Subject: **Physics**
Topic: **Space physics**
Application: **Space travel**

Using the worksheet and podcast resources

This worksheet is based on the Inventive podcast.

It supports Gatsby Benchmark 4: Careers in the curriculum by introducing a career and role model. The worksheets are based on topics in the KS3 curriculum.

The short audio clips can be used to provide context to the worksheet and could be played during a lesson.

A QR code on the student sheet links directly to the podcast.

KS3 National Curriculum statements

Physics

- Our Sun as a star, other stars in our galaxy, other galaxies;
- The light year as a unit of astronomical distance.

Audio clips from Inventive podcast.

Available from: *nustem.uk/inventive/#sian (scan QR code)*

- **Sian Clip 1:** Describing the space mission;
- **Sian Clip 2:** Project management;
- **Sian Clip 3:** More about the European Space Module panels;
- **Sian Clip 4:** John Chase's rap about the module.

Other resources

Sian's career poster
More information about Sian

Meet the engineer

Sian Cleaver

Spacecraft engineer

Sian Cleaver is a Spacecraft engineer working at Airbus. She is helping to design and build part of the Orion European Service Module so astronauts can return to the moon on NASA's Orion spacecraft. This module generates power using solar panel, controls temperature and provides consumables such as water, oxygen and nitrogen.

Scan the QR code

to access all the resources and the full podcast from: *nustem.uk/inventive/#sian*

This work was supported by EPSRC Engineering and Physical Sciences Research Council

Know

1a. Sun (star), Planet (e.g. Earth, Mercury, Neptune), moon .
1b. Moon, Sun, Neptune, Proxima Centauri.

2.

A - Neptune
B - Mars
C - Sun
D - Earth
E - Moon

3. Accept anything reasonable e.g. water, food, air/oxygen, safe range of temperature/pressure, toilet, communication, power, protection, etc.

Apply

4a. millimetre, inch, metre, kilometre, mile, light year.
4b. Light years are much bigger than metres, and distances in space are extremely large (compared with those on Earth).

5a. 300,000 km; 300,000 x 60 km = 18,000,000 km; 18,000,000 x 8 = 144,000,000 km
5b. 144,000,000 km
5c. 1.3 x 300,000 = 390,000 km
5d. 4.2 x (365x24x60x60) x 300,000 =3.97×10^{13} km (student calculators may not cope with such big numbers; you could just to show them how to work this out or split this question across the Apply and Extend sections)

Extend

6. Accept any sensible answers e.g. :

Type	**Advantage**	**Disadvantage**
Telescope on earth	Cheap, quick to design and build, easy to maintain and upgrade.	Limited range of information that can pass through the atmosphere; light pollution.
Telescope in space	Can take detailed images deep in space. Not affected by the Earth's atmosphere	More expensive than land-based; difficult to upgrade/maintain.
Space probe	Can collect and analyse samples as well as images. Can travel very long distances from Earth/to edge of solar system and cope with wide range of conditions.	More expensive than land-based; difficult to upgrade/maintain.
Space mission (people)	More detailed information and bigger range of experiments can be done; inspirational with spin-off benefits.	Very expensive, complex to design and build; needs a very long planning time; difficult to maintain living conditions; health risks for the crew; cannot travel far.

Worksheet version: 2.0, 2022-06

The solar system and beyond

There are many billions of galaxies in the Universe. Our solar system is a tiny part of a galaxy called the Milky Way.

Our solar system includes the Sun (our closest star), eight planets and their moons, comets, asteroids, and dwarf planets (like Pluto).

- Planets travel around the Sun in nearly circular paths called orbits.
- Our planet, Earth, is the 4th closest planet to the Sun, and orbits once each year.
- Our closest planet is Mars, and the furthest planet in the Solar System is Neptune.
- Our moon takes about 27¼ days to orbit Earth once. Some planets have many moons.

There are planets which orbit stars outside our solar system. These are called exoplanets.

Earth's next closest star is Proxima Centauri.

Astronomers sometimes use light years to represent how far objects in space are away. A light year is the distance light travels in a year.

Light takes about 8 minutes to travel to Earth from the Sun, 251 minutes from Neptune, 4.2 years from the star Proxima Centauri, and about 1.3 seconds from the moon.

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Link to Sian' story

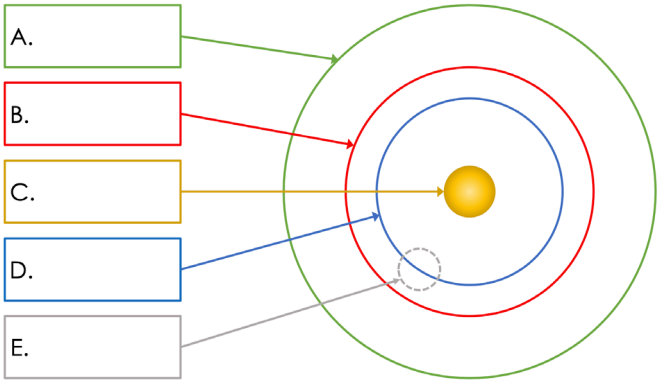
Know

1a. Name three objects found in our Solar System, in order of size (largest first).

1b. List these objects in order of closeness to Earth, closest first:

Moon, Neptune, Sun, Proxima Centauri.

2. Label the diagram on the right. It shows the *Sun*, and the orbits of *Earth, moon, Mars* and *Neptune*. It is not drawn to scale, and the orbits of other planets have been left out.



3. It takes about 3 days to travel to the moon in a space module. List 5 conditions/basic needs that keep astronauts alive and safe on this journey.

Apply

4a. List these units of measurement in order of size with the smallest first.

kilometer, light year, metre, millimetre

4b. Explain why light years are used to measure distances in space.

5. Light travels 300,000 km per second.

5a. How far does light travel in 1 second? In 1 minute? In 8 minutes?

5b. We say the Sun is 8 light-minutes away from Earth. Calculate how far this distance is in km.

5c. The moon is 1.3 light seconds from Earth. Calculate how far this distance is in km.

5d. Extend: Proxima Centauri is 4.2 light years away. How far is this in km?

Extend

6. Space exploration can be done using telescopes on Earth or in space, by sending probes into space and by sending people on space missions.

Compare some advantages and disadvantages of each method, for example cost, planning time (design and build), quality of information gathered. If possible, do some research to learn more about space missions.

Type	Advantage	Disadvantage
Telescope on Earth		
Telescope in Space		
Space probe		
space mission (people)		

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University of Salford MANCHESTER
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