

## Lesson 1: Introduction to the Night Sky

### Overview of Day and Night

Feet on the ground:

Set current time and place, use cardinal points (South centered)

Advance time to sunset and through the night to current time

(One day will not make a big difference later)

-Talking point: to ancient peoples, the sun, Moon and stars moved across the sky and disappeared until they returned the next morning or evening.

Pull away from Earth and look at Eastern PA landforms:

Atlantic Ocean, Delaware Bay, Appalachians, etc.

Pull back into space to look at the US and advance time to sunset

Watching the East Coast “light up”

Pull back farther to see the rotation of the Earth.

-Talking point: We now know the Earth spins around its axis – this is called rotation. The axis of the Earth is an imaginary line from the North Pole to the South Pole.

Return to the ground view with North centered. Time after sunset.

(winter ~5PM, Spring and fall ~7PM, Summer ~9PM ---may need adjusting)

Planet labels only turned on (not Uranus, Neptune, or any of the Plutoids)

also Moon label only

-Talking points: After the sunset, twilight lingers for about an hour until it gets dark enough to see most stars. In fact, the first “star” you see most nights will likely be a planet.

Younger students – have you ever said “star bright, star light, first star I see tonight”? You were likely wishing on a planet not the first star.

Older students – Twilight is the legal time when you need to turn on your headlights, but you’ll notice that it’s much easier to see cars that already have their lights on. Our eyes work better in daylight than at night (if you have students that have studied rods and cones, you can add that here).

Advance the time about an hour to remove the Sun's twilight glow.

All – our eyes take about 20 minutes to get used to the dark, so don't be impatient when you go outside to look for stars.

You may have recognized the Big Dipper. These 7 stars are fairly bright compared to other stars in our northern sky.

Is it possible to add lines to just the dipper? Since it's not possible at this point, the narrator will need to draw the Dipper with a laser pointer.

This is not a constellation – A constellation is defined as one of the 88 pictures that make up our modern sky. The Big Dipper is an asterism. An asterism is a group of stars that make a small pattern that is easily recognizable – some of you may have heard of Orion's Belt. The Belt is 3 stars in the larger constellation that we see in the winter as Orion. Our Big Dipper is 7 of the stars that make up the constellation Ursa Major or the Great Bear.

Add the Bear This will need to be drawn with the laser pointer or you can put up all the constellation pix at the same time.

You all may know that the Dipper can be used to find the North Star, the most important star in our night sky. Using the 2 stars at the end of the dipper part, trace a line as though you were pouring something out of the dipper, until you reach a star – this is the North Star, Polaris. It's not very bright so why is it so important. Watch what happens if we stay up all night.

Slowly advance the time for about 6 hours (you don't want daybreak, but 6 hours should give you time to see the bear orbit the North Star a bit)

The Bear moved, but Polaris did not. This is what made it important to early explorers and sailors. They realized they could rely on that star to guide them.

Here you can go into why the Pole Star remains "fixed" in the sky. See the notes at the end of this lesson.

But let's return to our night sky and look at what's out there tonight.

Reset the sky to after sunset and center south opposite the doorway. Add lines for the constellation if needed. Be sure planetary labels are activated.

If Winter:

In winter, you will see more bright stars than any other time of the year. The constellation that nearly everyone has heard of is Orion, the hunter. Look for 3 bright stars in a row – this is his

famous Belt. Now look for 4 bright stars forming a box around the Belt. The 2 stars above are Orion's shoulders, the 2 below, his feet or legs. You may notice that the star on his right shoulder is reddish and the one near his left foot is bluer. Stars have colors because they are different temperatures at their surfaces. Red stars are cooler than our Sun, blue ones are much hotter.

For older students you can go into more detail here if needed – see the Notes section at the end.

[Add Orion's picture \(since we can't do this yet, just add the lines and later after all the ones you want to look at are described, you can put up the pictures.](#)

Using Orion's Belt, draw a line to his right until you come to a nice bright star – this is Sirius the Dog Star, the brightest star in our night time sky.

If you wish, see if any students have read Harry Potter, they will name Sirius Black, Harry's godfather, who could turn himself into a dog. You can add that they'll find lots of neat references to the night sky in the Harry Potter books – see Notes at the end.

Sirius is the Dog's nose.

[Add the Big Dog and the Small Dog \(Canis Major and Canis Minor\)](#)

Here are Orion's 2 hunting dogs.

Go back to Orion's Belt and go the other way. You will come to a nice V-shaped ice cream cone in the sky. The ancient Greeks did not have ice cream – this is Taurus the Bull

[Add Taurus](#)

If you wish point out the Pleiades (also called the Seven Sister) sitting on Taurus's shoulder, you can talk about the pretty cluster of a bright star and 5-8 smaller stars, depending on their eyesight. But mention that if they look at this cluster with a pair of binoculars or a small telescope, they'll be able to count 50-100 stars in that spot. You can also tell them they know the Japanese name for the group – Subaru – look at the symbol for Subaru – it's an oval with a big star and 5 smaller ones.

If you draw a line from the blue star through the red star, you'll come to a rectangle of stars with 2 bright stars at the top. These 2 stars mark the heads of Castor and Pollux, the Gemini or Twins.

[Add Gemini](#)

The final star and constellation in a huge asterism called the Winter Circle is Cappella the Baby Goat in the constellation the Charioteer which looks a little like a pentagon.

#### Add Auriga

Now you can draw the Circle. Start with the red star in the center of the circle. Beginning with the blue star, move clockwise through Sirius, Procyon (the Little Dog Star), Castor, Pollux, Cappella, and end at Aldebaran, the eye of Taurus the Bull.

Be sure to point out any planets visible in the night sky. See Notes for any meteor showers. You can also point out the fall constellations in the western sky, the spring constellations beginning to “rise” in the east, and the position of the Big Dipper and Cassiopeia the Queen in the northern skies if there is time.

West: add the Great Square of Pegasus and Andromeda

East: add Leo the Lion

North: add Cassiopeia.

#### In Spring:

In the spring we see Leo the Lion high in the sky. Look for a backward question mark

Add the lines for Leo if possible

This is the face and front paw of the Lion. Look for a small triangle of stars for his tail and back foot.

Add the picture of Leo (again, at this point, I’d wait and add all the full pictures later)

Notice the Big Dipper high in the sky. If you filled the dipper with something like soup, and you filled it too full, it would spill right on the lion.

Using the handle of the Dipper, trace the curve to a nice bright star -- This is Arcturus in the constellation called the Herdsman or the Bear Hunter depending on who you ask.

#### Add Bootes

Point out the Winter Circle in the west (see **Winter**)

The bright star in the east is Spica in the constellation Virgo.

#### In Fall:

Fall brings the Great Square of Pegasus high into the sky

Possible to add the asterism, the Great Square, by itself? Otherwise add Pegasus and Andromeda, just the lines.

The Square is an asterism. Three of the stars belong to Pegasus, the fourth belongs to the princess Andromeda. Notice at this time of year it is difficult to find the Big Dipper (it's in the doorway,) so some people mistake this as the really big dipper. (Trace the Square as a dipper and Andromeda as the handle) Look for a W next to Andromeda, this is her mom the Queen.

Add Cassiopeia. If possible add M31.

In between the princess and the Queen, you might notice a fuzzy star this is the Andromeda Galaxy, the next closest spiral galaxy to our own Milky Way. If you could travel as fast as light, 186,000 miles a second, it would take you 2 ½ million years to get to this galaxy.

In the West, notice 3 bright stars. This is the asterism, the Summer Triangle.

Add in Lyra, Aquila, and Cygnus

The stars are Vega in Lyra the Harp, Altair the eye of the Eagle Aquila, and Deneb the Tail of Cygnus the Swan.

The Swan also contains an asterism know as the Northern Cross.

Here you can point out the first Black Hole discovered – indicate a spot in the middle of the Swan's neck – this is called Cygnus X-1. The X stands for X-ray source as this is how it was discovered. For more information on Black Holes, see Notes.

## Summer

The summer sky focuses on the Scorpion low in the southern sky. Look for a long J shape.

Add Scorpio, lines if possible then picture.

If you've never seen a colored star, look for the Scorpion in the summer. Bright red Antares, the Scorpion's heart, is a beautiful sight. It gets its name because people mistook it for the planet Mars. Antares basically means not Mars. (Planets are traditionally named for Roman gods and goddesses. Mars' Greek counterpart is Ares, thus the star's name anti (not) Ares (Mars)).

Near the tail of the Scorpion, look for another asterism, the Teapot

The lines for Sagittarius will show the Teapot

On a nice dark night somewhere without street lights, you might see steam coming from the spout of the Teapot. This is the Milky Way. While all the stars we are looking at belong to the Milky Way, when we look at the Teapot we are looking into the center of our galaxy and therefore see more stars. The Teapot belongs to the constellation Sagittarius the Archer.

[Add the picture for Sagittarius](#)

Overhead look for the 3 bright stars of the asterism the Summer Triangle.

[Add Lyra, Aquila, and Cygnus](#)

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Depending on the amount of time and the grade level, either finish with night becoming day by advancing the time until the sun reappears, using the time to reinforce rotation, pointing out the “stationary” North Star and the seeming movement of the stars around it or move into another season allowing a discussion of why we have seasons. See Lesson 2.