

## Welcome to the Reach for the Stars education pack!

### Introduction

This education pack is aimed at 5-10 year olds. You can use it to teach children about:

1. our solar system
2. two important York figures in the history of astronomy (Goodricke and Pigott)
3. the 1969 moon landing

The pack includes links to audio books and images from the York Explore archive. The activities are flexible – pick what you and your children find interesting, and supplement with your own craft activities if you choose.

### Contents:

In this pack you will find:

- Information on how to use the resources
- Links to space-themed audio/ebooks available to borrow from York Explore:
  - Stars, Stars, Stars by Bob Barner  
<https://yorklibraries.overdrive.com/library/kids/media/873124>
  - Cakes in Space by Philip Read and Sarah McIntyre  
<https://yorklibraries.overdrive.com/library/kids/media/4574462>
  - 100 Space Facts by Belinda Gallagher and Lucy Dowling  
<https://yorklibraries.overdrive.com/library/kids/media/1190857>
  - Goodnight Spaceman by Michelle Robinson  
<https://yorklibraries.overdrive.com/media/2625437>  
<https://yorklibraries.overdrive.com/media/3078967>
  - Space Penguins by Lucy Courtenay  
<https://yorklibraries.overdrive.com/library/kids/media/1494858>  
<https://yorklibraries.overdrive.com/library/kids/media/2137018>

Find out more on accessing Explore's audio and ebooks for children here:

<https://www.exploreYork.org.uk/children/>

- British Sign Language fingerspelling charts and signing challenges

- Facsimiles of some pages from John Goodricke's astronomical journals (originals held at York Explore Archive)
- Goodricke and Pigott Fact Sheet
- Constellations Fact Sheet
- Lunar and Solar eclipses Fact Sheets
- Moon landing Fact Sheet

### Suggestions on how to use the pack

1. Borrow one of the books in the list above and listen to/read a story, or delve into one of the educational books.

Learn more about the night sky by choosing to do as many as you wish of the following:

2. Tell the children about York's own 18<sup>th</sup> century astronomers, John Goodricke and Edward Pigott, using the Goodricke and Pigott Fact Sheet.
3. Learn about constellations, using the facsimile of Goodricke's illustration of constellations (Constellations Fact Sheet) and the information provided.
4. John Goodricke was deaf as a result of a childhood illness. Show your children the British Fingerspelling chart and ask them to sign words such as sun, moon, star, comet, and their own names!
5. Talk about lunar and solar eclipses using the Lunar and Solar Eclipses Fact Sheet and images – ask the questions included in the sheet (answers provided where relevant).
6. Learn about the moon landing using the Moon Landing Fact Sheet and ask questions (or make up your own).

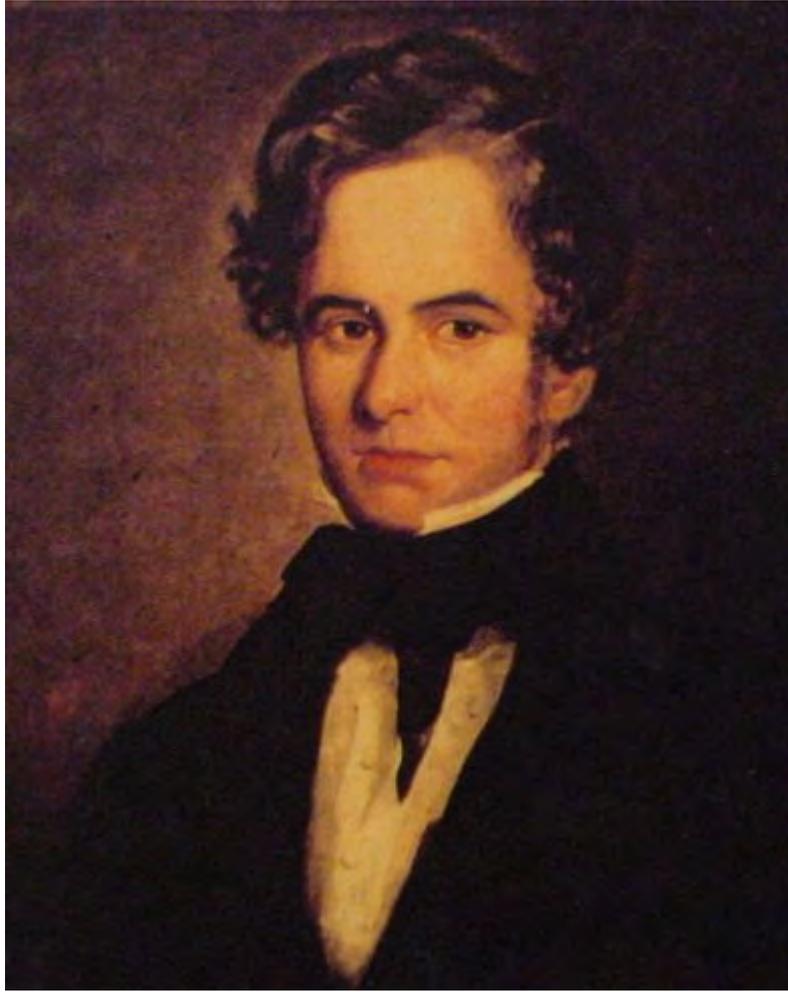
## Goodricke and Pigott Fact Sheet

### John Goodricke (1764-1786)



- Born in Groningen, in the Netherlands in 17<sup>th</sup> of September 1764.
- He was named after his grandfather Sir John Goodricke.
- His family returned to York in 1776.
- Goodricke became deaf in early childhood due to a severe illness, now thought to be scarlet fever. He was also thought to be mute, but from stories he wrote in his surviving journals about conversations with tradesmen it is clear that he read lips and almost certainly spoke.
- He attended the Thomas Braidwood Academy (a school for deaf pupils in Edinburgh), and the Warrington Academy (his notebooks from Warrington show that he was already observing the sky at the age of 15).
- By 1781, he was living on Bootham, next door to Nathaniel and Edward Pigott, who were astronomers, just like Goodricke himself.
- He had a friendly and professional relationship with Edward Pigott.
- He died on the 20<sup>th</sup> of April 1786, at the age of 21, of pneumonia.
- He was buried at Hunsingore Church in Yorkshire.

## Edward Pigott (1753-1825)



- He was born in France, in 1753.
- His first language was French, but he was also fluent in English.
- His father, Nathaniel Pigott, was also an astronomer.
- The family moved to York from France in 1781.
- He and his father collaborated with astronomers from continental Europe to determine the longitude and latitude of several cities in what is nowadays Belgium.
- His father built an observatory which is said to have been considered to be among the best private observatories in England.
- He moved to Bath in 1796.
- He died in 1825.

## Work and Discoveries:



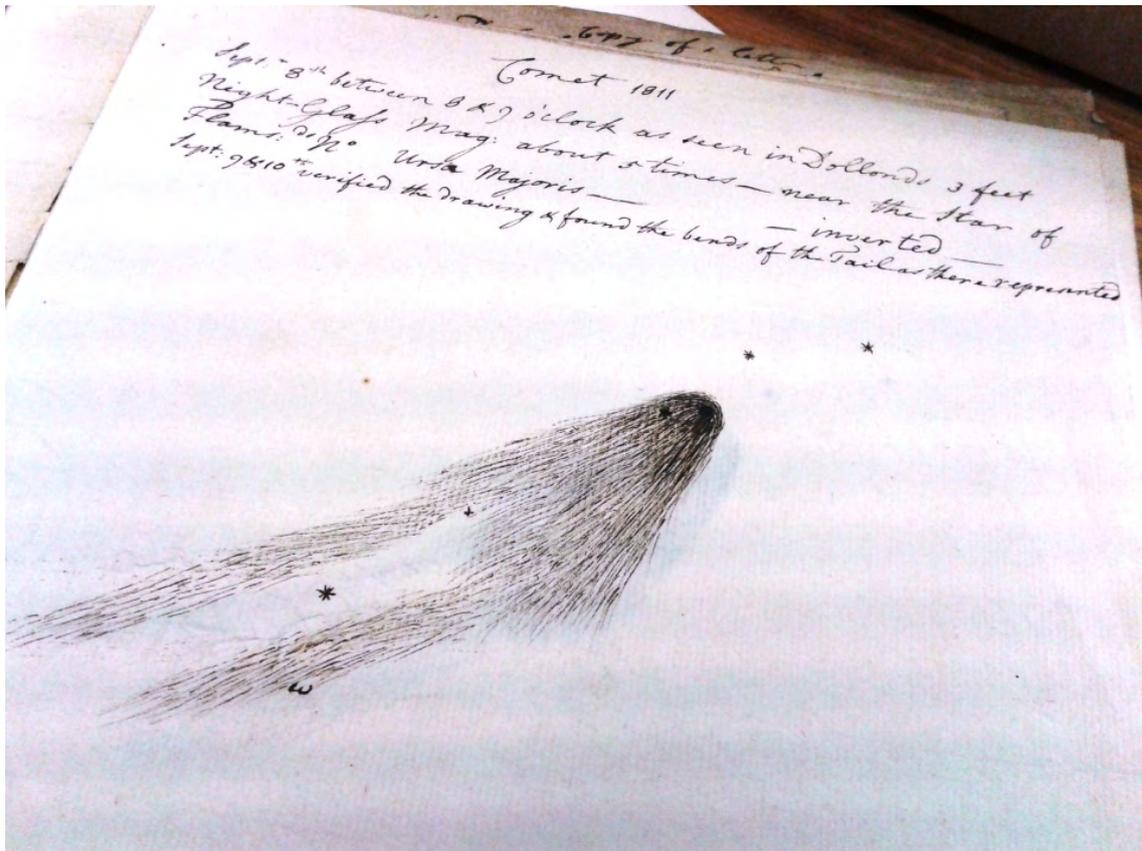
### John Goodricke:

- He discovered the periodic variation of  $\delta$  Cephei (read as Delta Cephei), meaning that he proved that the star's luminosity was subjected to variations.
- Goodricke's studies on the variation of light were one of the contributing factors that made astronomers in the 20<sup>th</sup> century be able to determine the distance between galaxies.
- He was the first to propose a mechanism to account for the apparent magnitude variation in stars\*.
- In one diary Goodricke noted: 'This night I looked at Beta Persei [Algol], and was much amazed to find its brightness altered... I observed it diligently for about an hour - I hardly believed that it changed its brightness because I never heard of any star varying so quickly in its brightness.'
- Goodricke and Edward Pigott determined that the dimming of Algol's light occurred exactly every 2.767 days and speculated that an unseen planet was eclipsing the star.
- Goodricke also determined the time of variation of two more important stars.
- For these findings, which he presented to the Royal Society in May 1783, and his work in general, the Society awarded him the Copley

Medal, which is a is a scientific award given by the Royal Society for 'outstanding achievements in research in any branch of science'. To this day, he remains the youngest person to receive this award.

- He was elected as a Fellow of the Royal Society on 16 April 1786, but he never knew this – he died four days later, before the news had reached him.
- A recent study by students from the University of York concluded that Goodricke worked from the Treasurer's House, more specifically from the eastern most window of the second floor, which faced south towards the Minster.

Edward Pigott:



- Pigott's work, much like Goodricke's, focused on variable stars.
- One of the stars which he studied in order to determine whether they were variable was Algol, which, as mentioned, is indeed variable.
- His collaboration with Goodricke was invaluable in finding the abovementioned conclusion.
- He discovered two more variable stars, these being R Scuti and R Coronae Borealis.
- He discovered the spiral galaxy known as M64.

A list of the Right Ascensions & Polar Distances  
of the most remarkable & brightest of the  
fixed stars taken from Bradley's Catalogue  
reduced to 1760, besides others added from different  
Catalogues

Star names	Mag in Febr.	R. A in degrees	Prosp in 2 <sup>d</sup>	Polar Dist.	Prosp in Declin.	Mag in Febr.
$\gamma$ Pegasi	2	0-13-35	46,2	76-9-5	20,04	2
$\epsilon$ Ceti	3	1-44-28	46,4	100-10-1	20,00	3
$\delta$ Andromeda	3	6-38-13 $\frac{1}{2}$	47,40	60-28-0	20,00	3
$\alpha$ Capricorn	3	6-45-35	49,58	31-46-52	19,91	2 or 3
$\beta$ Ceti	3	7-52-59	45,22	109-18-27	19,86	2
$\gamma$ Capricorn	3	10-36-19	52,42	30-35-16	19,71	2 or 3
Polaris*						2
$\beta$ Andromeda	2	14-5-40	49,52	55-39-33	19,35	2
$\eta$ Ceti	3	14-7-48	45,19	101-27-39	19,45	3
$\theta$ Capricorn	4	14-9-48	52,90	36-7-57	19,44	4
$\delta$ Capricorn	3	17-34-49	56,25	31-1-10	19,12	3
$\theta$ Ceti	3	18-0-33	45,15	99-25-41	19,07	3
$\epsilon$ Capricorn	2	24-21-0	62,18	27-31-27	18,27	3
$\gamma$ Arietis	4	25-6-7	39,00	71-53-33	18,20	4
$\beta$ Arietis	3	25-21-28	49,25	70-22-30	18,10	3
$\gamma$ Andromeda	2	27-19-7	54,25	48-50-2	17,80	2
$\alpha$ Piscium	3	27-24-46	46,43	85-24-21	17,80	3
$\alpha$ Arietis	2	28-25-28	50,60	67-41-1	17,60	2
$\circ$ Ceti - <i>vanæ</i>	2	31-48-41	45,41	94-4-48	17,04	2
$\delta$ Ceti	3	36-47-59 $\frac{1}{2}$	46,03	90-43-10	16,00	3 or 4
$\epsilon$ Ceti	3	36-59-31	43,42	102-54-10	16,02	3
$\gamma$ Ceti	3	37-43-27	46,65	87-47-18	15,86	3

2  
November & December York 1781

The Comets motion now appears to become slower - The same night Mr. E. Pigott shewed me a letter of om. Dr. Maskelyne Astron. Reg., who said that the Comet was first discovered in France abt. the beginning of October (being then not to be seen but by Telescopes) & afterwards by Mr. Sic of Canterbury on the 8<sup>th</sup> of November. Mr. Sic says its place at 10 in the evening on that day was  $25^{\circ} 30'$  in  $\zeta$  & its Latitude  $79^{\circ} 30'$  N. He saw it again on the 12<sup>th</sup> in the junion of the Northern Wing of Cygnus & says it appeared to have moved  $30^{\circ}$  since his first observation & had passed by within little more than two degrees the pole of the Celestic into another sign - At 12 in the evening on that day it was in  $12^{\circ} 00'$  in  $\zeta$  & had  $67^{\circ} 30'$  North Latitude -

The French observations by M. Nepean are thus

Time	R.A.	Declination
Oct. 10 <sup>th</sup> 15-53-49	127-21-11	19-49-39 N
9-12 <sup>th</sup> 15-37-0	127-39-52	21-5-59 N
5-14 <sup>th</sup> 14-50-26	127-52-55	21-36-8 N

Comet Dec. 19<sup>th</sup>

About a day or two ago Mr. E. Pigott shewed me a letter from Mr. Nepean the discoverer of the above mentioned Comet - In this letter he says that he discovered it on the 9<sup>th</sup> of October near  $\delta$  Cancri -

Its node was  $77^{\circ} 22' 13''$   
 Inclination  $27^{\circ} 11' 32''$   
 Perihelion  $26^{\circ} 0' 30''$   
 of its orbit

Dist. Perihel - 0,960997  
 Days in Perihel. 29<sup>th</sup> Oct. at  $12^{\circ} 32' 25''$  mean

3  
November & December York 1781

mean time at Paris - He thinks it is the same as that which appeared in 1337, for its N. D. & Inclination nearly agrees with the Comet that appeared in that year - He says that Dr. Halley's account of the Comet of 1337 is imperfect & that he intends to verify the Chinese observ. - His letter was in French -

Comet The following is a draught of the track of the Comet from Nov. 15 to the 22<sup>nd</sup>. The place on the 15<sup>th</sup> & 17<sup>th</sup> were observed by Mr. E. Pigott - the rest by myself - The figures & the stars were taken from Adams Celestial Globe 18 Inch Radius, in which all the stars of Flamsteed's Catalogue are set -

The star marked X in Cygnus is not visible

They are not very exactly set but nearly -

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## Journal 1791 York

by comparing path of the Comet to the field of the telescope I judged it had moved at the rate of about 9 minutes in an hour.

the difference of R.A. in time between the Comet & 2 was not  $3\frac{1}{4}$  <sup>Comet preceding</sup> ~~hours~~ <sup>minutes</sup> and 'about' minutes more both than the Comet, at  $7\frac{1}{2}$  hours time.

at  $9\frac{1}{4}$  hours the Comet followed  $\beta$  Cygni about 25 minutes in time and ~~was~~ was 10 minutes more to the South than  $\beta$ .

the position of 2 by one of Adams's last made Globes, feet Diameter, is in R.A.  $19^h 52^m$  and  $27^{\circ} 26'$  North Declin. reduced to

by several examinations with maps and Globes I conclude the position of the Comet Novem. 14<sup>th</sup> at 10 o'clock P.M. was in R.A.  $19^h 40^m$  and North Declin.  $34^{\circ} 20'$  and on the 16<sup>th</sup> at 10 o'clock P.M. its R.A.  $19^h 47^m$  and North Declin.  $27^{\circ} 20'$

the 16<sup>th</sup> comet at 10 P.M. ... <sup>Nov. of 1690.</sup> ~~...~~

what's marked with red ink is my additions to Kirch's drawing.

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## Journal 1791 York

### Comet

Novem. the 17<sup>th</sup> Night remarkably fine the Comet had much the same appearance as yesterday, the rather brighter, with a very faint tail of 10 or 15 minutes.

The following, as seen in the Telescope (shorts 18 inch) with small Stars.

the Stars A B one of the 4<sup>th</sup> or 5<sup>th</sup> Mag. the next in brightness one of 7<sup>th</sup> or 8<sup>th</sup> Mag. and the smallest of the 10<sup>th</sup> or 11<sup>th</sup> Mag.

the Comet in 4 hours had moved about 30 minutes.

the Star B is that which was compared to the Comet with the Micrometer, see the following pages 118 & 119.

at 12 25 minutes the Comet was distant from B about one minute of a Degree.

I intend when possible, to observe the R.A. & Declin. of these Stars, see

### Constellations Fact Sheet



## Constellations

### What they are:

Constellations are a group of stars which form a pattern in the sky. Many take their names from ancient mythology or animals. The individual stars which make up the constellation are actually very far away from each other.

### History and further Information:

- The constellations used nowadays have come down to us from the Greeks.
- Ptolemy, an ancient astronomer, gave a list of 48 constellations, all of which are still found in the present day astronomical maps.
- The ancient Chinese and Egyptians had their own constellation patterns.
- Constellations are not permanent, as stars are not fixed in space – if you went back in time 50,000 years the night sky would actually look very different from what you see today.
- New constellations have been discovered since ancient times, such as those in the far south of the sky.
- Currently, 88 constellations are recognized.

Activity: Try some of the constellations activities available at NASA's Space Place

<https://spaceplace.nasa.gov/>

Please note: If the children wish to read more about constellations, you can direct them to the following books (on which the information on this sheet is based on), available at York Explore:

Cornelius, Geoffrey, *The Complete Guide to the Constellations – the starwatcher's essential guide to the 88 constellations, their myths and symbols* (London: Duncan and Baird Publishers, 2005)

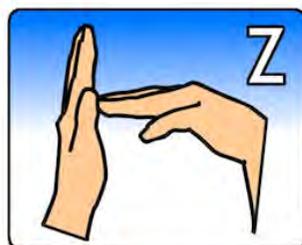
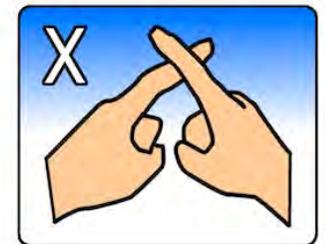
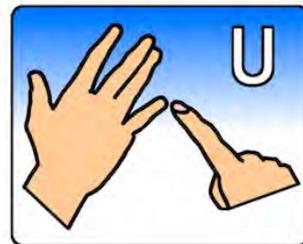
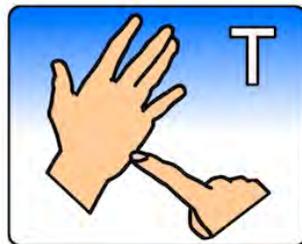
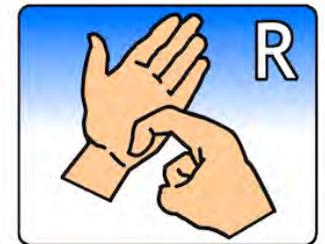
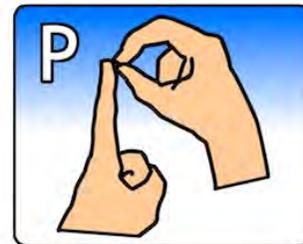
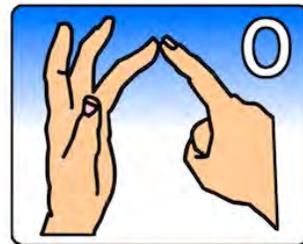
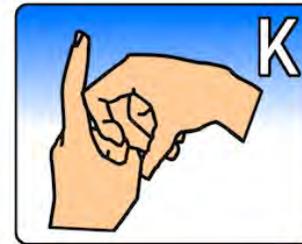
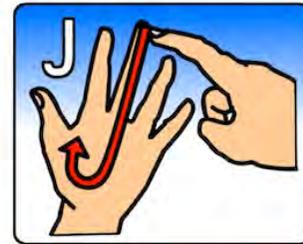
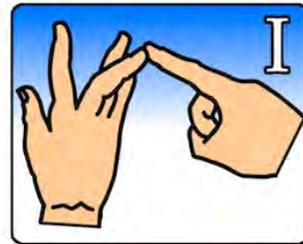
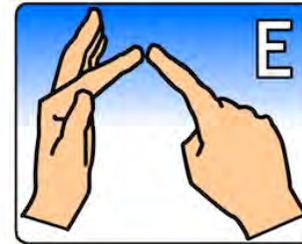
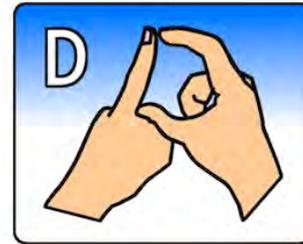
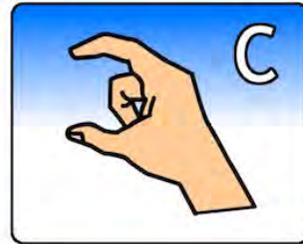
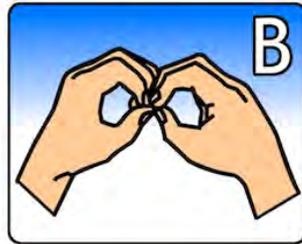
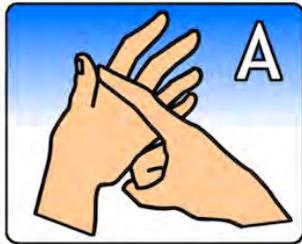
Nicolson, ed., *Stars + Planets, An Illustrated A-Z* (London: Starfire, 2006)

Moore, Sir Patrick, *Patrick Moore's Astronomy* (UK: Teach Yourself, 2010)

### **Signing the Stars**

Keeping in mind Goodricke was deaf, children can use the British Fingerspelling Chart to try and learn how to sign words that would have been useful to Goodricke, such as 'star', 'planet', 'comet', or even entire sentences.

# BSL Fingerspelling Alphabet



[www.british-sign.co.uk](http://www.british-sign.co.uk)

## Lunar Eclipse Fact Sheet

When the moon is full, it sometimes passes into the shadow cast by the Earth, resulting in a lunar eclipse. This does not occur every month, as the tilt of the moon's orbit doesn't allow for it, keeping it away from the ecliptic, which is the Sun's apparent path in the sky. Lunar eclipses may be total or partial, and can be seen from essentially anywhere – unlike solar eclipses, which you can only see from a specific place at a specific time, lunar eclipses can be seen from anywhere where the moon is seen above the horizon.

### Questions:

**Q. Have you ever seen a lunar eclipse?**

**Q. When was the last lunar eclipse?**

A. The last total lunar eclipse was on 21 January 2019.

**Q. When will the next lunar eclipse take place?**

A. On 16 May 2022 there will be a total lunar eclipse, also known as a blood moon, visible from the UK in the very early hours of the morning.



## Solar Eclipse Fact Sheet

Solar eclipses occur when the moon passes directly between the Earth and the Sun. They come in three types: partial (only a limited area of the Sun is hidden), annular (when a ring of the Sun is left showing around the dark disc of the moon), and total (when the Sun is fully covered and its atmosphere is visible).

### Questions:

**Q. Do you know anyone who has seen a total or partial solar eclipse?**

**Q. When was the last total eclipse of the sun?**

A. The last total solar eclipse in the UK was on August 11, 1999.

**Q When will the next solar eclipse take place?**

**2021** - On June 10, 2021, there will be a partial eclipse across Britain - around 50 per cent in the north if Scotland and only around 30 per cent in the south east

**2022** - On October 25, 2022, Britain will see another partial eclipse - but this time only 35 per cent in the north east of Scotland and only 20 per cent in Cornwall.

**2025** - Three years later, on March 29, 2025, there'll be another partial eclipse - around 40 per cent in Kent and 50 per cent in the north west of Scotland.

**2026** - On August 12, 2026, there will be a total eclipse of the sun across Iceland, the Atlantic Ocean and Spain. In Britain, there will be a very large partial eclipse, around 96 per cent in Western Ireland and Cornwall and 91 per cent in Aberdeen.

**2090** - But Britain won't see a total eclipse until **September 23, 2090 – How old will you be then?**



## Moon landing Fact Sheet



## Landing on the Moon

On July 20, 1969 Apollo 11 became the first manned spacecraft to land on the moon. This spacecraft had a crew of three astronauts Neil Armstrong, Buzz Aldrin and Michael Collins. The crew travelled 240,000 miles from the Earth to the moon in approximately 76 hours. After visiting the moon the strong odour of the lunar dust surprised all three astronauts the most. The moon dust gathered in the creases of their spacesuit when they were conducting experiments on the surface.

### **Fun facts: –**

- Before the Apollo 11 mission, all the three astronauts signed hundreds of autographs. If anything bad was to happen to them then their signatures could make some money to support their families.
- The commander of Apollo 11 mission, Neil Armstrong described the scent of moon dust somewhat similar to wet ashes in a fireplace.
- The moment Neil Armstrong stepped foot onto the moon, he said “That’s one small step for man and one giant leap for the mankind”.
- Neil Armstrong and Buzz Aldrin were on the lunar surface for about 21 hours, 36 minutes and 21 seconds.
- The television audience for the event of moon landing was approximately 600 million according to an estimate.
- After conduction various experiments on the surface of moon, Neil Armstrong and Buzz Aldrin returned to the Lunar Module to find a broken switch of a circuit breaker.
- This switch was important to ignite the engine. Later Aldrin used a pen to create a make-shift switch and luckily it worked.

### **Walking on the Moon**

- The Moon has only been walked on by 12 people; all American men.
- The first man to set foot on the Moon in 1969 was Neil Armstrong, while the last man to walk on the Moon in 1972 was Gene Cernan on the Apollo 17 mission.
- Since then, the Moon has only been visited by unmanned vehicles.

### **Questions:**

1. What would you bring if you were going to take a trip to land on the moon?
2. How do you think Neil Armstrong and Buzz Aldrin felt when they landed on the moon?
3. What name would you give your spaceship?

**Craft activity:** try building a spaceship out of empty cardboard boxes or other craft items you have around the home.