Big and small

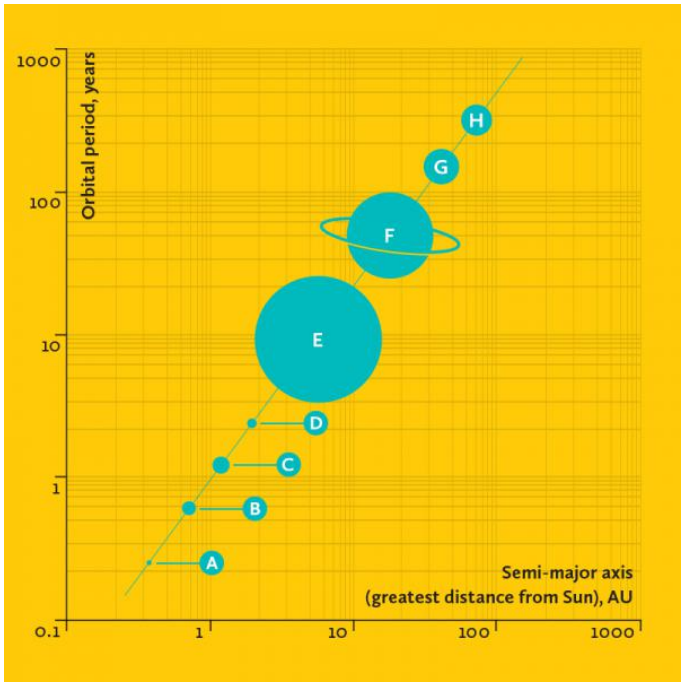
Grappling with the numbers

Biology often deals with very small numbers, whereas in space and astronomy the numbers can literally be astronomically huge. For example, it is thought the visible universe is just under a billion billion billion metres across, whereas the width of one of our neurons is about 10 millionths of a metre.

Rather than write these numbers out by hand, scientists use the shorthand of standard form. The diameter of the universe becomes 8.8 x 1026 metres; the width of a neuron becomes 1 x 10-5 metres.

Powers of ten can also be used to represent data on a logarithmic scale if the values you are looking to chart vary widely.

Take the pH scale. How much a substance is considered to be an acid or a base depends on how many hydrogen ions it contains. A strong acid can have one hundred million million times more hydrogen ions than a base. Imagine a pH scale that ran from 0 to one hundred million million. Instead, the pH scale is constructed by taking the negative logarithm of the number of hydrogen ions present. That yields a much simpler scale that runs from 0 to 14 – much more manageable!



Relationship between distance from the Sun and duration of orbit in the solar system

A logarithmic scale lets you see concepts on one graph that wouldn't be clear otherwise. This graph demonstrates Kepler's third law, which shows that there is a proportional relationship between a planet's orbital period and its semi-major axis.

A) Mercury; B) Venus; C) Earth; D) Mars; E) Jupiter; F) Saturn; G) Uranus; H) Neptune.

REFERENCES

Elmhurst College: Virtual Chembook

NASA's Cosmos: Kepler's third law

ABOUT THIS RESOURCE

This resource first appeared in 'Big Picture: Space Biology' in June 2015. Published by the Wellcome Trust, a charity registered in England and Wales, no. 210183.
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