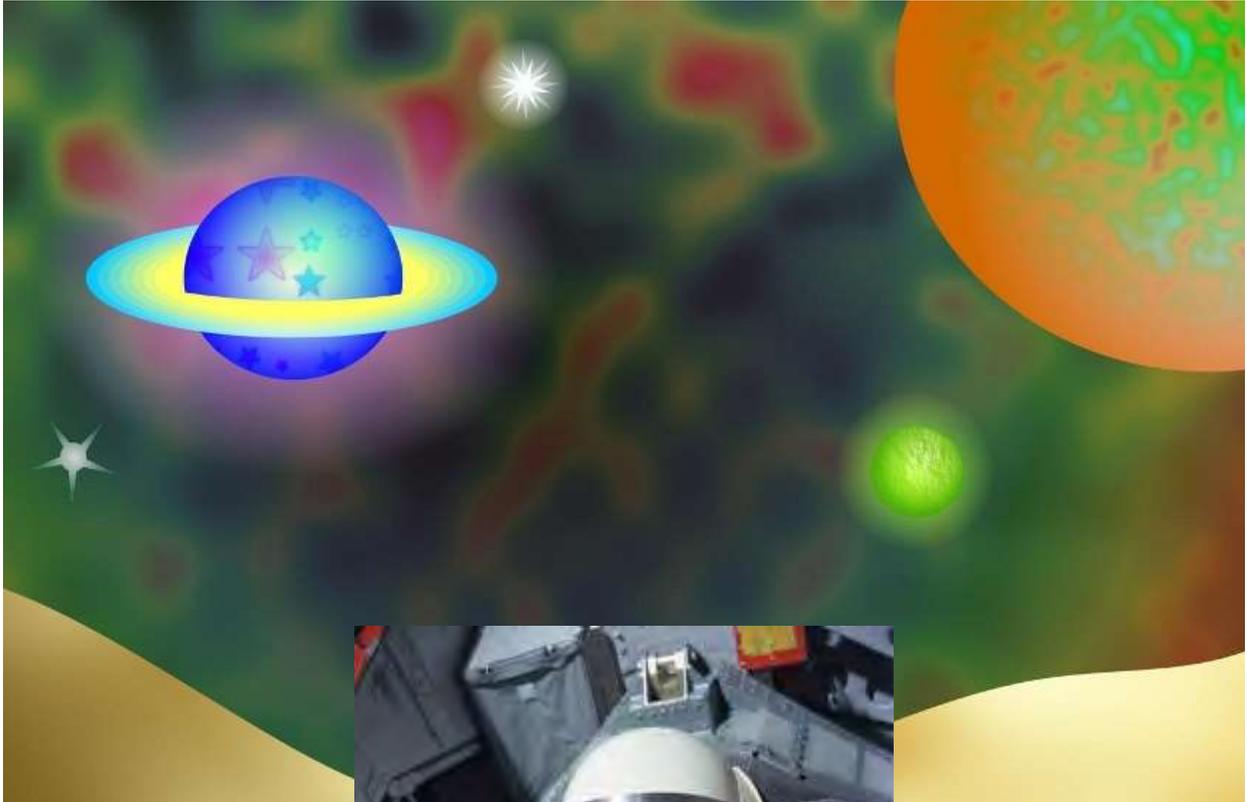


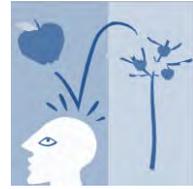
SPACE ACTIVITIES



WEIGHT, MASS, GRAVITY AND OTHER MYSTERIES OF THE UNIVERSE

What is Gravity?

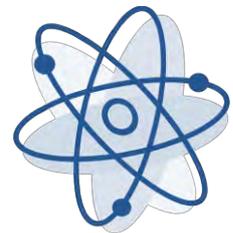
Gravity is a force that causes objects to be attracted to one another. If you slip and fall from a tree, you fall towards the earth. You are attracted to the centre of the earth by the force of gravity.



The closer objects are to one another and the larger the mass of the object, the stronger the attraction.

All objects are attracted towards one another, but the attraction, or force of gravity, is generally too small to be easily measurable.

Planets orbit around the sun because of the gravitational pull of the sun. The moon orbits the earth because of the gravitational pull of the earth.



Satellites are positioned at a particular distance from the earth so that they orbit the Earth instead of floating away.

What is Mass?

Mass is what objects are made of, the stuff inside. The mass of an object is determined by its size and density. The earth is quite dense because it has an iron core and so it has considerable mass and quite a strong gravitational force.

What is Weight?

Weight is the force of an object caused by the pull of gravity. Our weight, or the force of the gravitational pull, is measured when we hop onto the bathroom scales. A person with more mass will weigh more.

Your weight on earth is your mass on earth.



My weight on Earth is my mass on Earth. On Mars, my mass will still be the same, but my weight will be different. My weight is determined by gravity.

Gravity Song on Youtube

<https://youtu.be/H1kVro7P1KE?list=RDH1kVro7P1KE>

In outer space, where there is zero gravity, you would be weightless, but you would still have the same mass.

In a space ship there is a small amount of gravity, known as micro gravity. Objects, including people, are able to float around.

Different planets have different gravitational forces, depending upon their size and mass.

The moon has only 17% of the gravity that Earth has. When the Apollo astronauts took their first steps on the moon, they took giant, floating steps even though they wore heavy suits.

An astronaut weighing 100Kg on Earth when wearing a suit would weigh only 17% of that on the moon.

$100\text{kg} \times 0.17 = \quad \text{Kg}$



HOW MUCH WOULD YOU WEIGH ON EACH OF THESE PLANETS?							
Planet	My Weight	Gravity	New Weight	Planet	My Weight	Gravity	New Weight
Earth	40 Kg x	1.00	=40Kg	Neptune	x	1.23	=
Mercury	x	0.38	=	Venus	x	0.86	=
Mars	x	0.38	=	Jupiter	x	2.87	=
Saturn	x	1.32	=	Uranus	x	0.93	=

CHALLENGE

You are off on a Time Traveller’s Tour of Duty to spend a few months on a space station at each of planets below. In between each visit you will return to Earth.

Each space station has different luggage limits. How can you take with you when you leave Earth?

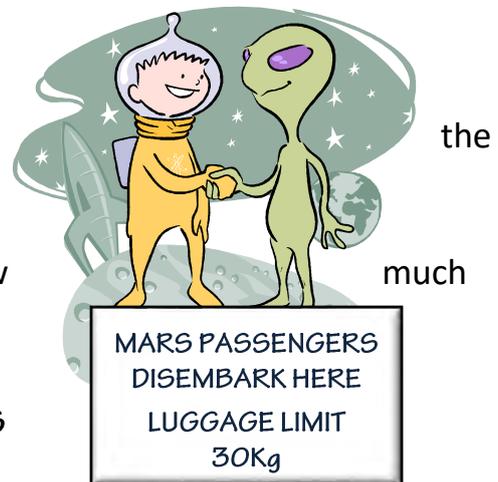
OUT OF THIS WORLD LANDING LUGGAGE LIMITS

Jupiter 50Kg divided by 2.87=

Mars Luggage Allowance=30Kg Earth weight=

Venus Luggage Allowance=60Kg Earth weight =

Jupiter Luggage allowance=50Kg earth weight=



The astronauts on Apollo 11 returned with 22Kg (Earth weight) of rock specimens. How much did the rock samples weigh when they were on the moon?

SPACE AND NUMBERS BOARD GAME – TEST YOUR KNOWLEDGE. Print out the pages and glue to card. You will need a dice and some counters. Suitable for 2-4 players. If you are unable to answer a question, you must skip a turn and take a Space Wizard card.

<p>START HERE Throw the dice. The person who throws the highest number can start first</p>	<p>1. What was the name of the first manned lunar module to touch down on the moon?</p>	<p>2. The space probes Voyager 1 and Voyager 2 both carry identical golden records. What do they contain and what is their purpose?</p>	<p>3. The dates selected for the launch of the space probes <i>Voyager 1</i> and <i>Voyager 2</i> were important to the success of the program. Why was the timing of the launch so important?</p>	<p>4. What was the name of the mission where the astronauts first set foot on the moon?</p>
<p>5. How many planets are there in our solar system? Divide this by 4 and move ahead the same number of spaces.</p>	<p>6. You must throw a prime number to move ahead.</p>	<p>7. Your spacecraft has arrived in the "doldrums" where the high-speed solar winds die down at the very edge of the Solar System. Take a rest and Skip a turn.</p>	<p>8. A meteor is sometimes called a _____ _____</p>	

<p>9. How many astronauts were aboard the Apollo 11 mission? Move ahead the same number of spaces.</p>	<p>10.</p>	<p>11. AU is an abbreviation for a measurement. 1. What does it stand for? 2. What does it mean?</p>	<p>12. How old was Neil Armstrong when he landed on the moon? Divide this by 8 and move ahead the same number of spaces.</p>	<p>13. A planet named after a Roman goddess of love and beauty is _____</p>	
<p>14. What is the name of the smallest planet in the our solar system?</p>	<p>15.</p>	<p>16.</p>	<p>17. Your spacecraft has returned safely to Earth.</p>	<p>18. You need to spend some time in quarantine. Skip a Turn</p>	<p>19. Safely Home</p>

Cut out some 'Space Wizard' cards. Decorate them on one side.
On the other side of each card enter a space question. You may find the 'solar system'
'Voyager' or 'Apollo' fact sheets helpful. Place the cards face down in the space provided.

PLACE SPACE WIZARD CARDS HERE



The year is 1969, and you are

Neil Armstrong or

Edwin Aldrin or

Michael Collins

on board the *Saturn V* on a mission to the Moon and back



Use the sequence of events as described in the Apollo 11 Fact Sheet to put together a diary of events **“Thirteen Days in the Life of an Astronaut” commencing with lift off.** You may choose to use a comic strip or story board or perhaps a slide presentation format. Add dates and times to each post.



Use the NASA website and your imagination to fill in details e.g.

- What famous words did Neil Armstrong say when he stepped onto the lunar surface?
- What did Edwin Aldrin say when he stepped out onto the lunar surface.?
- What was the message on the plaque that was left on the moon?
- What other items were left behind on the moon?
- How would it feel to be walking inside a spacesuit on the moon – a first for mankind?
- What would it feel like to re-enter the Earths atmosphere and splash down into the ocean?
- How were the astronauts “de-contaminated” when they first arrived back on Earth and what other safety precautions were taken ?



You may wish to work in groups. Each group could work on a different phase of the Apollo 11 events e.g.

1. Ascent
2. Earth Orbit
3. Trans lunar
4. Lunar Landing / Lunar
5. Trans Earth
6. Recovery



Challenge: Make a podcast of the take off, landing or splash down.



What's in the Pantry of Apollo 11?

You are the dietician for the Apollo 11 mission. Each astronaut has a ration of 3.8 lbs (pounds) of food. Foods are pre-cooked and processed so that refrigeration is not necessary. Handling is difficult in the micro-gravity conditions and so items are individually packaged.

What's in the pantry? (Weights include packaging.)

Item	Weight (grams)	Item	Weight (grams)
Peaches	480	Coffee	100
Carrots	600	Bacon Squares	270
Celery	420	Pineapple-grapefruit drink	600
Sugar cookie cubes	90	Orange drink	600
Beef Stew	900	Date fruitcake	450
Cream of Chicken Soup	600		

Apollo 11 Menu

There are three meals per day, A, B and C with the exception of day 1, when only meals B & C are provided..

- Allocate the pantry items fairly to each of the three astronauts. Meal A can be an in-flight snack, whereas Meal B and C need to be a bit more substantial.
 - Neil Armstrong prefers pineapple-grapefruit drink to orange drink.
 - Edwin Aldrin prefers orange drink to pineapple-grapefruit drink.

Fresh carrots and celery in the fresh food locker must be eaten in the first two days.

Your pantry items are in grams or Kg, so you will need to convert the total ration to imperial measurements. What is the total (metric) food allowance for all three astronauts?

- Create an attractive menu to give to the astronauts before they hop on board.

Personal Space Menu

- What foods would you like to take with you if you were off to space for a long time? How could you prepare the food so that it is suitable to take into space? Prepare a healthy space menu for yourself.

Extra: You will need: Lunch, food scales. What's in your lunch today? How much does each item, weigh? Is it too heavy to take on board? Is there a way to process the items to reduce their weight? How much will your lunch weigh on the moon?¹ See Apollo 11 Facts for weights

Voyager 1, Voyager 2 “Are We There Yet?”

You may need to refer to the *Voyager* fact sheet to complete this activity. Internet access to the NASA website is also required in order to follow the links.

Light Years Away

1. What if *Voyager 2* could travel at the speed of light – approx. 300,000 km per second? How long would it take to travel to:
 - The sun and return (hours, minutes, seconds)?
 - The earth and return (hours, minutes, seconds)?
2. On May 28, 2012, *Voyager 1* was 17,945,909,066 km from Earth. *Voyager 2* was 14,662,324,397 km from Earth. Use the real time Voyager status link on this page <http://voyager.jpl.nasa.gov/index.html> (NASA website, opens new window) to find out where *Voyager 1* and *Voyager 2* are today.

See if you can fill in the details on the table below.

	Voyager 1	Voyager 2
	Date:	Date:
Kilometres from earth	km	km
No of days elapsed since May 28, 2012 (24 hour days)		
Extra distance (from Earth) travelled since May 28 th 2012	km	km
Distance covered in one 24 hour day (assume same distance each day)	km	km
Kilometres travelled in one hour.	km	km

On Board – a Golden Record

Voyager 1 and *Voyager 2* are carrying identical golden records in case the probes should encounter extra-terrestrial life. Each golden record contains:

- 117 pictures explaining Earth. This includes drawings of our solar system, people, planets and animals, as well as scenes from around the world.
- Greetings in 54 different human languages and greetings from humpback whales.
- A selection of sounds from Earth. This ranges from natural sounds, like storms and volcanoes, to human-made noises such as trains, planes.

Challenge: In pairs or small teams, make your own audio recording to send on a space probe. What greetings would you include for any potential extra-terrestrial life forms? Information? Music?

Link to NASA Videos (opens new tab)

http://www.nasa.gov/multimedia/videogallery/index.html?media_id=84301411

SPACE CHALLENGES

MEMORY AIDS

Remembering the relative positions of the planets (Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune) in relation to the Sun is easier if you use a memory aid, known as a mnemonic.

One such example of a memory aid takes the first letter of each of the names of the planets and uses the letters to start each word of a sentence that is easy to remember.

The samples below do not take into account that in 2006 Pluto was downgraded to dwarf planet status, only eight planets are now recognized.

- My Very Easy Memory Jingle Seems Useful Naming Planets.
- My Very Educated Mother Just Showed Us Nine Planets
- My Very Educated Mother Just Said Uh-oh No Pluto.
- My very Ernest mother just served us nectarine pie.

Can you make similar memory aids for the following?

1. The names of the planets as above, but ensuring that Pluto is not included?
2. The names of the Apollo 11 astronauts (Neil Armstrong, Edwin Aldrin, Michael Collins)?

CRYPTOGRAM

Each letter of the alphabet has been assigned a number. Some of the numbers have been filled out for you on the grid below. See if you can work out the remaining numbers. Fill them in as you go.

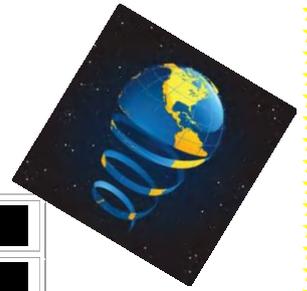
A	B	C	D	E	F	G	H	I	J	K	L	M
				3			2				5	1
N	O	P	Q	R	S	T	U	V	W	X	Y	Z.
					4							

Start by filling in the letters that you already know on the grid below. The first one is done for you. Can you complete the mystery space sentence?

M																				
1	3						4		2	3			5	4	4					
	5		3					2	3	4										

Solution to the Cryptogram

Mercury is the closest planet to the sun



SPACE CROSSWORD

■	■	■	■	■	■	■	■	■	■	■	■	1	■	■
■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
■	2	■	■	■	■	■	■	■	■	■	■	■	■	■
■	3	■	■	■	■	■	■	4	5	■	■	■	■	■
■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	6	■	■	■	■	■	■	7	■	■
8	■	■	■	■	■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	9	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
10	■	■	■	■	■	■	■	■	■	11	■	■	■	■
■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
■	■	12	■	■	■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

Across

- 3. The name of the Apollo 11 Lunar Module.
- 4. Planet named after the Roman goddess of love and beauty.
- 6. The commander of Apollo 11.
- 8. Tilted planet - one of the gas giants.
- 10. Smallest planet in the solar system.
- 11. Once a planet, now a dwarf planet.
- 12. The largest planet in our solar system.

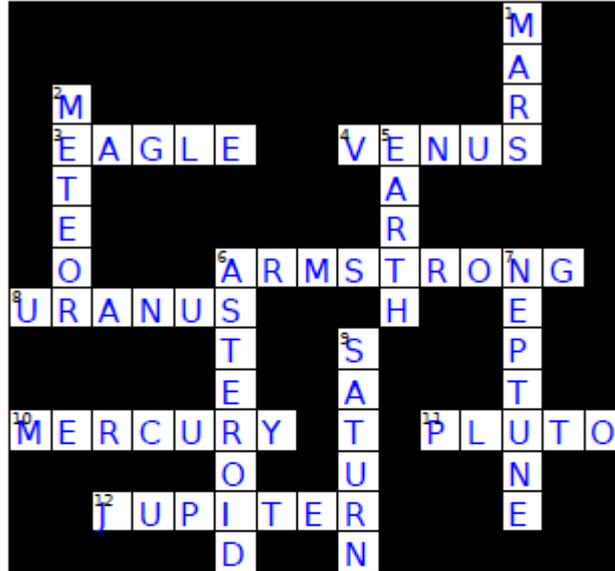
Down

- 1. The rovers Spirit and Opportunity have explored this planet.
- 2. A shooting star.
- 5. Name of a planet with an atmosphere.
- 6. The region between the inner planets and outer planets is known as the _____ belt.
- 7. A planet named after the god of the sea.
- 9. A gas giant known for its rings.

Solution next page

SPACE Webflight

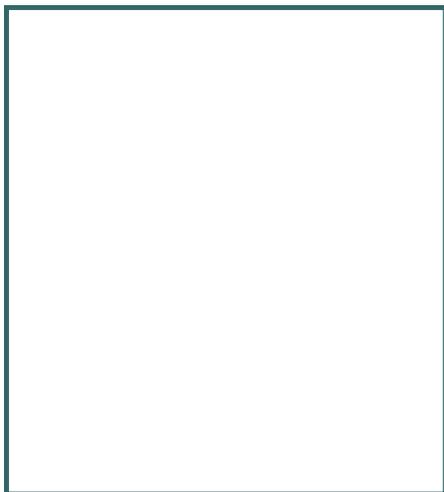
Solar system terminology, names of planets.



- | Across | | Down | |
|--------|--|------|--|
| 3 | The name of the Apollo 11 Lunar Module. | 1 | The rovers Spirit and Opportunity have explored this planet. |
| 4 | Planet named after the Roman goddess of love and beauty. | 2 | A shooting star. |
| 6 | The commander of Apollo 11. | 5 | A planet with an atmosphere. |
| 8 | Tilted planet - one of the gas giants. | 6 | The region between the inner planets and outer planets is known as the _____ belt. |
| 10 | Smallest planet in the solar system. | 7 | A planet named after the god of the sea. |
| 11 | Once a planet, now a dwarf planet. | 9 | A gas giant known for its rings. |
| 12 | The largest planet in our solar system. | | |

Places to Visit

Our planet is full of wonderful surprises. Mostly made of water, there are rivers, mountains, deserts forests, and more. The place I love to visit is



© Created by

Planet Earth

A Guide for Visitors,
all welcome!



January 2019

Earth



Humans, plants and animals live on our planet. A human being is

This is what we look like:

Countries

Humans live in different countries. My country is the one in the picture above. It is called

The names of some other countries are

Languages

There are lots of different languages on Earth. Different countries have different food and clothes sometimes too.

Plants

Have you ever been to a forest?

You would love our forests because

Animals



INVITATION FROM OUTER SPACE FOR ALL SPACE DETECTIVES

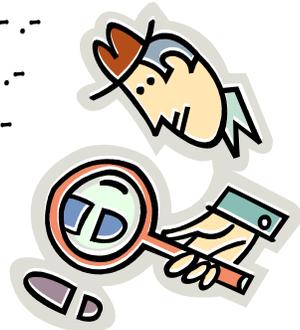
You have received the following message in your email.

The return address appears to be an asteroid somewhere in the asteroid belt between Mars and Jupiter. The message seems to be written in Morse code:



What is Morse code? Can you translate the message?

.-.-.- / --... / --. / ..-. --- .- / .- ...-- /
.-. / .- -- ..- .- / .- -- ..- / ..- -- ..- / ..- -- ..- / ..-
.-.- / .-- .- / .- -- .- ..- .- / .- -- ..- / ..-
.....- .-.-.



See if you can send a reply in Morse code.

Please meet me for afternoon tea, July 1st, 2020, Mars. RSVP January 1st 2020