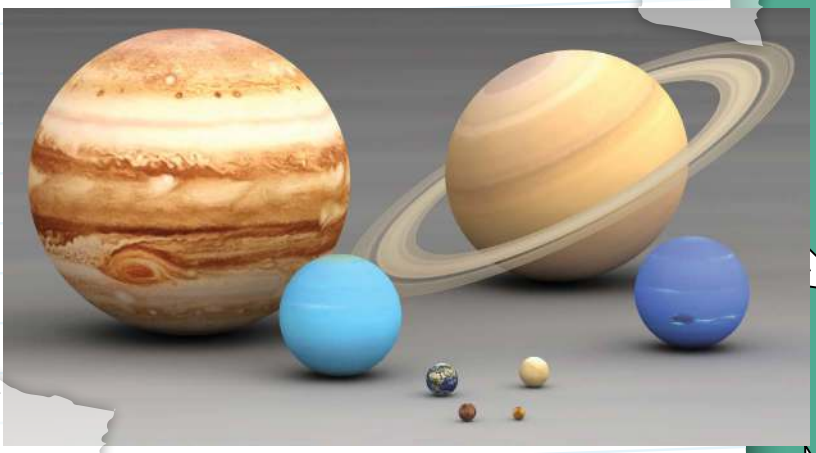
TEACHER RESOURCE

STARDOME OBSERVATORY & PLANETARIUM
FACTS, RESOURCES AND ACTIVITIES ON...

THE SCALE OF THE SOLAR SYSTEM

Space is vast. So vast, that it is difficult for us humans to even comprehend. We can put numbers on different sizes and distances of things in Space and this does help to visualise the scale better, but numbers like 1,392,684; (the width the Sun in kilometres) or 2,870,671,400 (the number of kilometres between our Sun and Uranus) are so far beyond the scale of things we encounter in everyday life that they are still difficult to make sense of.

To make it easier to visualise the scale of Space, we are going to shrink things down a bit so that we end up dealing with smaller numbers representing distances and sizes that we can identify. We will have to shrink things down **a lot** to do this. We are going to have to make our Solar System five billion times smaller!



Solar system planets size comparison. Largest to smallest are pictured left to right, top to bottom: Jupiter, Saturn, Uranus, Neptune, Earth, Venus, Mars, Mercury.

Image credit: Wikimedia Commons/Lsmpascal

> Using this scale, an average human would be the size of an atom and the Moon would be less than 1mm across and about 7.5cm from Earth!

Making space this teeny-tiny turns our Sun from a giant ball of hot gas, almost one and a half million kilometres in diameter, into a tiny ball of hot gas just 28cm in diameter. About the length of a typical classroom ruler. Meanwhile the largest planet in our Solar System, Jupiter gets shrunk down to a mere 2.8cm! The other planets in our Solar System are of course, even smaller: Saturn shrinks to 2.3cm (not counting its rings) while Uranus and Neptune both shrink to just 1cm. The rocky planets, are smaller still. Earth and Venus become just 2.5mm across each, Mars 1.3mm across, and tiny Mercury just 1mm; about the size of the full stop at the end of this sentence.

What is really surprising though is how far apart the planets are. The distance between our 1mm Mercury and our 28cm Sun is just over 11.5 **metres**! There is 22.5m between the Sun and Venus, 30m between the Sun and Earth, and 45.5m between the Sun and Mars. But these four rocky planets are very close to the Sun compared to Jupiter at 155m away, or Saturn at 287m away, or Uranus at 574m away, or Neptune at 900m away!

But that is just the planets of our Solar System. What about the nearest star? It is named Alpha Centauri and is actually a pair of stars orbiting each other. It is located outside the Solar System and in our shrunken down universe, they are located about 8000km away!

Check out these other resources...

- If the Moon were only a pixel – http://www.joshworth.com/dev/pixelspace/pixelspace_solarsystem.html
- BBC – How big is Space – http://www.bbc.com/future/bespoke/20140304-how-big-is-space-interactive/index.html

SCIENCE CONTENT/ CURRICULUM LINK

INVESTIGATE THE COMPONENTS OF THE SOLAR SYSTEM, DEVELOPING AN APPRECIATION OF THE DISTANCE BETWEEN THEM.

DISCUSSION POINTS

- In this exercise we've used km as a measurement. Astronauts and scientists use Astronomical Units. Why is this?
- Even though Mercury is the closest to the Sun, it's not the hottest. Explore why this is as a class.
- Why do all the planets orbit the Sun?

STARDOME OBSERVATORY PLANETARIUM

STARDOME.ORG.NZ
09 624 1246

ACTIVITY

STARDOME OBSERVATORY & PLANETARIUM

SHRINKING THE SOLAR SYSTEM

Using the figures given in this resource, create a model of the Sun and planets. In teams, the class can create Solar System models, either out of papier-mâché, or with items from the classroom that match the reduced measurements. Think about marbles, drawing pins, rubbers or craft supplies. They may not match the shape correctly but can still provide context for the different sizes of the planets.

Take items/model outside, and with a tape measure space out the students at the shrunk down distances from the Sun. It might be good to do this on a school field, particularly if it already has distances marked for sports activities.

If you run out of room, use google maps or a similar mapping programs to locate familiar local places which are at the correct distance from your Sun (e.g. corner dairy, child's house, the motorway etc.). While you won't be able to send a child to these locations, hopefully they will be familiar enough that the student can visualise the distance. Translating the size and distances to this micro-level makes it easier to understand how immense Space is and how different the planets are in size.

Ask the students what they notice about the planet sizes. The rocky planets (Mercury, Venus, Earth and Mars) are much smaller than the gas planets. Ask them to identify which planets would be hottest and which would be coolest. This is also a good opportunity to discuss measurements in Space. What is an Astronomical Unit? Why don't astronauts use the same measurement system we have on Earth?

Planet	Adjusted diameter	Average distance from the Sun
Sun	28cm	
Mercury	1mm	11.5m
Venus	2.5mm	22.5m
Earth	2.5mm	30m
Mars	1.3mm	45.5m
Jupiter	2.8cm	155m
Saturn	2.3cm	287m
Uranus	1cm	574m
Neptune	1cm	900m
An added extra if the class has been studying Pluto and New Horizons...		
Pluto	0.5mm	1182m

Take a photo of your activity and send it to us. We'd love to see it! education@stardome.org.nz

STARDOME OBSERVATORY PLANETARIUM

STARDOME.ORG.NZ
09 624 1246