Weight on Planets

This activity involves pupils using the NSO's Weight - Planet Calculator to investigate changes in weight on different planets.

Resources Required

The NSO's **Weight – Planet Calculator**

Graph paper, **rulers**, **pencils** and **calculators**:

- If desirable, pupils can use spreadsheet software such as **Excel** or Works.

Access to planetary data via the NSO Solar System Planets page.

Content

Start off by discussing the ideas of **gravity** and **weight** versus **mass**.

Pupils can then undertake some or all of the three activities set out below.

Classroom Activity 1

This activity involves all pupils accessing the NSO's Weight - Planet Calculator in order to look at how their weight changes on different planets.

- To start the activity every pupil must be able to work out their **weight** in **kilograms** - they may need reminding of how many pounds in a stone and how many pounds equal a kilogram. The alternative is to give the pupils a reasonable estimate for an average pupils weight, e.g. 7 stone = 45 kg, a specific animal e.g. cat = 4kg or ~9lbs.

- Pupils can input their Earth weight into the top box of the tool and then click on each planet in turn, noting down what their weight would be on each of the planets.

- A discussion of the results is required to determine on which planet they will weigh the least and on which the most. The order can be written up on the board to encourage them to see any correlation.

- With prompting, if necessary, they may come up with the idea that the smallest planet is where they weigh the least and the biggest planet is where they weigh the most. They should then be encouraged to consider the mass of the planets and compare the results.

  There is not a perfect correlation in either case and this should be discussed. The discussion and search for a relationship is important in helping the pupils to develop a mathematical approach and to develop thinking skills.

- For older/more able pupils the formula: $F = G\,\frac{m_1 m_2}{r^2}$ could be introduced.

The National Schools' Observatory wishes to thank
Sue Cronin (Liverpool Excellence in Cities programme) for writing this activity.

Classroom Activity 2

Following on from the discussion of **weight** and **mass** - one can pose the question...

Is there less of you on another planet?

Pupils can look up the formulae connecting mass of an object with its weight:

$$Weight = Mass \times Surface\ Gravity$$

and use it to calculate different weights on the planets of a 50 kg object. These can be checked on the planetary weight tool.

Classroom Activity 3

If pupils have an understanding of how to draw straight line graphs they can form equations such as:

$$\boldsymbol{Weight_{uranus} = 0.79 \times mass}$$

and draw **W** against **m**. By plotting all the straight line graphs on the one sheet they can see which planets have similar gravities which are greater/less than the Earth's etc.

They can consider the accuracy of the graphs by obtaining weight values for a given mass and comparing these with their calculations / computer answers. They can consider the advantages/disadvantages of each method.

If pupils are unfamiliar with ***y = mx + c*** they can plot a few values for each planetary equation to obtain the straight lines.

Extension Activities

Pupils may wish to explore the relationship of the size of the planet and its mass. This would require the use of log paper to plot the values of **mass** v **radius**. Values for **mass** and **radius** can be obtained via the planetary fact sheets listed on the NSO Solar System Planets page.

Pupils may wish to research the units of **weight** (**Newton**) and **gravity** (**N/kg**) and the incorrect usage of units in everyday life (bathroom scales etc.)

Keywords

Mass, Weight, Ratio, Graph, Algebra

Teacher's Notes

This task gives pupils the opportunity of converting their weight from imperial to metric units, working with basic equations, creating straight line graphs and using them to convert mass into weight.

It is likely that the class will require a reasonable degree of guidance.

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