Explore the moons of our Solar System
Key Stage 2

Topics covered: features (*properties and characteristics*) of some of the moons of the Solar System

Watch the video "Exploring Moons"
https://vimeo.com/323699722

Introduction

There are over 200 moons in our Solar System and they come in different shapes and sizes. Some moons have active volcanoes on their surface while others blast jets of material into space!

This resource is aimed at KS2 and will explore some of the moons of the Solar System. We will be starting off with a few teacher notes to give you an outline of the activities included and information you may find useful. You will then find a handout, printable activity sheets and answer sheets. For further exploration on the topic of moons of the Solar System, we have included a link to NASA's Solar System website – enjoy!

Teacher's Notes:

We recommend that you start off by showing your students our video 'Exploring Moons'. The video is available on our website (https://www.rmg.co.uk/discover/teacher-resources/exploring-moons) and on our Vimeo page (https://vimeo.com/323699722).

There are five activities included in this resource for your students to try. Each activity includes written instructions for the students. We recommend printing the activities on A4 sheets of paper.

In "**Decode the message**" (pages 9 - 10), students are given a coded message. By solving some mathematical problems, students will be able to crack the code and read the message.

The activity "**Base camp on the Moon**" (pages 11 - 12) consists of two parts. In the first part, students are asked to write a list of items they would take with them to the Moon. For this part of the activity, ask your students to think about what they would need in order to live and work on the Moon. In the second part, students are asked to draw what they think a future base camp on the Moon would look like. This ties in to the section of the video that talks about the possibility of building a base camp on the Moon.

On page 13 you'll find the activity "**Moon maths**". In this activity, students will explore fractions by looking at the number of known moons per planet in our Solar System.

On pages 14 – 15 you'll find the activity "**Compare the moons**". Using scaled drawings of some moons, students will measure the diameters of the moons and use their measurements to compare the sizes of the moons.

In "**Orbital periods of the moons**" (pages 16 - 17), students will compare orbital periods of some of the moons of our Solar System. To do this, they will need to convert the units of some of the given orbital periods.

Solutions to the activities are provided at the end of the document.

Further exploration of the topic: Visit the NASA Solar System website: https://solarsystem.nasa.gov/moons/overview/

Many marvellous moons!

What is a moon?

A moon, also known as a natural satellite, is a celestial body that orbits (goes around) a planet, dwarf planet or asteroid. The image on the right shows Asteroid Ida along with its moon Dactyl.

There are over 200 moons in our Solar System and they come in different shapes and sizes. Some moons have active volcanoes on their surface while others blast jets of material into space!

Planets and their moons

Astronomers have discovered moons around most of the planets in our Solar System. Below are the number of known moons as of January 2024

Planet	Number of known moons
Mercury	0
Venus	0
Earth	1
Mars	2
Jupiter	95
Saturn	146
Uranus	27
Neptune	14

Mercury and Venus don't have any moons. Mercury is the closest planet to the Sun and, because of the Sun's strong gravity, the planet wouldn't be able to hold on to a moon. Scientists still don't understand why Venus doesn't have a moon and they're working hard to solve that mystery.

Let's explore some of the moons of our Solar System.

Planet: Earth
Number of moons: 1

Our Earth only has one moon which we call the **Moon.** It's our closest neighbour in space and is, on average, 384,400 km away from the Earth. Our Moon formed from the debris (*scattered pieces or remains*) of a large object colliding with the young Earth. There is no air on the Moon but we know that there is a bit of water trapped under the surface. Our Moon is the fifth largest moon in the Solar System.

Features on the Moon

Our Moon is covered with craters which were created by space rocks that smashed into the surface. Some impacts threw up lots of material that fell back onto the surface producing bright rays that extend far from the craters. We also see lighter and darker regions on the surface. The lighter regions are called the lunar highlands while the darker regions are called the seas. Early observers thought that the Moon was covered in water which is why they called the darker regions seas. Thanks to observations that scientists have made, we know that the darker areas are where lava once flowed, then cooled down and became solid. Even though there are no real seas on the Moon, we still call the darker regions the seas.

The Moon – near side

The Moon – far side

The side of the Moon that we can see here from the Earth is called the **near side** and the side we can't see is called the **far side**.

Have any astronauts been to the Moon?

Yes! NASA's Apollo space programme sent astronauts to the Moon and 12 of those astronauts have walked on its surface. During their missions, the astronauts collected samples of the surface of the Moon and they performed scientific experiments.

The astronauts who walked on the Moon are:

Apollo Mission	Astronauts
11	Neil Armstrong (1st man on the Moon) Edwin "Buzz" Aldrin
12	Pete Conrad Alan Bean
14	Alan Shepard Edgar Mitchell
15	David Scott James Irwin
16	John Young Charles Duke
17	Eugene Cernan Harrison Schmitt
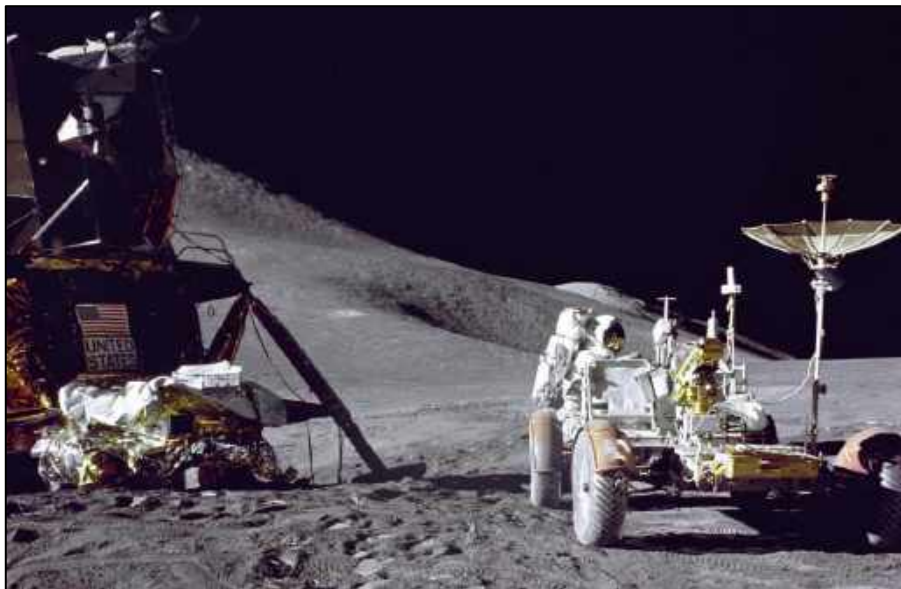
Astronauts of Apollo missions 15 – 17 had a Lunar Rover and could drive around on the surface of the Moon!
Image Credit: NASA

Planet: Mars
Number of moons: 2

Mars has two moons called **Phobos** and **Deimos**. Both moons look very different to our own Moon. Though they probably formed in a similar way to our own Moon, many scientists think that the moons of Mars were asteroids pulled into orbit by the planet's gravity. The moons of Mars are much smaller than the Moon – Phobos is only 23 km across and Deimos is only 12 km across. Phobos and Deimos are much closer to Mars than the Moon is to the Earth. Phobos is just over 9,000 km and Deimos just over 23,000 km away from Mars.

Planet: Jupiter
Number of moons: 95

The four largest moons of Jupiter are the Galilean moons **Io** ("eye-oh"), **Europa**, **Ganymede** and **Callisto**. The moons were discovered by Galileo Galilei in 1610. Io is the most volcanically active body in the Solar System and is covered with hundreds of volcanoes. Europa is an icy moon and is the smallest of the Galilean moons. Scientists think that Europa has a salt-water ocean hidden beneath its icy surface. Ganymede is the largest moon of Jupiter and the largest moon in the Solar System – it's even bigger than the planet Mercury! The surface of Callisto is covered in craters which makes this moon the most heavily cratered object in our Solar System.

Planet: Saturn
Number of moons: 146
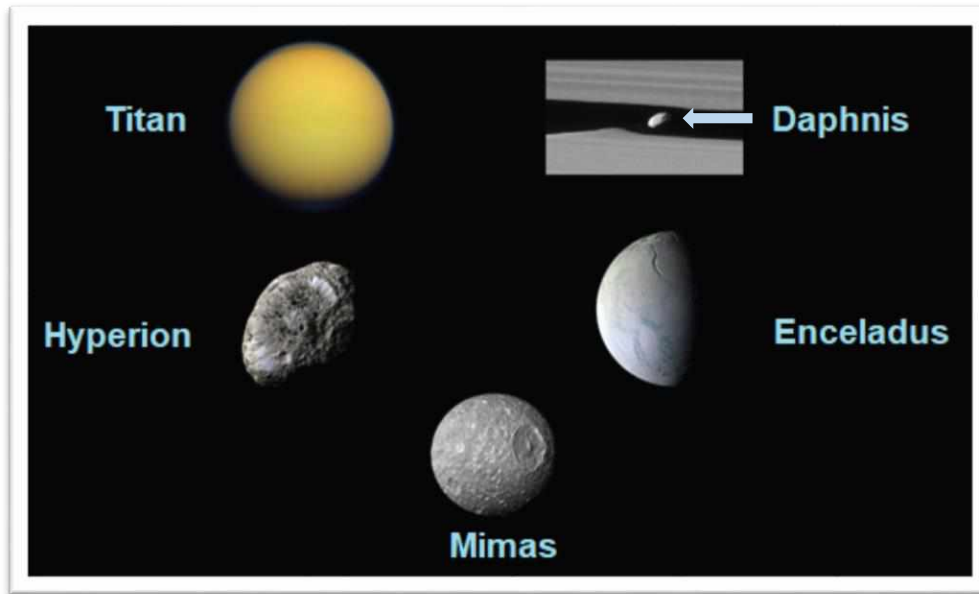
With over 100 moons, Saturn is home to some of the strangest moons of our Solar System. Let's have a look at some of the moons of Saturn. **Titan**, the largest moon of Saturn, is the only moon in the Solar System that has a thick atmosphere and the only other body that has liquid on its surface. We don't find liquid water on Titan, the temperatures are far too cold for water to be a liquid, but we've found liquid methane and ethane. **Enceladus** is an icy moon and, just like Jupiter's moon Europa, scientists think there is an ocean of water underneath an icy shell. NASA's Cassini spacecraft spotted jets of water vapour and ice particles blasting out near the south pole of Enceladus which supports the idea of a subsurface ocean. **Hyperion** is shaped like a potato but looks like a sponge. Scientists think that this moon might be the remains of a bigger moon that was destroyed by a big impact. **Mimas** looks just like the Death Star from Star Wars! The big impact crater on Mimas is called Herschel crater. Some of the smaller moons of Saturn, including the moon **Daphnis**, orbit inside the planet's rings. We call these moons the 'shepherd moons' because they act like shepherds and keep the ring particles in place.

Planet: Uranus
Number of moons: 27

The best images that we have of the biggest moons of Uranus were taken by the Voyager 2 spacecraft. Just like Frankenstein's monster, **Miranda** looks like it was put together with pieces that don't quite fit together properly. Miranda is home to the tallest cliff in the Solar System – it's around 10 kilometres high! **Titania** is the largest moon of Uranus and is covered with craters and canyons.

Planet: Neptune
Number of moons: 14

Triton is the largest of moon of Neptune. This icy moon has active ice volcanoes and geysers spewing material out onto the surface of the moon. Part of the surface of Triton looks like a cantaloupe (a type of melon).   This moon is one of the coolest objects in our Solar System with a surface temperature of -235 degrees Celsius!

Dwarf planet: Pluto
Number of moons: 5

The largest moon of Pluto is called **Charon** and it is almost half the size of Pluto. NASA's New Horizons spacecraft returned the only close-up images we have of the moon. The images revealed that Charon is covered in craters and has a canyon that is far longer and deeper than the Grand Canyon on Earth.

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Activity: Decode the message

When the Apollo 11 mission landed on the Moon, astronaut Neil Armstrong sent a message back to the Earth. Solve the problems below to read the message. We've done problem for you and filled in the corresponding letter in the message on the next page.

A	22+41	
B	$\frac{1}{4}$ of 28	
C	0.5 x 2	
D	2 x 47	
E	113 - 40	
F	$\frac{7}{8}$ of 40	

N	$\frac{6}{7}$ of 49	
O	65 - 39	
P	10 x 4	
Q	$\frac{150}{10}$	15
R	0.1 x 100	
S	77 + 21	

G	$\frac{45}{5}$	
H	2 x 25	
I	42 - 29	
J	38 + 37	
K	$\frac{1}{3}$ of 81	
L	0.3 x 20	
M	24 ÷ 8	

T	$\frac{1}{10}$ of 80	
U	51 - 35	
V	40 ÷ 20	
W	0.8 x 30	
X	19 + 11	
Y	$\frac{36}{3}$	
Z	$\frac{1}{5}$ of 20	

Neil Armstrong's message:

First sentence

1st word:
_____
50   26   16   98   8   26   42

2nd word: **Q**
_____
8   10   63   42   15   16   13   6   13   8   12

3rd word:
_____
7   63   98   73

4th word:
_____
50   73   10   73

Second sentence

1st word:
_____
8   50   73

2nd word:
_____
73   63   9   6   73

3rd word:
_____
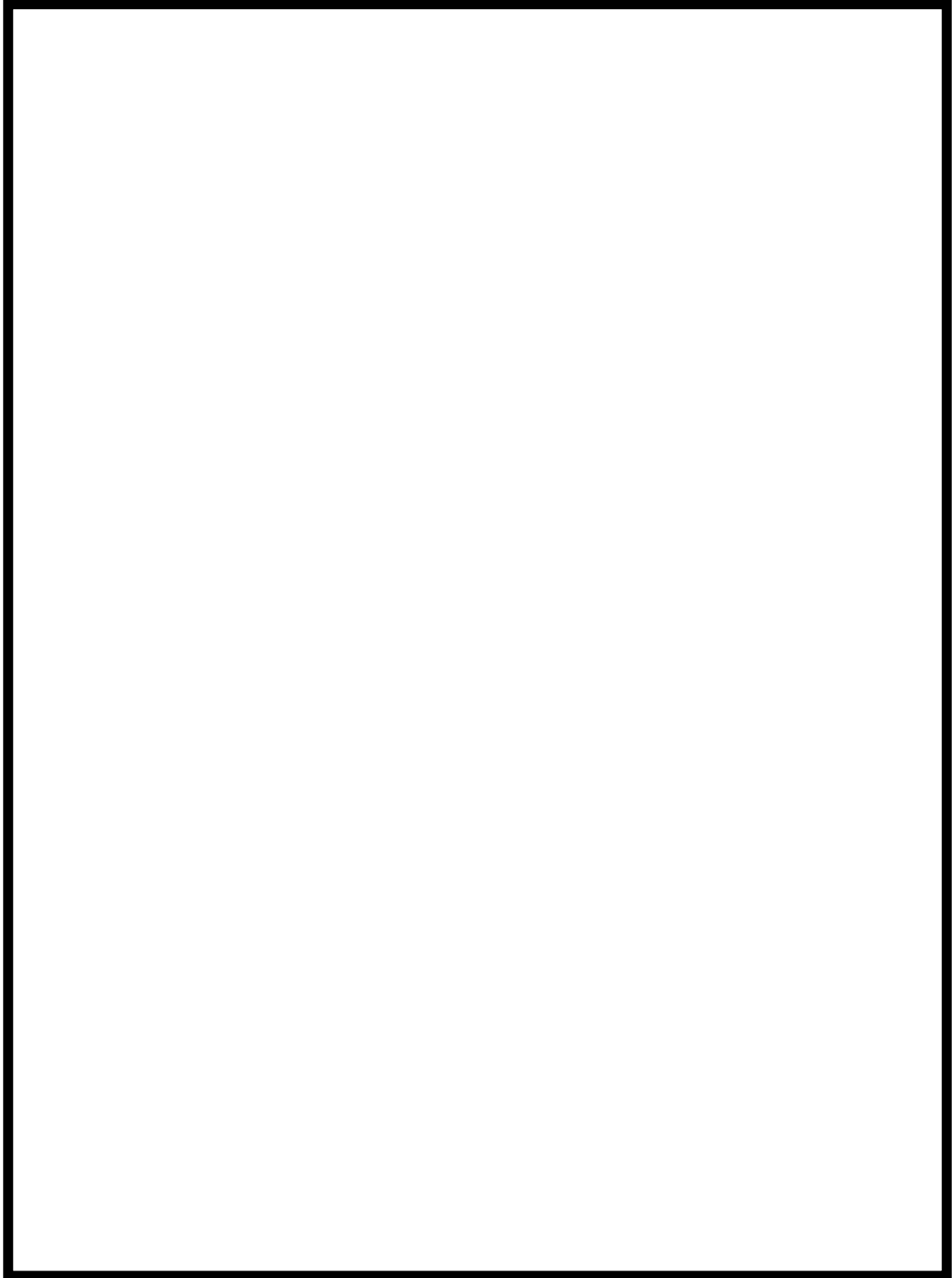50   63   98

4th word:
_____
6   63   42   94   73   94

Write out the message:

_____

_____

_____

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Activity: Base camp on the Moon

Scientists are planning to return to the Moon to set up a base camp that can be used by astronauts. Astronauts will live and work in the base camp. There is no supermarket on the Moon, so astronauts will need to take everything they need with them to the Moon. What would you pack if you were going to live on the Moon? Write down your list of items below.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Draw a lunar base camp:

In the box below, draw what you think a future base camp on the Moon would look like.

Activity: Moon maths

Listed in the table below are the number of known moons in our Solar System (**As of January 2024**):

Planet	Number of known moons
Mercury	0
Venus	0
Earth	1
Mars	2
Jupiter	**95**
Saturn	**146**
Uranus	27
Neptune	14

Answer the questions that follow using information provided in the table above.

1. Calculate the total number of moons orbiting the planets in our Solar System.

2. What fraction of the total number of moons orbit the planets Jupiter and Neptune?

3. What fraction of the total number of moons are found beyond Saturn?

4. How many moons orbit the Gas Giants?

5. What fraction of the total number of moons orbit the rocky planets?

6. Compared to Uranus, how many more moons does Saturn have?
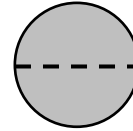
Activity: Compare the moons

Shown below are scaled drawings of some of the moons of our Solar System. The diameter of each moon is indicated by the dashed line.
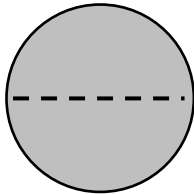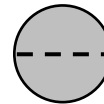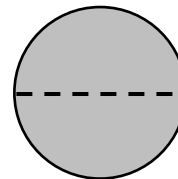
Europa
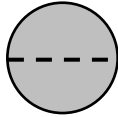
The Moon

Ganymede
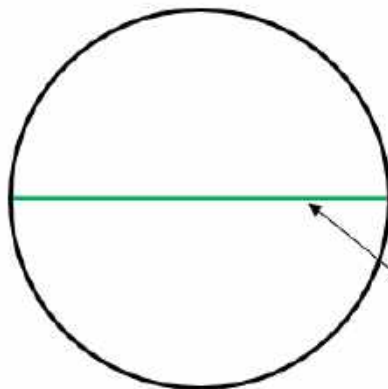
Triton

Titania

Callisto

In this activity, you will compare the sizes of the moons.

Refresh: What is the diameter of a circle?

The diameter of a circle is the length of a line through the centre, from one edge to another.

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1. Use a ruler to measure the diameters of the moons. Write your answers, rounded to the nearest millimetre, in the table below.

Moon	Diameter (mm)
Europa	
The Moon	
Ganymede	
Triton	
Titania	
Callisto	

2. List the moons in order of **decreasing** diameter.

3. How many times bigger is Europa compared to Titania? Round your answer to the nearest whole number.

4. Which moon is just over half the size of Ganymede?

5. This is a scaled drawing of the Earth:
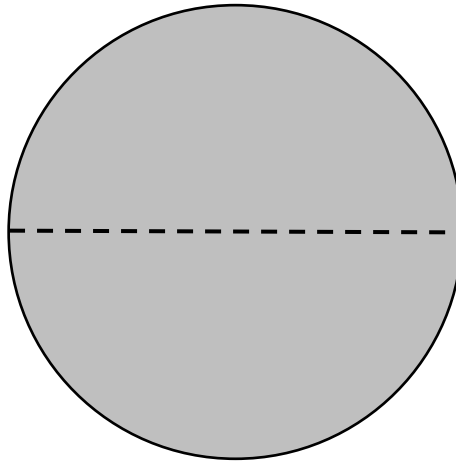
How many times bigger is our Earth compared to the Moon? Round your answer to the nearest whole number.

Activity: Orbital periods of the moons

Listed in the table below are the orbital periods of some of the moons of our Solar System. The orbital period of a moon is the time it takes for the moon to go once around its planet.

Moon	Orbital Period
The Moon	27.3 days
Phobos	0.32 days
Deimos	30 hours
Io	1.8 days
Ganymede	7.2 days
Daphnis	14 hours
Titan	381.6 hours
Mimas	22.6 hours
Miranda	33.6 hours

Read through the section below before beginning the activity on the next page.

Converting units of time

In the table, we can see that the orbital periods of some moons have units of days but others have units of hours. We can convert the units of time by following the steps below.

1. Converting days into hours

In one day there are 24 hours:

$$1 \text{ day} = 24 \text{ hours}$$

To convert from days into hours, **multiply the number of days by 24**. For example, if a moon has an orbital period of 2 days, then its orbital period in hours is:

$$\text{Orbital period in hours} = 2 \times 24 = 48 \textbf{ hours}.$$

### 2. Converting hours into days

There are 24 hours in one day:

$$24 \text{ hours} = 1 \text{ day}$$

To convert from hours into days, **divide the number of hours by 24**. For example, if a moon has an orbital period of 72 hours, then its orbital period in days is:

$$\text{Orbital period in days} = 72 \div 24 = 3 \textbf{ days}.$$

1. Convert the orbital period of Deimos into days.

2. How long, in minutes, does it take for Daphnis to go once around its planet?

3. Convert the orbital periods of Daphnis, Titan, Mimas and Miranda into days.   Round your answers to one decimal place.

4. The orbital period of the Earth's moon is 27.3 days. How many hours and minutes does 0.3 days equal?

5. List the moons in order of **increasing** orbital period.

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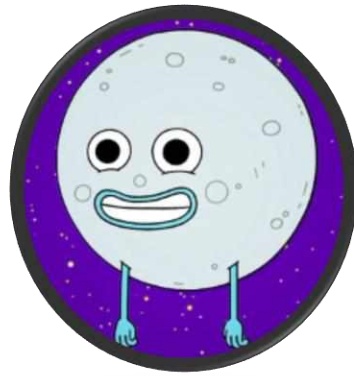
Explore the moons of our Solar System: ANSWERS
Key Stage 2

Activity: Decode the message

A	22+41	63
B	$\frac{1}{4}$ of 28	7
C	0.5 x 2	1
D	2 x 47	94
E	113 - 40	73
F	$\frac{7}{8}$ of 40	35

N	$\frac{6}{7}$ of 49	42
O	65 - 39	26
P	10 x 4	40
Q	$\frac{150}{10}$	15
R	0.1 x 100	10
S	77 + 21	98

G	$\frac{45}{5}$	9
H	2 x 25	50
I	42 - 29	13
J	38 + 37	75
K	$\frac{1}{3}$ of 81	27
L	0.3 x 20	6
M	24 ÷ 8	3

T	$\frac{1}{10}$ of 80	8
U	51 - 35	16
V	40 ÷ 20	2
W	0.8 x 30	24
X	19 + 11	30
Y	$\frac{36}{3}$	12
Z	$\frac{1}{5}$ of 20	4

Neil Armstrong's message:

First sentence

1st word:

H	O	U	S	T	O	N
50	26	16	98	8	26	42

2nd word:

T	R	A	N	Q	U	I	L	I	T	Y
8	10	63	42	15	16	13	6	13	8	12

3rd word:

B	A	S	E
7	63	98	73

4th word:

H	E	R	E
50	73	10	73

Second sentence

1st word:

T	H	E
8	50	73

2nd word:

E	A	G	L	E
73	63	9	6	73

3rd word:

H	A	S
50	63	98

4th word:

L	A	N	D	E	D
6	63	42	94	73	94

The message that Neil Armstrong sent is:

Houston Tranquility base here. The Eagle has landed.

Activity: Base camp on the Moon

Here are just some of the items that astronauts would take to the Moon:
- Material to build a base camp
- Food
- Water
- Clothes and spacesuits
- Medical supplies
- Air supplies
- Solar panels
- Lunar rover/car
- Communication equipment
- Books to read
- Movies to watch
- Exercise equipment

Draw a lunar base camp:

As this is a creative exercise, there is no formal answer for this activity. As a fun extension, this NASA website provides a guide on how students can build a Moon habitat in the classroom:
https://spaceplace.nasa.gov/moon-habitat/en/

Activity: Moon math

1. 285

2. 109 / 285

3. 41 / 285

4. 282 / 285

5. 3 / 285

6. 119 more

Activity: Compare the moons

1.

Moon	Diameter (mm)
Europa	15
The Moon	16
Ganymede	25
Triton	13
Titania	7
Callisto	23

2. Ganymede, Callisto, The Moon, Europa, Triton, Titania

3. Diameter of Europa = 15 mm
   Diameter of Titania = 7 mm

   Diameter of Europa / Diameter of Titania = 15 mm / 7 mm = 2.14 = 2

   Europa is twice the size of Titania.

4. Triton.

5. Diameter of the Earth = 60 mm
   Diameter of our Moon = 16 mm

   The Earth is
   60 mm / 16 mm = 3.75 = 4

   The Earth is 4 times bigger than the Moon.

Activity: Orbital periods of the moons

1. 1.25 days.

2. 840 minutes.

3. Daphnis = 0.6 days
   Titan = 15.9 days
   Mimas = 0.9 days
   Miranda = 1.4 days

4. 7 hours 12 minutes.

5. Phobos, Daphnis, Mimas, Deimos, Miranda, Io, Ganymede, Titan, The Moon