

Unit 1: How many planets are there in space?

Topics

- space and space travel
- the Hubble Space Telescope

Use of English

passive verbs, *Wh-* questions



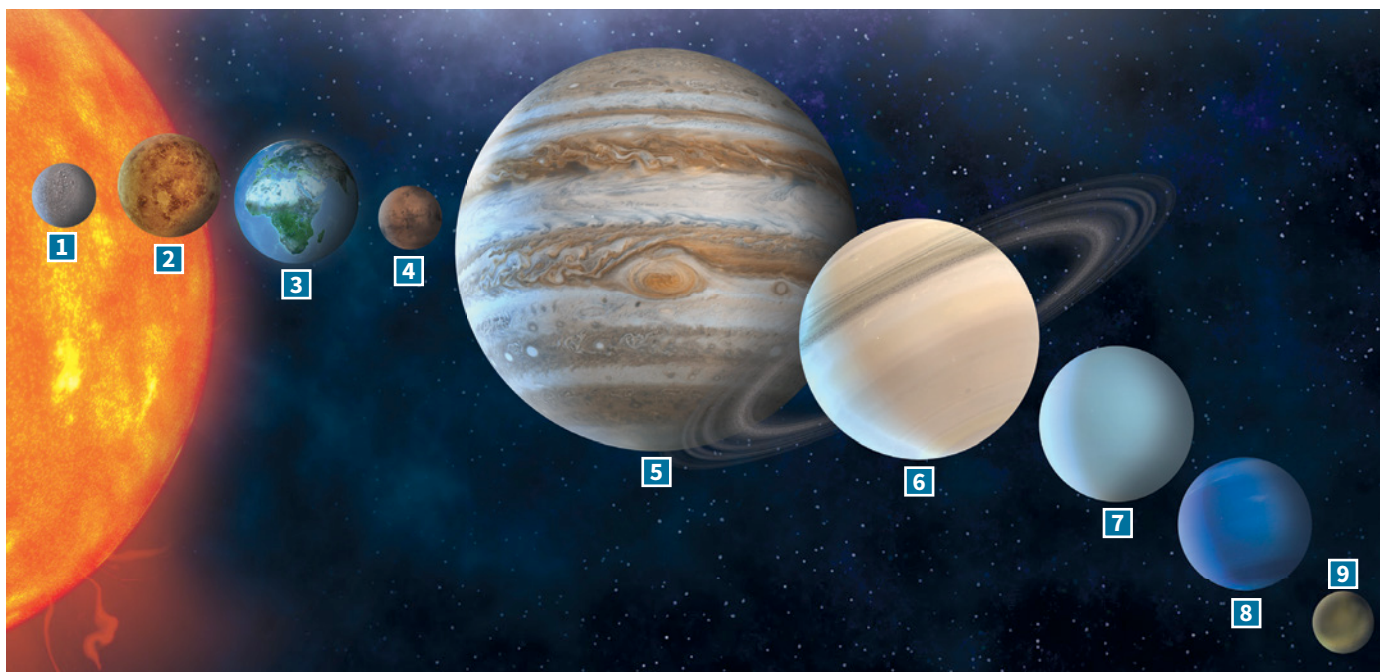
VOCABULARY

dwarf planet an object that is similar to the eight planets in the solar system, but is smaller

A Speaking and thinking

- 1 Our solar system consists of the sun and the planets, their moons and other objects. Discuss what you know about the planets with a partner. Use these questions as a guide.
 - a How many planets are there in our solar system?
 - b Which planets are the biggest and smallest?
 - c What are their names in your language? Do you know the names of the planets in English? Do any of the planets have similar names in your language and in English?
- 2 The scrambled letters below are the names of the eight planets (plus Pluto, which is called a '**dwarf planet**') in our solar system. Copy and unscramble the letters and then match the words to the planets 1–9 in the picture. Use these headings to record your answers in your notebook: **Position/Name**. Compare your answers with your partner's.

- | | | |
|-----------|----------|----------|
| a teenpun | d lotup | g arms |
| b ripejut | e nevus | h heart |
| c curryme | f ratsun | i urnusa |



VOCABULARY

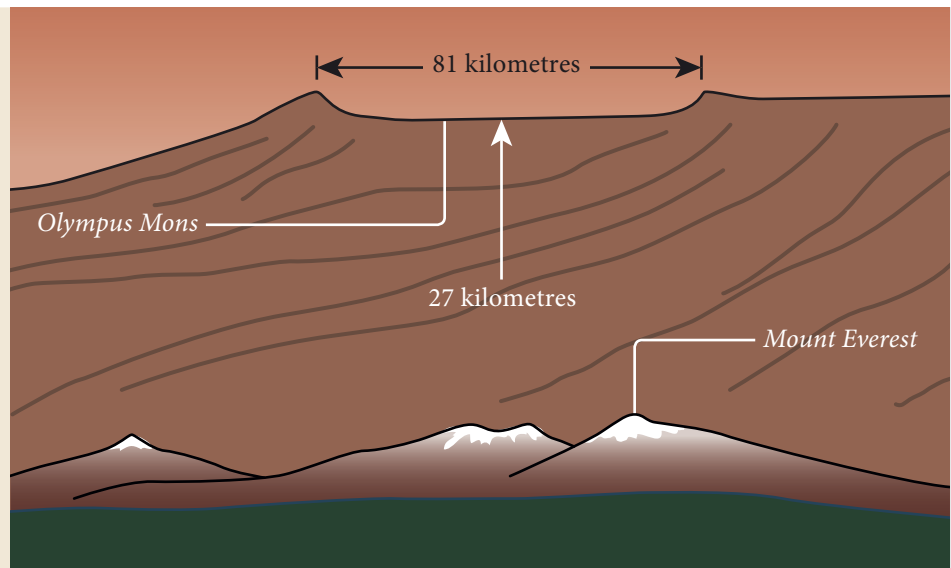
mythical not true or real, imaginary

- 3 Most of the planets are named after a **mythical** Greek or Roman god or goddess.
 - a Do you and your partner know which ones are not?
 - b Are there any myths behind the names of the planets in your own language? What are they?



- 4 Here is a list of gods and goddesses. Match them to the planets. Add the heading **god/goddess** next to **Position/Name** in your notebook and write your answers.
- a God of farming and agriculture and father of Jupiter
 - b God of the sea
 - c God of the sky and heavens and son of Saturn
 - d God of the underworld
 - e God of war
 - f Goddess of love and beauty
 - g King of the gods
 - h Winged messenger of the gods

DID YOU KNOW?

The planet Mars is the home of the largest volcano found in our solar system. The volcano, named 'Olympus Mons', is about 27 kilometres high and its crater (the bowl in the middle) is 81 kilometres wide. How does this compare with the height of Mount Everest on Earth?



B  **Listening**

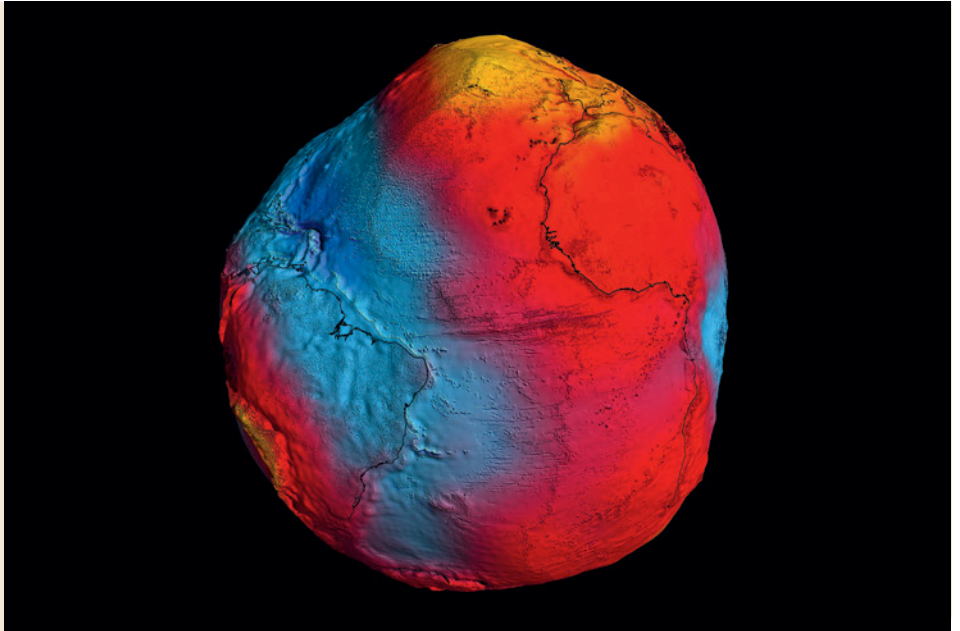
- 1 How do you and your partner think the planets got their names? Why is Mercury named after the winged messenger, for example? What is the connection between the colour or size of a planet and its name? Look at the information in your notebook and at the picture of the planets on page 7, and try to guess how the planets got their names.
- 2  Listen to Taran talking about how the planets got their names. Were your ideas in Activity B1 correct?
- 3  Listen again and answer these questions. Compare your answers with your partner's.
 - a When were the planets Jupiter, Saturn, Mars, Venus and Mercury named?
 - b Write the dates when these planets were discovered:
 - (i) Uranus, (ii) Neptune, (iii) Pluto.
 - c Which planet travels around the sun in 88 days?
 - d What is the association between the planet Mars and the colour red?
 - e Which planet is the king of all the planets?
 - f Why is Neptune named after the mythical god of the sea?
 - g Which planet is always in the dark?

C Use of English: Passive verbs

- Look at these sentences taken from Section B. What do you notice about the underlined verbs? Can you give the verbs a name?
 - ... all of the planets, except for Earth, are named after Greek and Roman gods and goddesses. Jupiter, Saturn, Mars, Venus and Mercury were given their names thousands of years ago ...
 - ... Mars is red in colour and this colour was associated with blood in battles.
 - Pluto, which is no longer classified as a planet, is the furthest from the sun ...
- The underlined verbs are all forms of the passive. *Who* or *what* is the person or thing affected by each action? Do you know *who* the doer is?

DID YOU KNOW?

The earth is not round; in fact, it is geoid. This means that the round shape has a slight bulge (or lump) towards the equator, the imaginary circle around the earth. What other 'shape' words do you know?



Passive verbs

We use the passive to focus on the person, or thing, affected by an action, rather than on the person, or thing, that performs that action (the doer).

With your partner, look again at the three sentences in Activity C1.

How is the passive formed? Copy and complete the following sentence.

*The passive is formed with the verb **to** ... , followed by the ... of a main verb.*

- Now copy the table and complete the 'Tense' column.

To be	Past participle	Tense
are	named	present simple
were	given	...
was	associated	...
is	classified	...

- 4 How are the present perfect passive and the past perfect passive tenses formed? Look at the table on page 9 for help in working it out.
- 5 Have you heard of the Hubble Space Telescope? What do you and your class know about it?
- 6 Read the following text about the Hubble Space Telescope. In your notebook, write the correct passive form of the verbs in brackets.

Out of this world

the Hubble Space Telescope (HST)

- [1] The Hubble Space Telescope **(a)** ... (*launch*) in 1990 by the space shuttle *Discovery* and it orbits the earth about 610 kilometres above us. Scientists and star gazers **(b)** ... (*delight*) by Hubble's pictures ever since its launch.
- [2] The Hubble Space Telescope is as large as a school bus and looks like a five-storey tower of silver cans. Each one of the cans holds important telescope equipment: the mirrors, computers, imaging instruments, and pointing and control machines. Solar panels **(c)** ... (*use*) for generating electricity, and antennas communicate with scientists on Earth.
- [3] The 11,110-kilogram telescope collects starlight with a 2.4-metre-diameter mirror. The mirror, which **(d)** ... (*hide*) inside a long, hollow tube that blocks the glare from the sun, Earth and the moon, **(e)** ... (*slightly curve*) to focus and magnify light.
- [4] Hubble is not like a normal telescope on the ground because astronomers cannot look through Hubble's lens to see the planets and stars.

Instead, Hubble's scientific instruments are the astronomers' electronic eyes. By closely studying the colours of light from a star, astronomers can understand the star's temperature, its movements, what it **(f)** ... (*make*) of and its age.

- [5] When Hubble collects pictures and data, information **(g)** ... (*turn*) into long strings of numbers that **(h)** ... (*transmit*) as radio signals. This information, which **(i)** ... (*send*) back to Earth, **(j)** ... (*stream*) through a series of satellite relays to the Goddard Space Flight Center, Maryland, USA, and then by telephone line to the Space Telescope Science Institute, where the numbers **(k)** ... (*turn*) back into pictures and data.
- [6] The information, which **(l)** ... (*collect*) daily by Hubble, **(m)** ... (*store*) on computer disks. A single day's worth of observations would fill an encyclopaedia! The constantly growing collection of Hubble pictures and data is a unique scientific resource for current and future astronomers.

Adapted from www.stsci.edu



DID YOU KNOW?

The Hubble Space Telescope moves at a speed of more than 28,150 kilometres per hour! Nothing on land or water can beat this. Do you know what living thing moves at the fastest speed on Earth?

D Reading

- 1 Before humans went into space, animals were used as the first space travellers. In small groups, discuss these questions.
 - a Why do you think this happened?
 - b What do you think about sending animals into space?
 - c Do you think it is acceptable to send some animals but not others? Which ones? Why?
 - d Some planets are so far away that it is impossible for animals (or humans) to travel to them. What is the solution to this problem?



- Look at the picture above. What does it show you? What do you think it is called? Where is it? What can it do?
- Here are five dimensions for the machine in the picture. Decide what each one refers to.

2 metres 3 metres by 2.8 metres 2.1 metres
900 kilograms 50.8-centimetre diameter

- You are going to read about NASA's Mars rover, *Curiosity*. First, work with a partner and use paper or digital reference sources to check the meaning of the following words.

altitude ambitious centrepiece daring habitable
manoeuvres obstacles severed withstand zap

- Copy the following table and complete it using the words from Activity D4.

Word	Translation	Grammar	Example sentence
altitude	...	noun	The spacecraft flew at an altitude of 5 kilometres above Earth.

- Skim the text, *Mars Curiosity: Facts and information* on page 12 to check your answers to Activity D3. Do not worry about the gaps for the moment.
- Complete the gaps a–j in the text using the words from Activity D4.
- Answer these questions about the text.
 - What are the two main objectives of the Mars *Curiosity* mission?
 - Why is *Curiosity*'s large size an advantage?
 - What is the difference between a Martian year and an Earth year?
 - How long did it take MSL to reach Mars?
 - Which word describes MSL's entry into Mars's atmosphere?
 - What three things were used to slow down MSL before it landed on the surface of Mars?

DID YOU KNOW?

On 12th April 1961, Russian cosmonaut Yuri Gagarin became the first man in space. Gagarin's spacecraft, *Vostok 1*, completed one orbit of Earth and landed about two hours later. Gagarin had to jump out and land using his parachute because *Vostok 1* was designed to crash land! Do you know who the most recent space traveller is?

Mars *Curiosity*: Facts and information

[1] The Mars Science Laboratory and its rover **(a)** ... , *Curiosity*, is the most **(b)** ... Mars mission ever flown by NASA. The rover's primary mission is to find out if Mars is, or was, suitable for life. Another objective is to learn more about the red planet's environment.

[2] *Curiosity*'s large size allows it to carry many scientific experiments that will be able to **(c)** ... , analyse and take pictures of any rock within reach of its 2-metre arm. *Curiosity* is about the size of a small sports utility vehicle (SUV). It is 3 metres by 2.8 metres wide, about 2.1 metres high and weighs 900 kilograms. *Curiosity*'s wheels have a 50.8-centimetre diameter.

[3] Engineers at NASA's Jet Propulsion Laboratory designed the rover to roll over **(d)** ... up to 65 centimetres high and to travel about 200 metres per day. The rover's power comes from a multi-mission power generator, which produces electricity from the heat of plutonium-238's radioactive decay. The power supply should last a full Martian year (687 Earth days) or more.

A complicated landing

[4] The \$2.5-billion Mars Science Laboratory (MSL) spacecraft launched from Cape Canaveral, Florida, on 26th November 2011, and arrived on Mars on 6th August 2012, after a **(e)** ... landing sequence that NASA called 'Seven Minutes of Terror'. Because of *Curiosity*'s weight, the rover had to go through an extremely complicated sequence of **(f)** ... to land.

[5] Firstly, from a fiery entry into the atmosphere, a supersonic parachute was needed to slow down MSL. NASA officials said the parachute would need to **(g)** ... 29,480 kilograms to break the spacecraft's fall to the surface. Under the parachute, MSL let go of the bottom of its heat shield, so that it could get a radar fix on the surface and calculate its **(h)** The parachute could only slow the spacecraft to 322 kilometres per hour, which was still far too fast

for landing. To solve the problem, engineers designed the assembly to cut off the parachute and use rockets for the final part of the landing sequence.

[6] Then, about 18 metres above the surface, MSL's 'sky crane' was used. The landing assembly dangled the rover 6 metres below the rockets. Falling now at 2.4 kilometres per hour, MSL gently touched the ground at about the same moment the sky crane **(i)** ... the link and flew away, crashing into the surface. NASA personnel tensely watched the rover's descent on live television. When they received confirmation that *Curiosity* was safe, engineers pumped fists and jumped up and down in jubilation. News of the landing spread through social media, such as Twitter and Facebook, and traditional outlets, such as newspapers and television.

Primary mission: Can, or could, Mars support life?

[7] *Curiosity*'s main mission is to determine if Mars is, or was, suitable for life. While it is not designed to find life itself, the rover carries a number of instruments on board that can bring back information about the surrounding environment. Scientists were excited when the rover beamed back information showing that Mars had had **(j)** ... conditions in the past. Powder from the first samples that *Curiosity* obtained included the elements of sulphur, nitrogen, hydrogen, oxygen, phosphorus and carbon, which are all considered 'building blocks' or fundamental elements that could support life. While this is not evidence of life itself, the find was still exciting to the scientists involved in the mission.

'A fundamental question for this mission is whether Mars could have supported a habitable environment,' stated Michael Meyer, lead scientist for NASA's Mars Exploration Program. 'From what we know now, the answer is yes.' And the search continues ...

Adapted from www.space.com

E Use of English

Wh- questions

When you want to get a more detailed answer you should use a *wh*-question. To make a *wh*-question in English, use this word order: question word (*who, when, etc.*) + auxiliary verb (*were, have, did, etc.*) + subject (*she, we, astronauts, etc.*) + main verb (*go, know, fly, etc.*)

If *who, what* or *which* is the **subject**, it is not possible to use *do*.

What slowed down the MSL spacecraft?

If *who, what* or *which* is the **object**, use *do*.

What did MSL transmit back to Earth?

PREFIXES

We can add *prefixes* to the beginning of words in order to change their meaning. A prefix can be a letter or group of letters. Look at these examples from the texts in this unit:

discovered, telescopes, kilometres, diameter, radioactive, supersonic.

What do you think these prefixes mean? Use a dictionary, or other reference source (paper or digital), to help you find out. Do you use similar words in your own language? Can you think of any other English words that begin with these prefixes? Start keeping a list of commonly used prefixes.

- 1 Decide if *who, what* or *which* is the subject or the object in each of the questions below. Then answer the questions. The first one is an example.
 - a **What** did NASA engineers design the rover to do?
Example: *What = object. Engineers designed the rover to roll over obstacles.*
 - b **Who** called MSL's landing sequence 'Seven Minutes of Terror'?
 - c **What** was needed to slow down MSL?
 - d **Who** watched the rover's landing on television?
 - e **Which** social media spread the news about the landing?
 - f **What** samples do you think *Curiosity* collected?
- 2 In your notebook, write questions for the following answers. Compare your questions with a partner's. The first one is an example.
 - a Its heat shield.
Example: *What did MSL let go of?*
 - b Engineers. **Who designed the assembly to ... ?**
 - c The skycrane. **What severed ... ?**
 - d Rockets. **What was ... ?**
 - e If Mars is suitable for life.
 - f They felt excited.

F Writing

- 1 In the three listening and reading texts there have been many expressions that tell us *when* something happened. Look at these examples of *time sequencers*.
Listening text: ... *thousands of years ago* ... , ... *until much later* ... , ... *more recently* ... , ... *as recently as 1930* ...
Out of this world text: ... *in 1990* ... , ... *ever since its launch* ...
Look at the Mars *Curiosity* text and find examples of time sequencers.

- 2 Look at these notes about space achievements:
 - 12th April 1961 – first human in space, 320 kilometres above Earth
 - 18th March 1965 – first spacewalk (12 minutes)
 - 11th October 1968 – first live television pictures from space
 - 20th July 1969 – first man on moon, collected 21 kilograms of lunar rock
 - 17th July 1975 – first international space meeting between USA and Russian astronauts

Look again at the listening and reading texts in this unit. Choose **at least four** more important space achievements and add them to the list above.

- 3 For each note (you should have nine or ten now), write a sentence. Then put the sentences into a paragraph. Try to use the time sequencers from this section, plus any others that are appropriate.
- 4 Look at the following notes about missions into space. Use the notes to write a paragraph. Look at the example first.
 - a early 1960s / many attempts made / USSR / reach Mars / but / all ended / failure / for different reasons
Example: During the early 1960s, many attempts were made by the USSR to reach Mars, but all ended in failure for different reasons.
 - b first success / 1964 / USA *Mariner 4* / sent back 21 images
 - c late 1960s / more USSR attempts / none successful / because / launch failure
 - d 1971 / USSR first success / *Mars 3 Orbiter-Lander* / sent back data for eight months / and landed on Mars / but / only 20 seconds of data
 - e mid 1970s / USA *Viking 1* and 2 Orbiter-lander / 16,000 images returned / large quantity of data and soil experiments
 - f 1980s and 1990s / mostly failures / USA, USSR, Japan
 - g 1985 / Sultan bin Salman Al Saud / join / international crew / on *Discovery* / launch satellite / space
 - h early to mid 2000s / plenty of USA success / sending back enormous amounts of data
 - i 2012 / Chinese astronauts / eat / fresh vegetables / gardens / extra-terrestrial bases in space

DID YOU KNOW?

Mars is mostly a very cold desert. Even in the warmest parts, its maximum temperature is about -5°C . The minimum temperature is about -87°C . Water cannot exist in liquid form on Mars, although it is believed there might have once been rivers and streams on the planet. What is the temperature on the other planets? Find out!

G Project work

- 1 You have learned a lot about the planets and space in general in this unit. What do you think is the most interesting thing you have learned? Why? Use the Internet and reference books to find out as much as you can about your choice, then produce an illustrated poster that you can display in your classroom. Be prepared to present your research to your class and to answer any questions.