models of Mercury and Venus were placed at a distance of 58m and 107m respectively from one end of the ground. There was no space for Earth and other planets. If extended, nano-Neptune will be at a distance of 4.5 km.

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