**Space: the final frontier**

**Part 1: Our place in space**

**Our amazing Universe**

The scale of our Universe is incomprehensible. To help us better understand it scientists look up in wonder at the stars, launch missions to study the planets in our Solar System and send probes into space to explore what lies beyond our tiny planet.

Follow our traveller’s guide through the Solar System and learn about our place in space in the first of our three-part series ahead of the 40th anniversary of the Skylab crash-landing in WA and the 50th anniversary of the first person to walk on the Moon.

**What is space?**

Space can be thought of as everything that exists above the Earth’s atmosphere. While there is no clear edge to the atmosphere many scientists agree that this is approximately 80-100km above the Earth’s surface. Although we often think of space as a vacuum, it is not completely empty. There are many planets, asteroids, stars and an abundance of gases and dust.

After you’ve had a go at the activities, check out the answers at mediaeducation.com.au/students to see how well you did!
A Sun is born!

Our Solar System is a busy place with all kinds of planets, moons, asteroids and comets zipping around the Sun. So how did this busy stellar neighbourhood come to be?

About 4.6 billion years ago a wispy cloud of stellar dust that was part of a bigger cloud (called a nebula) collapsed, creating a disk of material surrounding it.

Long story short, hydrogen atoms began to fuse into helium, releasing a tremendous amount of energy – and our Sun was born. Even though the Sun ‘gobbled up’ more than 99 per cent of all the stuff in this disk, there was still some material left over.

Bits of this material clumped together because of gravity. Big objects collided with bigger objects, forming still bigger objects . . . Finally some of these objects became big enough to be spheres – and these spheres became planets and dwarf planets.

And – just like that, the Solar System as we know it today was formed.

Space terminology

Do you know constellations from comets? Match the space terminology with the descriptions.

SPACE SPEAK:

1. moon
2. galaxy
3. asteroid
4. black hole
5. comet
6. planet
7. star
8. meteorite
9. constellation

MEANING:

- Rocks floating around in space. Some are the size of a truck, others are hundreds of kilometres in size.
- A collection of hundreds of billions of stars held together by gravity. The one we live in is called the Milky Way.
- A group of stars in the sky that form a pattern when viewed from Earth, such as the Southern Cross.
- A large body in outer space that circles around the Sun or another star.
- A place in space where matter and light cannot escape if they fall in.
- An icy rock that lets off gas and dust, which may form a tail when flying close to the Sun.
- An object that comes from space and survives travelling through the atmosphere to land on a planet’s surface. As it passes through the atmosphere it is sometimes known as a ‘shooting star’ or ‘fireball’.
- A large ball of superheated gas, called plasma, such as our Sun. Comes in many colours such as white, blue, red and yellow.
- A natural object that travels around a bigger natural object. Astronomers usually call them satellites or natural satellites.

What is space junk? Why do we need to track it?

Search ‘space junk’ online and write down three examples or reasons why it may become a problem.

1.
2.
3.

Hello, Pluto!

There used to be nine planets, and now there are only eight. Did one explode? Did it fly out of the Solar System? No, all that happened was that in 2006 scientists decided that Pluto didn’t fit in enough to be considered a conventional planet, so it became one of the five recognised dwarf planets. Pluto’s distance from Earth (as much as 7.5 billion km) makes it difficult to study and explore, but in July 2015, a NASA spacecraft named New Horizons arrived at Pluto after a long journey and took pictures with new detail never seen before.

Pluto discovery

Compared to the other bodies in our Solar System, Pluto is a relatively recent find. When was it discovered?

☐ 1730 ☐ 1830 ☐ 1930

Solar System Play-Do challenge!

Take the ICRAR Play-Do challenge to compare how big planets are in our Solar System. Search online for ‘ICRAR solar system scale’

Name the planets

It is not known with certainty how planets are formed but what we do know is there are eight planets in our Solar System. Can you name them in order of distance from the Sun?

1. 2. 3. 4. 5. 6. 7. 8.

Look up!

Five planets in our Solar System are visible to the naked eye: Mercury, Venus, Mars, Jupiter and Saturn. Check out apps such as ‘Planets’ or ‘Planet finder’ to help you find them in the night sky.

Space invaders: what else is in space besides planets and stars?

There are many other objects in our Solar System as well as the planets and their moons. Some things, such as asteroids, comets and meteoroids, are natural while other ‘invaders’ such as satellites, space junk and robots are artificial. The European Space Agency says that as of January 2018, about 29,000 objects larger than 10cm, about 750,000 objects between 1cm to 10cm and about 166 million objects between 1mm to 1 cm in size are floating in space. A radio telescope in WA, the Murchison Widefield Array, is being used to track space junk and other objects in space so we know where it all is.

Space the final frontier
When the Soviet Union launched the satellite Sputnik in 1957 it set off an era known as the ‘space race’. The Soviet Union was also the first to send a human to orbit Earth, however it was the Americans that achieved the ultimate ‘prize’ – the first to land humans on the Moon. Most of the race for space was led by the Americans and the Soviets but many other countries became involved, including Australia.

Although Australia never landed any people on the Moon we played a crucial role in the 1969 Apollo landing and were involved in several other areas of space exploration and technology. Our role in space has been ongoing since the 1960s and it is ‘heating up’, with a Queensland rocket firm preparing to fire a rocket 40km into the stratosphere and the formation of the Australian Space Agency based in South Australia. Within the next five years, rocket launches from Australian shores will likely be a monthly — even weekly — occurrence.

**Significant space missions**

When the Soviet Union launched the satellite Sputnik in 1957 it set off an era known as the ‘space race’. The Soviet Union was also the first to send a human to orbit Earth, however it was the Americans that achieved the ultimate ‘prize’ – the first to land humans on the Moon. Most of the race for space was led by the Americans and the Soviets but many other countries became involved, including Australia.

Although Australia never landed any people on the Moon we played a crucial role in the 1969 Apollo landing and were involved in several other areas of space exploration and technology. Our role in space has been ongoing since the 1960s and it is ‘heating up’, with a Queensland rocket firm preparing to fire a rocket 40km into the stratosphere and the formation of the Australian Space Agency based in South Australia. Within the next five years, rocket launches from Australian shores will likely be a monthly — even weekly — occurrence.

**Space Search**

Discover some significant missions and vehicles linked to space travel in this word search.

<table>
<thead>
<tr>
<th>I</th>
<th>N</th>
<th>F</th>
<th>G</th>
<th>Y</th>
<th>E</th>
<th>Q</th>
<th>P</th>
<th>N</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>N</td>
<td>I</td>
<td>Z</td>
<td>Q</td>
<td>D</td>
<td>O</td>
<td>A</td>
<td>S</td>
<td>O</td>
</tr>
<tr>
<td>S</td>
<td>R</td>
<td>I</td>
<td>L</td>
<td>W</td>
<td>L</td>
<td>S</td>
<td>T</td>
<td>O</td>
<td>T</td>
</tr>
<tr>
<td>T</td>
<td>K</td>
<td>B</td>
<td>S</td>
<td>L</td>
<td>A</td>
<td>H</td>
<td>R</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>I</td>
<td>Y</td>
<td>O</td>
<td>S</td>
<td>R</td>
<td>B</td>
<td>F</td>
<td>I</td>
<td>O</td>
</tr>
<tr>
<td>I</td>
<td>P</td>
<td>P</td>
<td>L</td>
<td>L</td>
<td>A</td>
<td>S</td>
<td>I</td>
<td>O</td>
<td>V</td>
</tr>
<tr>
<td>X</td>
<td>A</td>
<td>B</td>
<td>I</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>N</td>
<td>N</td>
<td>O</td>
</tr>
<tr>
<td>T</td>
<td>L</td>
<td>N</td>
<td>K</td>
<td>H</td>
<td>B</td>
<td>N</td>
<td>D</td>
<td>P</td>
<td>W</td>
</tr>
<tr>
<td>R</td>
<td>E</td>
<td>G</td>
<td>A</td>
<td>Y</td>
<td>O</td>
<td>V</td>
<td>E</td>
<td>N</td>
<td>H</td>
</tr>
<tr>
<td>R</td>
<td>K</td>
<td>E</td>
<td>P</td>
<td>L</td>
<td>E</td>
<td>R</td>
<td>R</td>
<td>B</td>
<td>I</td>
</tr>
</tbody>
</table>

**CLUES:**

- Vostok
- Apollo
- Voyager
- Pathfinder
- Kepler
- Cassini
- Orion
- Skylab
- Starliner

**Animals in space**

In the early days of humanity’s space programs, no one knew what the effect of weightlessness would be on living beings, so animals were used. On August 19, 1960 the Soviet Union launched Sputnik 5 which carried the dogs Belka and Strelka, along with a grey rabbit, 40 mice, two rats, and 15 flasks of fruit flies and plants. It was the first spacecraft to carry animals into orbit and return them alive. Monkeys have also been used.

**Should animals be used in space experiments? Give one reason for and against this practice.**

**For**

- Scientists can learn about weightlessness and the effects on living species.

**Against**

- Animals suffer and may be killed.

**Space travel is changing...**

Since NASA launched its last space shuttle mission in 2011, Russia’s space agency has been the main organisation taking astronauts into space. Private companies have started to play an increasingly important role in space travel and exploration. Companies like SpaceX and Blue Origin are two of the leaders in the new ‘space race’, with crewless supply missions to the International Space Station, and promises of space tourism.

**Space X**

SpaceX designs, manufactures and launches advanced rockets and spacecraft. The company was founded in 2002 to revolutionise space technology. [www.spacex.com](http://www.spacex.com)

**Blue Origin**

For an impressive insight into space travel, check out the website of Blue Origin, the spaceflight company aiming to take tourists to space and send humans back to the Moon. [www.blueorigin.com](http://www.blueorigin.com)

**Gilmour Space**

A homegrown Aussie company starting low cost launches of satellite technology to space from a shed in Queensland! [www.gspacetech.com](http://www.gspacetech.com)

**Australian connections**

**City of Lights**

John Glenn, the first American to orbit Earth in 1962 on board Friendship 7, passed over Perth three times and declared Perth the ‘City of Lights’. The mission was supported by a tracking station at Muchea, just north of Perth.

**Aussie astronauts**

Adelaide-born Andy Thomas became Australia’s first professional astronaut to travel into space when he boarded NASA’s Endeavour space shuttle, spending 10 days in orbit. (The first Aussie in space was oceanographer Paul Scully-Power, in 1984). Andy went on to complete several NASA missions, including 141 days aboard the Russian space station MIR.

**Australia supporting Apollo 11**

Canberra’s Honeysuckle Creek Tracking Station received the footage of Neil Armstrong’s first steps on the Moon and transmitted it to the world for eight minutes. Then the stronger signal from the CSIRO Parkes Observatory, NSW, took over the broadcast. Honeysuckle Creek was built by NASA for the Apollo Project to keep in constant contact with astronauts, and was critical to the success of the Moon landing. It was in operation from 1967 to 1981. A tracking station in Carnarvon also supported the Apollo missions.

**New Norcia Deep Space Ground Station**

The European Space Agency has its own tracking station here in WA to make sure ESA operators can maintain constant contact with their missions in deep space, such as BepiColombo, ExoMars and Rosetta.
Imagine you were in Esperance the night Skylab crash-landed. Write a headline to describe what you saw.

As NASA, and the world’s media, tracked Skylab’s progress in early July 1979, it seemed it could end up anywhere. In the early hours of July 12, after five years in orbit, Skylab burned-up as it entered the atmosphere, with much of the debris landing in the ocean. Smaller pieces made it to WA’s south-east coast, with debris scattered across the Nullarbor and the eastern Goldfields. Some parts were found in the township of Esperance, on a farm east of Norseman and uninhabited places between.

Locals rushed out to collect debris, and some pieces can still be seen in museums in Esperance and Balladonia. Today, as the 40th anniversary of the event nears, Skylab is a source of pride to the people of Esperance and the Nullarbor, who remember the lights, the sonic boom and the fuss that followed.

Ten years ago there weren’t many professional astronomers in WA, but now there are hundreds of people working to study space, based right here in Perth. But it’s not just astronomers looking up – there are also computing and engineering researchers, who work on designing and building computers and telescopes that astronomers need to learn about what’s out there.

You can study astronomy, engineering or computer science locally at both Curtin University and the University of Western Australia and get involved with the International Centre for Radio Astronomy Research (ICRAR) as part of your studies.

If you want to be part of WA’s astronomy and space research before you’ve finished school you can search online for ‘work experience at ICRAR’ or come along to Perth’s Astrofest held each year in February or March (search online for ‘Perth Astrofest’).

If you’ve got a hankering to help out with some of your spare time, you can also become a citizen scientist and help astronomers make discoveries. Local citizen science astronomy projects include AstroQuest, Radio Galaxy Zoo and Fireballs in the Sky.

Imagining you were in Esperance the night Skylab crash-landed. Write a headline to describe what you saw.