



# Snowdonia National Park

## An International Dark Sky Reserve

### What is an International Dark Sky Reserve?

It's a prestigious award given by the International Dark Sky Association to places with outstanding night air quality and where real efforts are being made to minimise light pollution, both within the reserve and from surrounding towns and villages. Snowdonia National Park provides a sanctuary for wildlife and visitors, ensuring that stargazing is at its best and that the stars of the Milky Way are clearly visible.

**There are only 18 International Dark Sky reserves in the world and 6 of these reserves are in the UK!**

### What is Light Pollution?

Excessive artificial light, particularly at night is called light pollution. The different types of light pollution are called:

- Glare - excessive brightness that causes discomfort
- Sky glow - brightening of the night sky over towns and cities
- Light trespass - light that falls where its not needed
- Clutter - bright, confusing and excessive groups of lights

**Light pollution means that 1/3 of people on Earth can no longer see the night sky clearly**

### The impact of Light Pollution

Plants and animals depend on the daily cycle of night and day to determine when to eat, sleep and reproduce. This is called the Circadian Rhythm. The use of poor street lighting, garden lights and light trespass from buildings, means most of us no longer experience truly dark nights. This can lead to disrupted sleep patterns, mood changes, stress, obesity and other health problems.

For nocturnal species, scientists have shown that artificial lighting is radically effecting migratory patterns, eating, sleeping and reproductive habits. For them, light pollution has turned their night-time into day.

This is putting many species, including amphibians, birds, insects, plants and their ecosystems at risk.

**60% of vertebrates and 30% of invertebrates are actually nocturnal**



### ParadropVR at Adventure Parks Snowdonia

Fly high above the landscape of Snowdonia National Park and experience the full panoramic of our night sky.

ParadropVR brings the constellations above us to life and provides a unique opportunity to experience the tranquillity of flying by night.

For more information visit:  
[www.paradropvr.com](http://www.paradropvr.com)

Snowdonia National Park covers 2130km<sup>2</sup> and has an average Sky Quality Meter reading of 21.37.

The reserve is home to 26,000 people and has an estimated 4.7 million visitors per year.

It is the largest National Park in Wales covering approximately 10% of the total land area.

Whilst the vast majority of towns and villages are located outside of the Park's central area, they still pose a threat to sky quality.

The Park is home to a large range of wildlife, including y gwyniad (a freshwater whitefish) and the Snowdon beetle - both are only found in Snowdonia.



Very Bad

Bad

Better

Best

### Economical cost

Light pollution costs billions of pounds each year in unnecessary electricity charges and has an environmental cost - the production of this wasted energy through mining and the burning of fossil fuels contributes to the increase in carbon dioxide in the atmosphere. On top of this, the decline in many of our nocturnal species such as pollinating insects is having a direct impact on biodiversity and food chains, including our food production.

**One street light can kill up to 150 insects each night.**

### With a few simple changes we can all make a big impact.

- Use low temperature LEDs and compact fluorescents to reduce energy consumption and minimise glare. By replacing all the bulbs in your home you could reduce your carbon dioxide emissions by up to 40kg per year and save money.
- Install dimmers, motion sensors, or timers on outdoor lighting and shield the light source to minimise glare and light trespass.
- Turn off unnecessary indoor lighting. Too often we leave lights on, but this is the cheapest, easiest and most effective way to reduce light pollution, energy consumption and cost.
- Use drapes or blackout curtains to reduce light trespass, especially in high rise buildings where there is a greater risk of bird collision.

Additional work is ongoing in our towns, cities, countryside and oceans to reduce light pollution and ensure:

- Lights are turned off in empty buildings and those not in use
- Street lights are shielded, energy efficient and on only where and when needed
- Stadiums, arenas and events are working to reduce their brightness
- New vehicles are fitted with glare free headlights
- The impact from Christmas decorations, illuminated advertising and shop fronts is minimised
- Marine habitats are protected from lights on ships, lighthouses and sky glow from our towns and cities
- More dark sky policies and practices are put in place to reduce light pollution and its effects on plants, animals and people



### Light bulb Moments

Diurnal species are awake during the day. Nocturnal Species are awake during the night. Both are effected by light pollution.

14 of 17 bat species which are native to the UK are thought to live in Snowdonia National Park.

Birds that hunt at night are adapted to see in the dark.

Artificial lights can mean they miss opportunities for prey that could feed them and their young.

Light pollution interferes with the light male fireflies create to attract their mates. This means less fireflies are born each year.

Exposure to artificial light causes migrating species such as Monarch Butterflies to veer off course on their long journeys.

Frogs and toads croak at night as part of their breeding ritual.

Artificial lights disrupt this chorus and result in less spawn and reduced populations.

Many insects are drawn to light and often die. Nocturnal species that feed on insects avoid the light, so have less food. Declining insect populations are impacting all ecosystems that rely on them for food or pollination.





### Alternative ways to light our way

Start with darkness and only add artificial light for a specific purpose and where needed.

Keep lights close to the ground, directed and shielded.

Use the lowest intensity light rather than the brightest.

Coloured lights are better than bright white lights.

Use non-reflective, dark coloured surfaces to reduce light bouncing off of materials.

### Colour makes a difference

Blue-rich white lights are the cheapest to run, providing the most light for the electricity used, but because their colour is closer to that of natural daylight, when used at night they cause more glare and disruption to the Circadian Rhythm. Other colours of light, with warmer tones are less bright, but have much less impact on us and the environment.

- Outdoor lighting with strong blue content is likely to worsen sky glow because it has a significantly larger reach than lighting that is less blue.
- Devices such as tablets, mobile phones, computers and TV's all use blue-rich white light. Some are worse than others, but we can reduce their impact by using Apps and other tools to change the temperature and glare of the screens at night. It is also recommended that we turn off all devices at least an hour before bedtime to minimise disruption to sleep.

**A white LED can be 8x brighter and so 8x more light polluting than the same wattage warmer LED**

**The damage that light pollution is causing can be reversed!**

**The solutions are easy to implement and can deliver immediate and lasting results.**



# Our Night Sky

## What is a Star?

Look up at the night sky and you'll see thousands of lights. Some are bright. Some look white or blue. Others look red or orange. Most of what you can see are stars - They are huge, glowing balls of super-hot gas made up of hydrogen and helium.

The closest star to Earth is the Sun, but most stars are incredibly far away and a lot are too far from Earth to be seen without a telescope. Stars are found in huge groups called galaxies. The Sun and our solar system, including Earth, are part of the Milky Way Galaxy, which contains hundreds of billions of stars.

As light from a star travels through Earth's atmosphere it gets distorted and appears to twinkle.

## What else might you see in the night sky?

**The Moon:** This is not a planet or a star, but a natural satellite that orbits the Earth and whose gravitational pull creates our tides.

**Shooting Stars (Meteors):** These are tiny pieces of dust and debris that burn up as they enter the Earth's atmosphere, creating bright streaks across the night sky.

**International Space Station:** This is the Earth's biggest man-made satellite. It is very reflective, making it the 3rd brightest object in the sky after the Sun and Moon, and it is fast moving, travelling around the Earth every 90 minutes.

**The Milky Way:** We are part of the Milky Way Galaxy, but the term "Milky Way" refers to the hazy band of coloured light arching across the sky.

**Planets** - There are 8 planets in our solar system, all orbiting the Sun. Mercury, Venus, Mars, Jupiter and Saturn are visible to the eye most of the year.

The Moon's distance from Earth is about 385,000km and is the only place in space humans have set foot.



## The life cycle of stars

Stars begin life as giant clouds of dust called nebulae. As more and more dust gathers, the centre gets very hot and nuclear fusion begins, creating a young star.

A newly formed star will continue to burn energy and glow for billions of years until it runs out of hydrogen.

Very hot stars look white or blue. Cooler stars look red or orange.

Once a star begins to run out of hydrogen it starts to die. They expand in size and cool on the outside, turning bright orange red in colour. These stars are called Red Giants.

Once all the energy is gone, most stars die, shrink and turn white. These stars are called White Dwarf Stars.

Larger dying stars (Red Super-giants) go out with a brilliant explosion, called a supernova.

Sometimes a supernova leaves a small, dense centre behind called a black hole.





## What is a constellation?

A constellation is a group of stars that make an imaginary shape in the night sky. They are usually named after mythological characters, people, animals and objects. There are 88 recognised constellations around the world and they have been used for many years in astronomy, navigation, farming, and storytelling.

The stars and their constellations change position in the sky because the Earth is rotating on an axis through the North and South Pole. Our galaxy surrounds the Earth's globe and different constellations are visible in the Northern and Southern Hemispheres, divided by the Equatorial Line (Equator). Snowdonia National Park lies within the Northern Hemisphere.



The "Plough" (also referred to as the Big Dipper) looks like a square frying pan in the sky and forms part of Ursa Major

## Resource Pack

We have provided the following resources:

- Fact cards for each constellation in the Northern Hemisphere, including the name and the image associated with it; Where the star is mainly visible (the Northern Hemisphere or the Equator);
- A Description of the constellation; The largest star and the best time to see it in our skies. These cards can be used for reference or in memory matching games.
- A checklist for all the constellations so you can mark off what you've seen.
- Phases of the Moon spinner: As the Moon orbits the earth the amount of light shining on it from the sun changes. This creates lunar phases. You can use the spinner to identify the current phase.



## Some more fun facts

People have used the North Star (Polaris) for centuries to guide them. Other stars move, but the North Star stays fixed in the sky.

On a really clear night, with no light pollution, a person with very good eyesight may be able to see about 2000 stars.

The farthest star we can see with the naked eye is Deneb, about 19,000,000,000,000 miles. That's 19 Quadrillion miles!

An Asterism is a commonly recognised pattern of stars that is not a constellation, such as the "Plough"

## Additional sources of information

[www.darksky.org](http://www.darksky.org)  
[www.visitsnowdonia.info](http://www.visitsnowdonia.info)  
[www.paradropvr.com](http://www.paradropvr.com)  
[www.adventureparcsnowdonia.com](http://www.adventureparcsnowdonia.com)

There are various free mobile apps for recording and monitoring light levels (SQM), and for stargazing.

There are also free apps and tools that reduce glare and blue light on devices.



## Andromeda



Mythology	Princess, chained to a rock to be eaten by Cetus
Brightest Star	Alpheratz
Best time to see	September



## Aquila



Mythology	Eagle, the bird carrying the thunderbolts of Zeus
Brightest Star	Altair
Best time to see	June



## Aries



Mythology	Ram whose fleece was recovered by Jason
Brightest Star	Hamal
Best time to see	October



## Auriga



Mythology	Shepherd / Charioteer, son of Vulcan
Brightest Star	Capella
Best time to see	February



## Boötes



Mythology	Herdsman, son of Zeus
Brightest Star	Arcturus
Best time to see	May



## Camelopardalis



Mythology	Giraffe
Brightest Star	$\beta$ -Cam
Best time to see	February



## Canes Venatici



Mythology	Hunting dogs of Boötes
Brightest Star	Cor-Caroli
Best time to see	April



## Canis Minor



Mythology	Orion's lesser hunting dog
Brightest Star	Procyon
Best time to see	January





## Cassiopeia



Mythology	Queen Cassiopeia, mother of Andromeda
Brightest Star	$\gamma$ -Cas
Best time to see	May



## Cepheus



Mythology	Ethiopian King
Brightest Star	Alderamin
Best time to see	September to November



## Coma Berenices



Mythology	Hair of Queen Berenice of Egypt
Brightest Star	$\beta$ -Com
Best time to see	March



## Corona Borealis



Mythology	Northern Crown
Brightest Star	Alphecca
Best time to see	May





# Cygnus



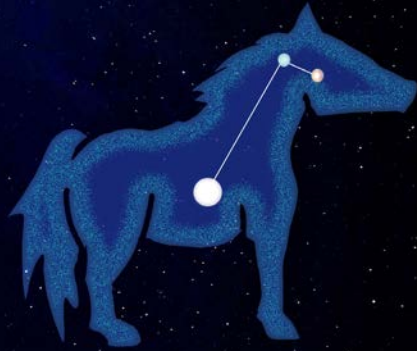
Mythology	Swan, Zeus in disguise
Brightest Star	Deneb
Best time to see	Summer



# Draco



Mythology	Dragon that guards the golden apple
Brightest Star	Eltanin
Best time to see	July



# Equuleus



Mythology	Little Horse
Brightest Star	Kitalpha
Best time to see	September



# Gemini



Mythology	Mythical twins Castor and Pollux
Brightest Star	Pollux
Best time to see	Winter



# Hercules



Mythology	Hercules, the greatest hero in Greek Mythology
Brightest Star	Kornephoros
Best time to see	May



# Lacerta



Mythology	Lizard
Brightest Star	$\alpha$ -Lac
Best time to see	August



# Leo



Mythology	Lion of Nemea, slain by Hercules
Brightest Star	Regulus
Best time to see	February



# Leo Minor



Mythology	Lion Cub
Brightest Star	46-LMi
Best time to see	February





# Libra



Mythology	Balance
Brightest Star	Zubeneschamali
Best time to see	May



# Lynx



Mythology	Lynx
Brightest Star	$\alpha$ -Lyn
Best time to see	January



# Lyra



Mythology	Lyre played by the musician Orpheus
Brightest Star	Vega
Best time to see	June



# Monoceros



Mythology	The Unicorn
Brightest Star	$\alpha$ -Mon
Best time to see	December



# Ophiuchus



Mythology	The Serpent-bearer, god of medicine
Brightest Star	Rasalhague
Best time to see	June



# Orion



Mythology	The Hunter, son of Poseidon
Brightest Star	Rigel
Best time to see	Winter



# Pegasus



Mythology	The Winged Horse
Brightest Star	Enif
Best time to see	September



# Perseus



Mythology	Husband of Andromeda, slayer of Medusa
Brightest Star	Mirfak
Best time to see	November

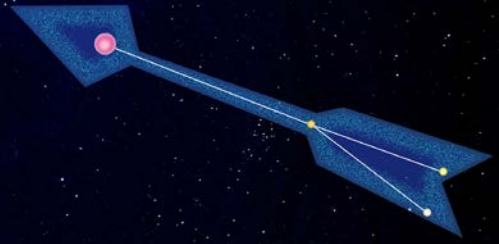




## Pisces



Mythology	Two fish swimming opposite each other
Brightest Star	$\eta$ -Psc
Best time to see	September



## Sagitta



Mythology	Arrow used by Apollo to kill Cyclops
Brightest Star	$\gamma$ -Sge
Best time to see	June



## Scutum



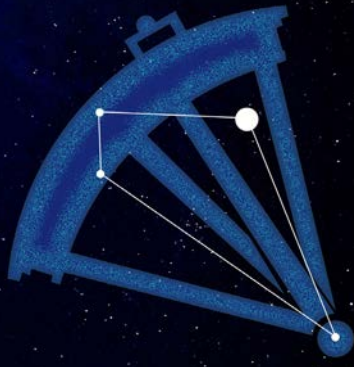
Mythology	Shield, honouring King John III of Sobieski
Brightest Star	$\alpha$ -Sct
Best time to see	June



## Serpens



Mythology	Serpent's Head
Brightest Star	Unukalhai
Best time to see	June



## Sextans



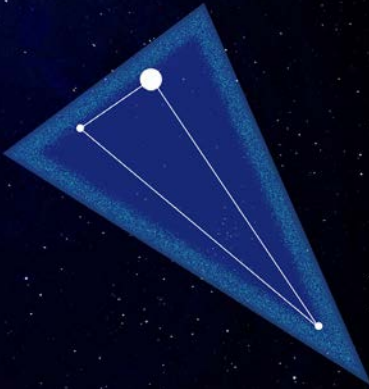
Mythology	Sextant, instrument for measuring star positions
Brightest Star	$\alpha$ -Sex
Best time to see	February



## Taurus



Mythology	The Bull, Zeus in disguise
Brightest Star	Aldebaran
Best time to see	December



## Triangulum



Mythology	The Triangle
Brightest Star	$\beta$ -Tri
Best time to see	October

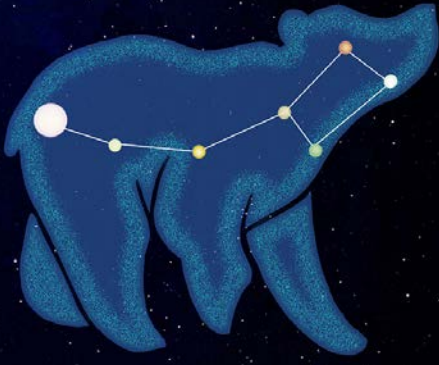


## Ursa Major



Mythology	Great Bear, or Callisto, the lover of Zeus
Brightest Star	Alioth
Best time to see	Spring





# Ursa Minor



Mythology	Small Bear, nymph that nursed Zeus as an infant
Brightest Star	Polaris
Best time to see	June



# Virgo



Mythology	Virgin, the goddess of justice
Brightest Star	Spica
Best time to see	April



# Vulpecula



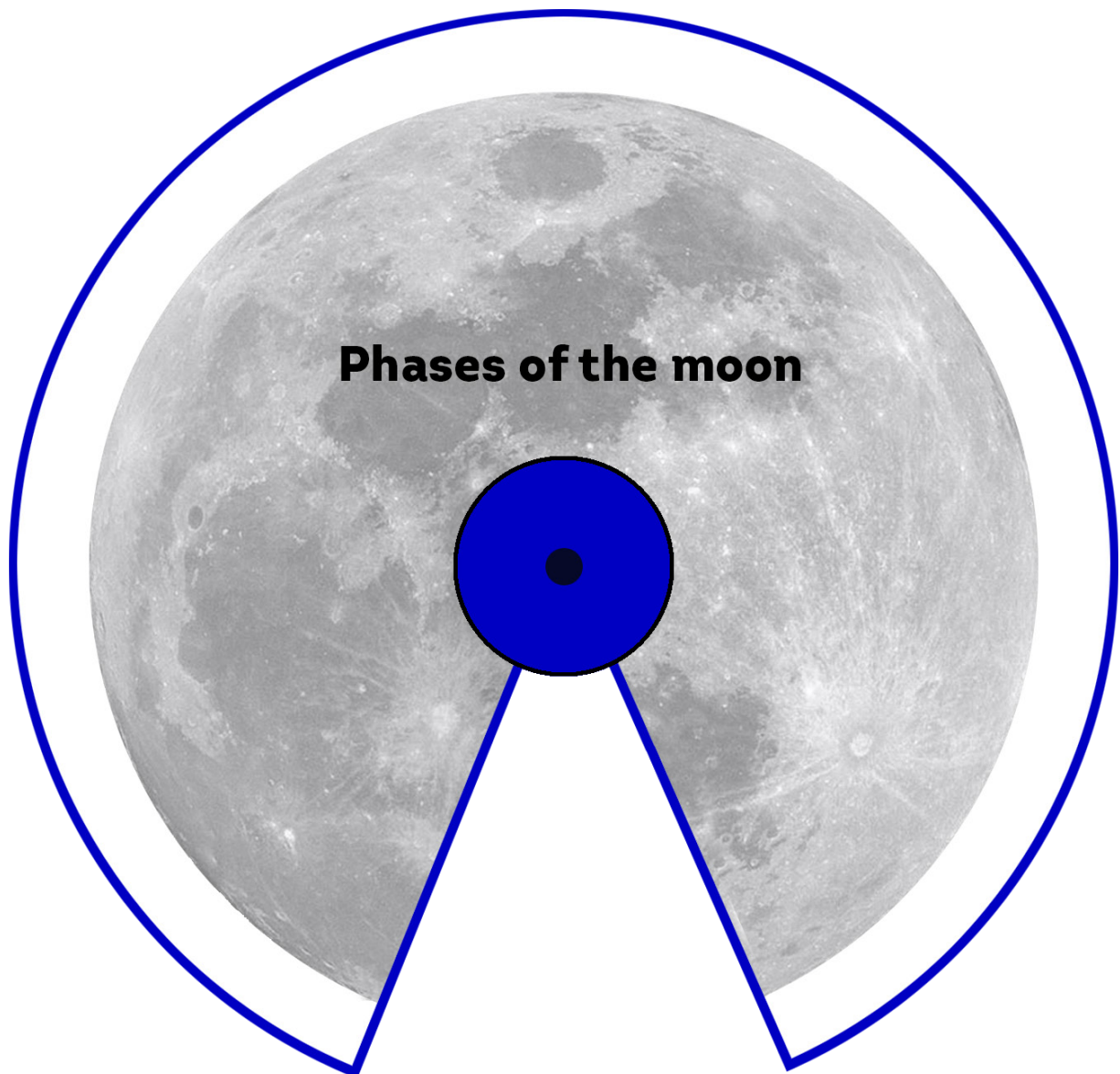
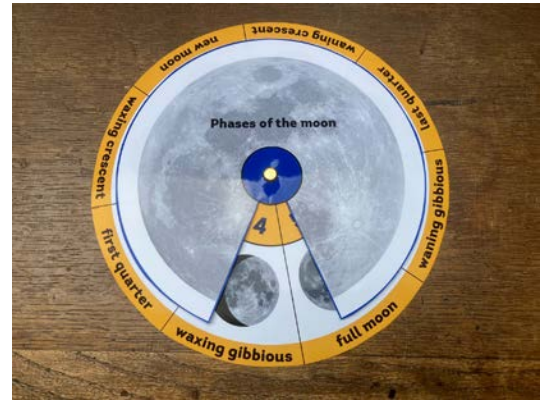
Mythology	The Fox
Brightest Star	$\alpha$ -Vul
Best time to see	July

## Constellation Checklist

- |  |                                     |
|--|-------------------------------------|
| <input type="checkbox"/> Andromeda       | <input type="checkbox"/> Leo Minor  |
| <input type="checkbox"/> Aquila          | <input type="checkbox"/> Libra      |
| <input type="checkbox"/> Aries           | <input type="checkbox"/> Lynx       |
| <input type="checkbox"/> Auriga          | <input type="checkbox"/> Lyra       |
| <input type="checkbox"/> Boötes          | <input type="checkbox"/> Monoceros  |
| <input type="checkbox"/> Camelopardalis  | <input type="checkbox"/> Ophiuchus  |
| <input type="checkbox"/> Canes Venatici  | <input type="checkbox"/> Orion      |
| <input type="checkbox"/> Canis Minor     | <input type="checkbox"/> Pegasus    |
| <input type="checkbox"/> Cassiopeia      | <input type="checkbox"/> Perseus    |
| <input type="checkbox"/> Cepheus         | <input type="checkbox"/> Pisces     |
| <input type="checkbox"/> Coma Berenices  | <input type="checkbox"/> Sagitta    |
| <input type="checkbox"/> Corona Borealis | <input type="checkbox"/> Scutum     |
| <input type="checkbox"/> Cygnus          | <input type="checkbox"/> Serpens    |
| <input type="checkbox"/> Draco           | <input type="checkbox"/> Sextans    |
| <input type="checkbox"/> Equuleus        | <input type="checkbox"/> Taurus     |
| <input type="checkbox"/> Gemini          | <input type="checkbox"/> Triangulum |
| <input type="checkbox"/> Hercules        | <input type="checkbox"/> Ursa Major |
| <input type="checkbox"/> Lacerta         | <input type="checkbox"/> Ursa Minor |
| <input type="checkbox"/> Leo             | <input type="checkbox"/> Virgo      |
|  | <input type="checkbox"/> Vulpecula  |

# Phases of the Moon Spinner

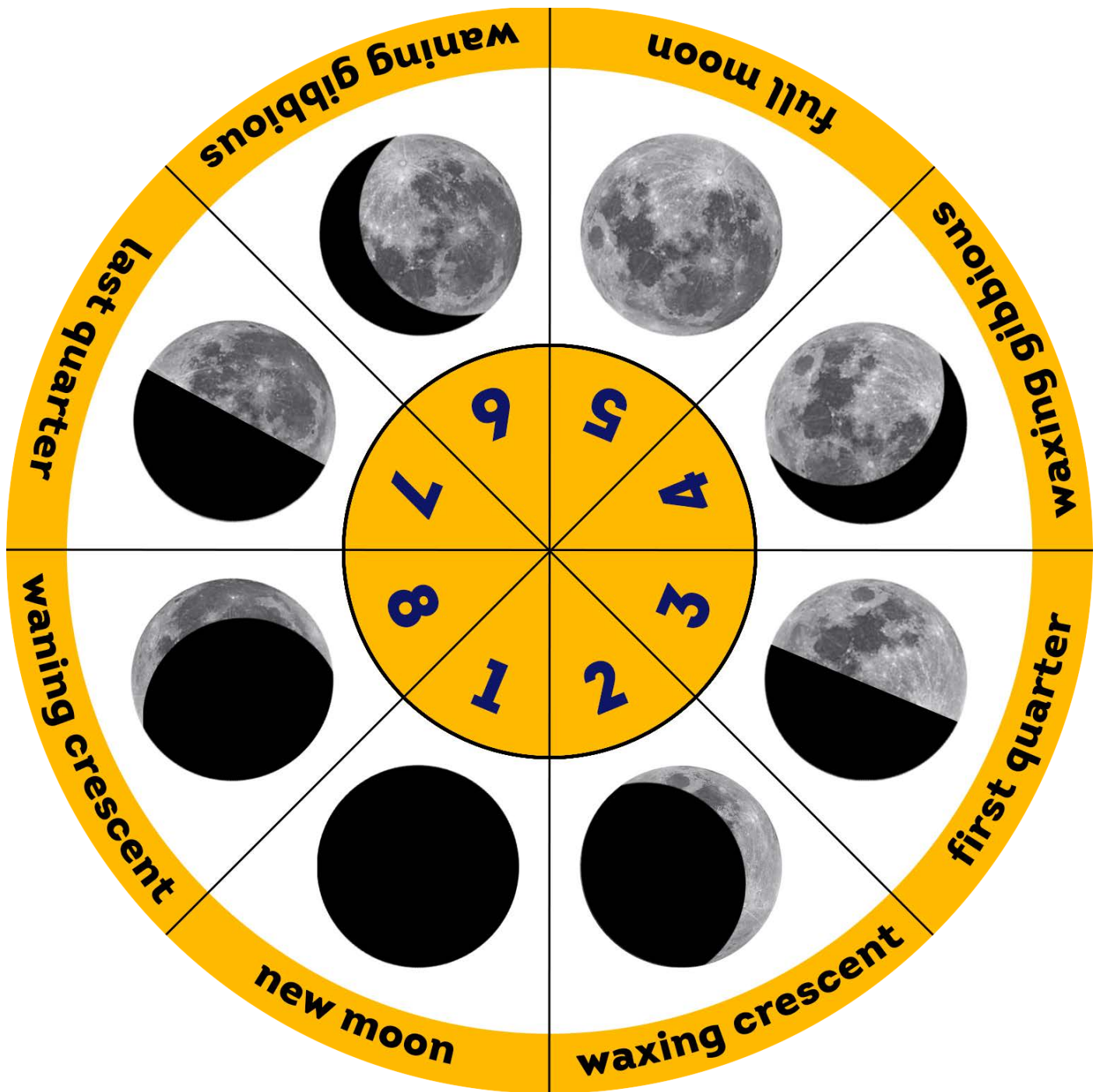
Simply print and cut out the discs and use a split pin  
in the middle to join them together.



Top

# Phases of the Moon Spinner

Simply print and cut out the discs and use a split pin in the middle to join them together.



Bottom