



# BepiColombo Lesson Plan 1 – Introduction

## LESSON OBJECTIVES

1. To introduce students to our solar system, particularly Mercury
2. To understand that we send missions into space
3. To know that BepiColombo is Europe's first mission to Mercury

## BACKGROUND

### BepiColombo

BepiColombo is a joint mission between the European Space Agency, ESA, and the Japanese Space Agency, JAXA. BepiColombo is Europe's first mission to Mercury. It launched in October 2018 and will take 7 years to reach its final orbit around Mercury, so it will arrive in 2025. Even though Mercury is close to Earth, it takes a long time to get into orbit around it. This is because the Sun's gravity is so strong that if you were to send a spacecraft directly towards Mercury, it would fly past it and into the Sun. Hence, BepiColombo needs to slow down in order to get into its orbit around Mercury.

When BepiColombo reaches Mercury, it will split into two spacecraft. ESA's Bepi spacecraft will orbit around closer to the planet, and JAXA's Mio spacecraft will orbit further out, to explore Mercury's magnetic field.

### MIXS – Mercury Imaging X-ray Spectrometer

MIXS is the UK's contribution to the BepiColombo mission and was developed by the University of Leicester. Bepi carries MIXS and so will be orbiting closer to the planet. It will use X-ray fluorescence to determine what the planet's surface is made from. (More information on our website). For the class, this can be explained by saying that MIXS uses X-rays to work out what the surface is made of.

MIXS will look at some craters, as these can tell us more about the different layers of the planet. From this data MIXS can learn about the how Mercury formed and how it changed over time. This will be explored in the second lesson plan.

### Mercury

There have been two previous missions to Mercury – Mariner 10 and MESSENGER, both NASA missions. There is still much to learn about this mysterious planet, as the previous missions raised many questions.

Mercury is a terrestrial planet (one of four rocky planets in the inner solar system) and is the inner most planet in the solar system. It has many impact craters (a depression caused by a smaller body colliding with the planet) which MIXS will look at and use X-ray spectroscopy to determine the composition of the surface.



Mercury has a huge iron core which is unusual – perhaps a huge body the size of the moon impacted Mercury during its formation, and so vast material from the surface was lost. The exact cause of Mercury’s magnetic field is also unknown.

MESSENGER data showed that there is ice in permanently shadowed craters at the poles, which MIXS hopes to survey.

### **LESSON- Total time: 50 minutes**

#### **Introduction – 10 minutes**

Ask the class if they know what the names of the planets in the solar system are. (Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune). Pluto is classed as a dwarf planet.

Ask the students if they have heard of ESA (European Space Agency) before. They may have heard of NASA. Ask them if they know what ESA does.

Explain how NASA is not the only space agency and how other countries, including the UK, have one. (UK Space Agency).

Explain to the students that ESA has launched BepiColombo in October 2018, a mission to Mercury. BepiColombo carries many instruments to learn about the inner most planet to the Sun.

Show the class this YouTube video: <https://www.youtube.com/watch?v=MKEcanjC0eM&t=75s>

#### **Mercury – 10 minutes**

Ask the class what they think Mercury is like. Ask questions about the temperature, and whether we could live there. What challenges will BepiColombo face? They may respond that the Sun is really hot and so BepiColombo needs a way to cool down. BepiColombo will experience extreme temperature differences – on the side of Mercury facing the Sun, temperatures can reach 400 °C, and on the other side can be as low as -170 °C. Brainstorm ideas on the board.

#### **Worksheet – 25 minutes**

Slide 1 should be shown (Mercury).

Ask the class to complete the worksheet provided at the end of this document. Show the MESSENGER picture of Mercury on the board. They may need to be provided with coloured pencils to complete their drawing of Mercury.

For students who finish early, there is an extension. They should be provided with prompts and be encouraged to think about geological features here on Earth. Afterwards, you may discuss with them about craters, volcanism etc, and why there may be different materials on the surface (Leads to next lesson).

#### **Conclusion – 5 minutes**

Explain that Europe’s contribution to BepiColombo is MIXS (Mercury Imaging X-ray Spectrometer), which was developed by the University of Leicester (more information is on the University of Leicester’s website). MIXS is one of the instruments which the Bepi spacecraft carries and will orbit



close to the planet. MIXS will use X-rays to work out what the surface of the planet is made of. Next lesson, we will explore this by doing an experiment.



Name \_\_\_\_\_

# BepiColombo – The Mission to Mercury

BepiColombo is currently on its way to Mercury!

BepiColombo launched in October 2018 and will arrive in December 2025.

The journey to Mercury takes \_\_\_\_\_ years! I will be \_\_\_\_\_ years old when BepiColombo reaches Mercury.

Draw a picture of the planet Mercury

There are 8 planets in our solar system. Can you name them all?

1. M \_ R \_ U \_ Y
2. V \_ N \_ S
3. \_ A \_ T \_
4. M \_ R \_
5. J \_ P \_ T \_ R
6. \_ A \_ U \_ N
7. U \_ A \_ U \_
8. \_ E \_ T \_ N \_



**Extension**

BepiColombo will fly past Earth, Venus and Mercury! Bepi and Mio will orbit around Mercury when they arrive.

Bepi is carrying an X-ray telescope called MIXS which was developed by the University of Leicester. X-rays are a type of light that MIXS will use to work out what the surface of Mercury is made of.

What features can you see on the surface of Mercury? What do you think these are?

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