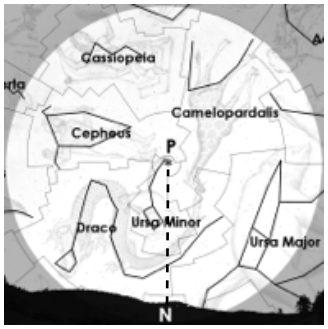
## * Why Polaris Doesn't (Seem To) Move


Like the Sun, the Night Sky appears to rise in the East and set in the West (which is a result of the Earth spinning from West to East).

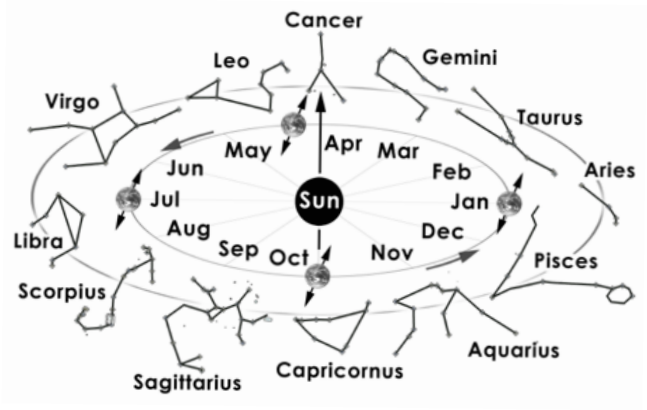
The Earth's rotation axis is tilted 23 degrees and does not wobble* as the Earth revolves around the Sun (as shown at left and above). These arrows in the Northern Hemisphere appear to point to the same distant point (so far away that parallax doesn't come into play, top right). This point is very close to **Polaris**, the North Star.


* Actually it does wobble. This phenomenon, called the "precession of the equinoxes," takes 26,000 years to complete a single cycle.

## * The Circumpolar Constellations




The sky spins from East to West around Polaris ("**P**" in the image). If you draw a (dotted) line from Polaris to the Northern Horizon and spin that line to make a circle with Polaris as the center (white circle shown at left), that circle contains stars that are **ALWAYS VISIBLE** in the Night Sky from Central New York (or any location between 40 to 45 degrees North Latitude). These are **circumpolar stars**. The constellations made up of these stars are the **circumpolar constellations – Ursa Minor (Little Dipper), Ursa Major (Big Dipper), Draco, Cepheus, Camelopardalis**, and **Cassiopeia**. Their orientations due to Earth's rotation may change, but they are **ALWAYS VISIBLE IN THE NIGHT SKY – SO LEARN THESE SIX FIRST**!




## * Zodiac, Ecliptic, Solstices, Equinoxes

The constellations of the **Zodiac** are special because they mark the apparent path the Sun and planets take across the sky as the Earth revolves around the Sun.

**Ecliptic** - Because the Solar System is a nearly flat disk, all objects within in appear to move through the same area of the sky from our vantage point. This path, marked by the **Zodiacal Constellations**, is known as the **ecliptic**.

**Rotation Axis** - The rotation axis of the Earth is tilted 23 degrees (as shown in the image above) and this axis always points the same way (the Northern arrows marking the axis all point in the direction of **Polaris**) as the Earth revolves around the Sun.

**Solstices** - The Summer and Winter Solstices occur when the Northern tip of the arrows are either closest to (longest daylight, Summer) or farthest from (shortest daylight, Winter) the Sun. In actuality, the Earth is slightly closer to the Sun in January than it is in July!

**Equinoxes** - The Spring And Fall Equinoxes occur when the Northern and Southern arrows (the North and South Poles) are equidistant from the Sun (so both hemispheres see equal amounts of light and dark).

**Zodiacal Jargon** - The Sun is described as being "In Cancer" (note the arrow in the image above) when Capricornus reaches its highest position in the Night Sky (Midnight). Ancient astronomers (and astrologers) understood the periodicity of the Night Sky well enough to know which stars were being hidden by the blindingly bright Sun, thus knowing which part of the sky the Sun must be obscuring. Note the positions of opposite pairs of constellations in the image above.

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# How The Night Sky Moves (v4)



This brochure explains how the Night Sky appears to move from our position on the Earth's surface. Of course it is not the Night Sky that is moving – the Earth spins on its axis each day and revolves around the Sun once every 365 days. These two regular, highly predictable motions produce the periodic changes to our Night Sky. Understanding these changes enables simple tricks, like finding North without a compass, and more complicated tricks, such as setting up and operating GOTO telescopes.

## A. 24 Hours In A Day…

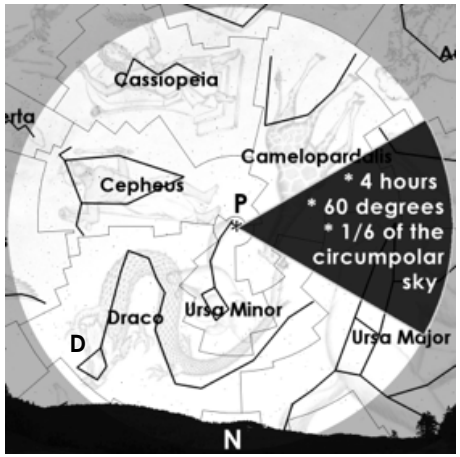
* With **24 hours in a day**, the sky turns **15 degrees** (**1/24th of 360 degrees**) **per hour**. During a 4-hour observing session, **circumpolar constellations** will then appear to move **counterclockwise (East-to-West) 60 degrees** - 1/6th of a circle - around **Polaris** ("**P**" - see below).
* This can easily be seen by following objects on the horizon (trees, buildings) to mark star positions hourly (consider Draco's head ("**D**") - see below).

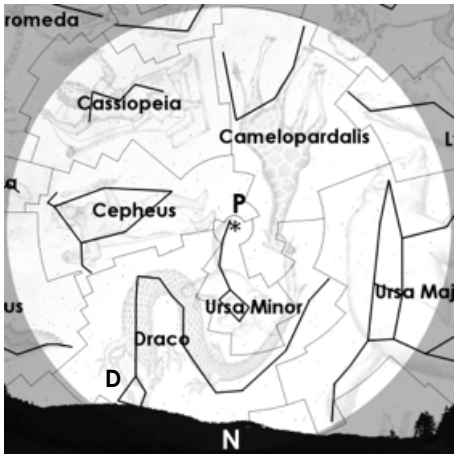
## B. 23 Hours 56 Minutes 4 Seconds In A Rotation…

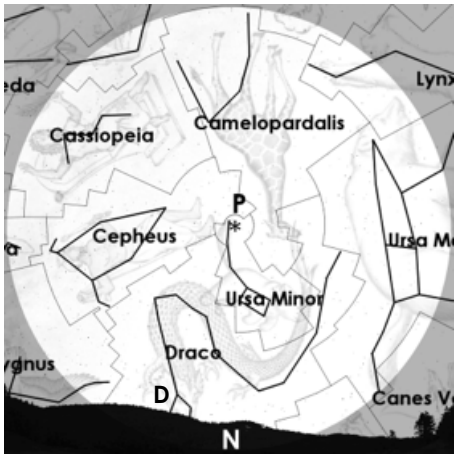
* But wait! There are **24 hours in a day**, but the Earth takes **4 minutes less than 24 hours** to make one full rotation. This means that, at a fixed time every night (using 9 p.m. below), the sky will appear different each night by **3 minutes and 56 seconds** – **1 full degree** – of counterclockwise rotation (when facing North). The sky then looks different by a **90 degree counterclockwise rotation** every **3 months** (see below).
* After 12 months, the Earth (and our view of the Night Sky) almost returns to the same position it was the year before. Why almost? Because the year (the time it takes for Earth to make one full revolution around the Sun) is **NOT 365 days**, but **365.25 days**! We use the "Leap Year" (by adding February 29th) to correct for this, which then returns us to the same position every **4 years**. That said, the difference in the Night Sky at **9 p.m. - 1 January 2013** and **9 p.m. - 1 January 2014** is virtually imperceptible.

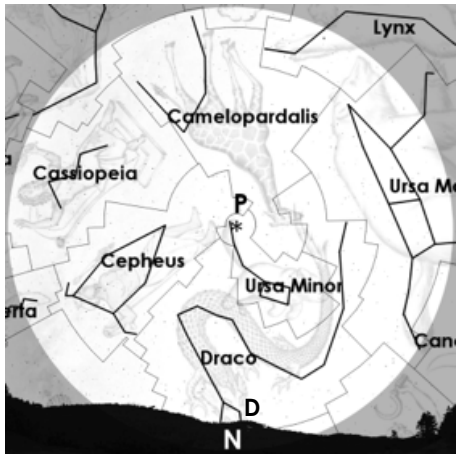
**1 January 2013 - 9 p.m.** | **1 January 2013 - 10 p.m.** | **1 January 2013 - 11 p.m.** | **2 January 2013 - 12 a.m.**

A

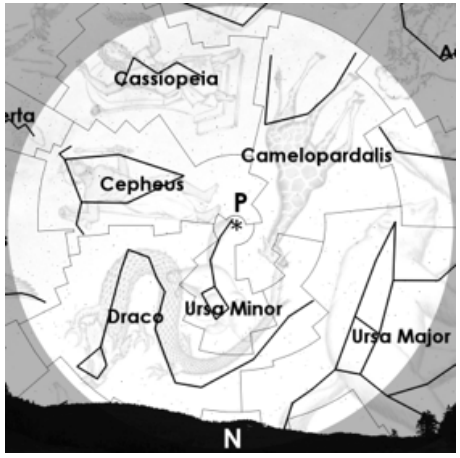


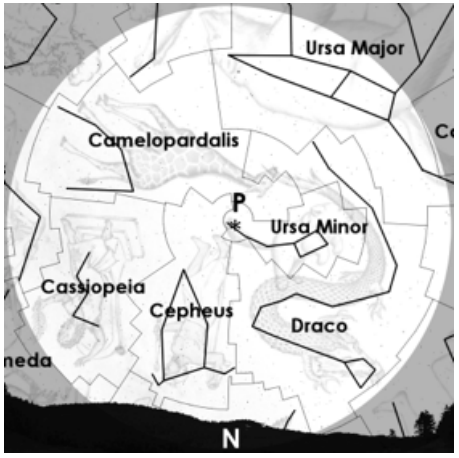



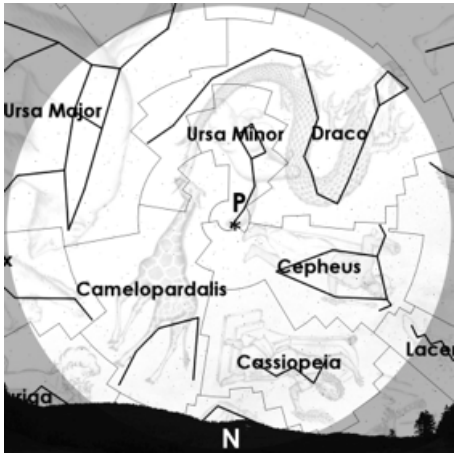



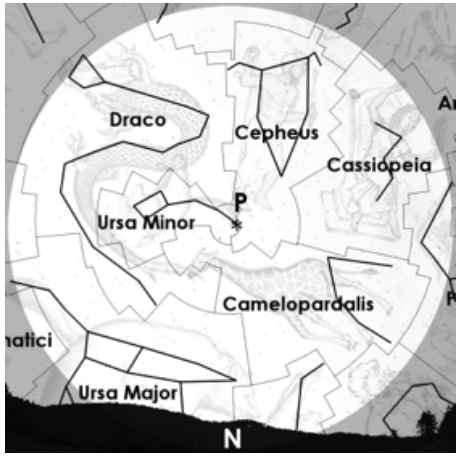




B




**1 January 2013 - 9 p.m.** | **1 April 2013 - 9 p.m.** | **1 July 2013 - 9 p.m.** | **1 October 2013 - 9 p.m.**