Your Mission MARS DIARY

ACTIVITY 2.1
GOING THE DISTANCE

From the Chapter Two of the Mission Mars Diary
marsdiary.org/activities/going-the-distance

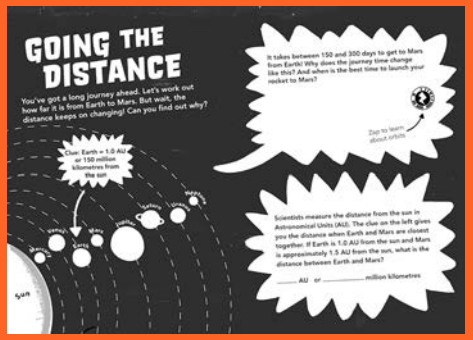
LEARNING LEVEL

KS2, P5-7, Y4-6

CURRICULUM LINKS & DIFFERENTIATION IDEAS

View detailed curriculum links for England, Scotland, Northern Ireland and Wales in the Teacher Toolkit, plus differentiation ideas for your region and year level.

marsdiary.org/resources/#teacher-toolkit



Resources Required

- Smartphone or device for Zap code (optional – see Useful Links)
- Various sized spheres to represent the sun, Earth and Mars

Background to this Activity

This exercise helps students to comprehend the scale of the solar system and the huge distances involved in travel in space. It gives the students a chance to take an overview of the solar system as a whole while also learning about how orbits affect the distances between individual planets. It also introduces students to Astronomical Units (AU).

The distance between the Earth and the sun is about one hundred and fifty million kilometres. This is a big number, and so astronomers use astronomical units to describe this distance. One astronomical unit, or 'AU', is the distance between the Earth and the sun. It is used to compare the distances of other bodies in the solar system, such as the sun, the planets, comets, and asteroids.

This activity also asks students to consider planetary orbits and how these affect distances between the planets. When the planets are closest, it will take six months for astronauts to travel from Earth to Mars. A return trip however will take 500 days. The ExoMars mission launch date will be planned very carefully, taking the orbital paths of Earth and Mars into consideration, so that the ExoMars rover can arrive safely at the landing site on Mars.

Running the Activity

Ask the children to recap what they know about the solar system. Revise the order of planets including Pluto as a dwarf planet. Explore why it was reclassified using other dwarf planets and moons in the Kuiper Belt.

Within the solar system what is moving and what is stationary? Emphasise that the sun doesn't move and the planets orbit around it. Discuss measuring distances from the sun in AUs. Can the children suggest any reasons why scientists use the sun as a starting point for AUs? Watch the clip showing the orbits of planets around the sun (see Useful Links).

What do the children notice? Encourage the children to identify the different lengths of orbits taking place. Explain to students that they are going to look at the distance between Earth and Mars. Ask them to explain why the distance between Earth and Mars might change.

Put students into groups and provide them with spheres to represent the sun, Earth and Mars. Ask them to model the orbits of Earth and Mars based on what they saw in the clip. Challenge the more capable children with a further sphere to represent Earth's moon or alternatively provide more spheres to model the entire solar system.

Solution to the Activity

Distance between Earth and Mars: 0.5 AU or 75 million kilometres

Questions for the Class

- What does orbit mean?
- How do we define a year?
- How long would it take to travel 75 million km to Mars?
- How long is a Martian year? (How long does it take to orbit the Sun?)
- Why do planets have different year lengths?
- Why does the ExoMars rover launch need to take account of the orbital paths of Earth and Mars?

Additional Challenges / Extension Activities

Investigate the AU between the sun and other parts of the solar system such as the dwarf planets.

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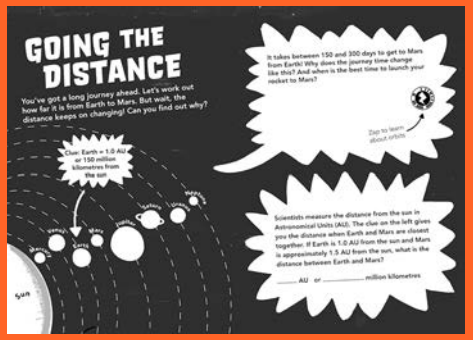

Draw or make a scale model of the solar system using a scaled distance.

Research the similarities between Earth and Mars e.g. number of moons, names of moons, furthest distances apart from each other in AUs and millions of km.

Ideas for Differentiation

Lower:

- Work with a partner to solve the problem
- Provide a word bank to help write an explanation of why the distance between planets keeps changing (e.g. gravity, orbit, speed, planet, sun)

Upper:

- Investigate the AUs between the rest of the planets and Mars. Find the distance from the sun for each planet, then adjust using the AUs from the sun to Mars.
- Write an explanation/answer to the question 'Why does the distance between planets keep on changing?'

Useful Links

Zappar Content: Download or view the Zappar content for this activity on its webpage (URL to the left) or access it via the Zap.

Information about our solar system: https://www.esa.int/esaKIDSen/SEM9BNRD2NI_OurUniverse_0.html

An overview of the planets in our solar system: https://solarsystem.nasa.gov/planets/

Animated clip showing NASA's MAVEN launch in 2014 and explaining how to overcome the orbital differenced between Earth and Mars, to get a spacecraft into orbit around Mars: https://youtu.be/1Hm8b-L62y4

National Geographic clip about our Solar System: https://www.youtube.com/watch?v=libKVRa01L8

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Your Mission MARS DIARY

ACTIVITY 2.2
ASTRONAUTS WANTED

From the Chapter Two of the Mission Mars Diary
marsdiary.org/activities/astronauts-wanted

LEARNING LEVEL

KS2, P5-7, Y4-6

CURRICULUM LINKS & DIFFERENTIATION IDEAS

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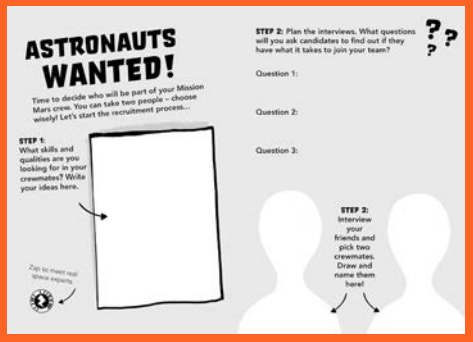

Resources Required

- Smartphone or device for Zap code (optional – see Useful Links)
- Pencils, paper

Background to this Activity

This careers activity invites students to think about the skills, knowledge and experience people might need to go to Mars. Use this activity as a PSHE resource by encouraging students to think about their relationships with others, how to manage risk and make good decisions, and the benefits of having a range of personalities within a collaborative team.

The first humans who travel to Mars will need to be able to take care of themselves and their crew members, as well as having the right skills to set up their living and work environments and conducting scientific research. They will need to be resourceful and good at problem solving, because any help sent to Mars from Earth will take six months to arrive. They will also need to be able to take care of their psychological and emotional needs, because they will be living and working together every day.

The Zap code provides profiles on STEM experts including Tim Peake, Maggie Aderin-Pocock, Sue Horne, Vinita Marwaha Madill and other people with specialist skills.

Running the Activity

Start by discussing personal qualities and strengths and make a list or mind map as a group. Next, talk about who pupil get on with the most and what qualities and strengths these people have.

Introduce the task and the qualities of people that you would chose to go into space with. Pupils must consider how they get on with others, decision making, skills and problem solving abilities. Write down these skills and qualities. Ask each child to prepare some information about themselves.

As a class/group consider what questions to ask interviewees – think about skills as well as personal qualities. Children could take it in turns to interview each other before choosing their two crewmates and drawing their pictures.

Questions for the Class

- What personal qualities do you have?
- What qualities do other people have that you like?
- What happens if you disagree with someone?
- What kind of skills/qualities would you need to have to go into space?
- How do we find out about people? What kinds of questions could we ask?

Additional Challenges / Extension Activities

Pupils present to the class/group their chosen crewmates and why they picked them.

Pupils compare their skills/qualities to the space experts.

Ideas for Differentiation

Lower:

- Discuss in groups rather than class level
- Use pre-prepared questions to choose from

Upper:

- Children could have a go at writing a CV for themselves, take notes from information given by the Space Experts
- Role play an interview

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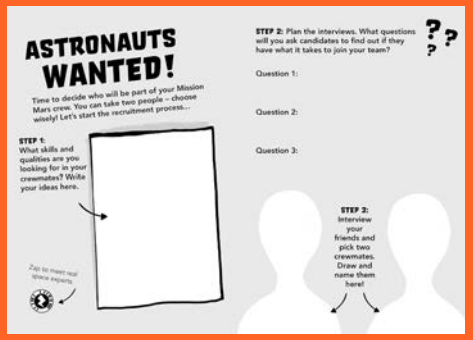

Useful Links

Zappar Content: Download or view the Zappar content for this activity on its webpage (URL to the left) or access it via the Zap.

Meet STEM experts and understand more about their jobs marsdiary.org/get-inspired/

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Your Mission MARS DIARY

ACTIVITY 2.3
EXCESS BAGGAGE

From the Chapter Two of the Your Mission Mars Diary
marsdiary.org/activities/excess-baggage

LEARNING LEVEL

KS2, P5-7, Y4-6

CURRICULUM LINKS & DIFFERENTIATION IDEAS

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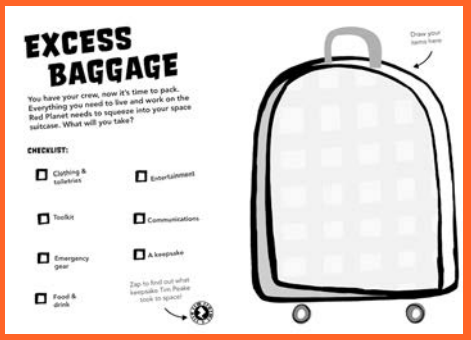

Resources Required

- Smartphone or device for Zap code (optional – see Useful Links)
- Drawing materials

Background to this Activity

When Tim Peake went to the ISS, he was able to take a few personal items with him. Everything he needed for his scientific experiments and wellbeing was already waiting for him on the ISS. But the first humans to travel to Mars will need to take sustainable food and water supplies, scientific equipment, tools to maintain their spacecraft and other machinery, communications systems, safety equipment, medical supplies and entertainment to support mental health.

This activity asks students to consider the essential things humans need to survive, as well as what equipment they would need to carry out their research on Mars. When students write and draw their packing list, they will have to think carefully about what is essential for human welfare and safety. As they can only take a few items, they will have to justify each item and explain why they have made certain choices.

Running the Activity

Begin with talking about what we take on our holidays, either in pairs, small groups or as a class. Why do we choose these items (sun cream, swim suits, shorts and t-shirts etc)? Make a list of things we could take to space – carousel under the headings from the activity checklist. If working in groups, ask each group to add to the list.

Now imagine being the first people on Mars – what will be most essential (food and water, tools etc)? Ask you class to reflect on their initial ideas of what they would take to Mars. Would anyone change or add things? Compare to what Tim Peake took to space. Would they now change anything?

Questions for the Class

- What do we take on our holidays?
- What about different types of holidays?
- Why do we take these things?
- What would we need in space?
- Why would you choose these items?

Additional Challenges / Extension Activities

Children could write a justification of why they have picked certain items.

Ideas for Differentiation

Lower:

- Teacher could prepare pictures of set things – both appropriate and inappropriate – to be taken into space such as computer game and a photo of loved ones. This could scaffold the children's learning and give them an idea of where to start and what things are inappropriate and why.

Upper:

- Children could explore the more technical aspects of items that would have to be taken and their uses for them. They could write a report on what they have packed and why they have packed these items or they could research some of the things that they would need to take and write a report on what these things are and how they work.

Useful Links

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LEARNING LEVEL

KS2, P5-7, Y4-6

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Your Mission MARS DIARY

ACTIVITY 2.4
DESIGN YOUR OWN ROCKET

From the Chapter Two of the Mission Mars Diary
marsdiary.org/activities/design-your-own-rocket

LEARNING LEVEL

KS2, P5-7, Y4-6

CURRICULUM LINKS & DIFFERENTIATION IDEAS

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marsdiary.org/resources/#teacher-toolkit

Resources Required

- Smartphone or device for Zap code (optional – see Useful Links)
- Squared paper, ruler, pencil, rubber etc
- Recyclable modelling materials including boxes, egg cartons etc, sticky tape, glue, scissors etc
- Computers including laptops or tablets and information books
- Construction toys including Lego, Mechano and Polydrons

Background to this Activity

This creative challenge involves research into different types of spacecraft, different shapes and designs and their suitability for the tasks outlined so far.

Spacecraft have two main parts: the rocket, which contains fuel and engines to propel the craft into space, and the capsule, where the astronauts sit and where the payload – supplies and equipment for the mission – are kept. After the launch, the rocket and capsule separate. The rocket returns to Earth and the capsule continues on to its destination.

In December 2015, ESA astronaut Tim Peake travelled to the ISS in a Soyuz rocket. The Soyuz capsule also has a Decent Module, which he used to return to Earth. Diagrams of the Soyuz rocket and capsule are available here: http://blogs.esa.int/VITAmission/2017/07/26/soyuz-ms-spacecraft-in-infographics/

Although the ExoMars mission won't carry any humans, its rocket looks similar to the one which carried Tim Peake. You can watch the launch here: https://youtu.be/p_ApOEVOM0g

To get to Mars, humans will need a space launch system with unprecedented power. NASA is currently developing its Space Launch System – or SLS – which will launch missions exploring deep space, including Mars. SpaceX is also developing rockets capable of carrying humans to Mars. Its Falcon Heavy spacecraft is the most powerful rocket every made. This animation shows it launching, and carrying its payload (which includes humans) into space. https://youtu.be/u26-CIDaazQ

Running the Activity

Children could do this activity in groups or individually. Allow access to books about space and rockets as well as internet access. Lower ability children will need support to access the range of resources and could be guided through this process. Provide lower KS2 children with a list of recommended websites. Upper KS2 will begin to be more independent in finding useful information online.

Allow the children to choose how they wish to present their rocket design – it could be drawn on paper, created using recyclable modelling materials, on the computer etc.

Plenary: Children to present their designs to the class or to another group, discuss the pros and cons of their design.

Questions for the Class

- How is the ExoMars rocket different to the rocket that carried Tim Peake into space?
- Can you think of any alterations, enhancements or differences that would need to be made to carry humans to Mars on a rocket?
- What features or equipment do you think you need to survive on a rocket to Mars?

Additional Challenges / Extension Activities

Encourage the children to reflect on what is good about their design, or on ways that it could be improved. Would this be easily achieved?

Your Mission MARS DIARY

ACTIVITY 2.4
DESIGN YOUR OWN ROCKET

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LEARNING LEVEL

KS2, P5-7, Y4-6

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Ideas for Differentiation

Lower:

- Support the pupils in their research, providing a shorter more comprehensive list of websites to visit or books to look at.
- Discuss the pros and cons of design features prior to beginning the design process and together write a 'success criteria'.
- Allow less 'choice' for lower ability children, giving more scaffolded support.

Upper:

- Encourage the higher ability children to decide on their own 'success criteria' based on their research.

Useful Links

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Tim Peake looks at his Soyuz capsule while it is on display at the Science and Media Museum in London: https://youtu.be/6FHOvZFQ6iA

Charts of rockets from around the world: http://i.dailymail.co.uk/i/graphics/2015/02/space_shuttles_triple/images/small/small.png

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