

Stars and Cells 2007 Astronomy Challenge

Due: Friday July 20

These questions are challenging. They are very hard, and one is downright tricky, but these questions will allow you to take what you know and apply it to new and interesting problems. The main purpose of the challenge is to get you thinking.

How you reach your answer is more important than the answer itself. I am not interested in a simple one-line answer. I want to know how you found your answer. Please write down everything you think about the questions (like a journal).

Working together is strongly encouraged. I expect it will be very useful for you to discuss in groups. Please write up your answers in your own words (or at least your own handwriting), and please list with whom you worked.

Please ask me for help. I am willing to help anytime. Please do not use the internet to simply Google the answers; I have websites listed for the images for citation purposes, not for you to visit and download an answer.

1. Figure 1 is commonly called “Earthrise.” It was one of the first images of the Earth from space. From the perspective of the moon, the Earth looks to go through phases like the moon does when viewed from Earth.
What is the phase of the Earth in Figure 1?
What is the phase of the moon as viewed from Earth?
2. Figures 2 and 3 are curious pictures of the moon doing the same thing (note the pattern of light and less light on the disk of the moon). You may have seen this at night occasionally. It’s not that rare, and it’s not some special adaptive optics image.
What is the configuration of the Earth, moon, and Sun to make this happen? (Diagram with labels is probably more useful than a description. Please include the path of the light.)
3. Figure 4 combines many pictures of the moon taken at various intervals of a total lunar eclipse. The positions of the moons in the image do NOT correspond to physical locations on the sky during the actual eclipse.
Why does the moon change color during the eclipse? There are two subtly different but related reasons why the moon changes color early in the eclipse and late in the eclipse. To start, familiarize yourself with what the configuration of the Earth, moon, and sun are during a lunar eclipse.
4. Merriam-Webster Online Dictionary has the following definitions:
 - a. Astronomy: the study of objects and matter outside the earth's atmosphere and of their physical and chemical properties
 - b. Astrology: the divination of the supposed influences of the stars and planets on human affairs and terrestrial events by their positions and aspects

Sign	Dates
Aries	March 21-April 20
Taurus	April 21-May 21
Gemini	May 22-June 21
Cancer	June 22-July 22
Leo	July 23-August 21
Virgo	August 22-September 23
Libra	September 24-October 23
Scorpio	October 24-November 22
Sagittarius	November 23-December 22
Capricorn	December 23-January 20
Aquarius	January 21-February 19
Pisces	February 20-March 20

This cluster is about studying *astronomy* but astrology has some foundation in astronomy, and I'm going to use astrology to teach about the *planisphere* and the stars. Given is a chart that will help you identify your astrological sign, which corresponds to a constellation on the ecliptic on your planisphere. A constellation is a region of the sky that bounds the few visible stars that make up the shapes and is typically larger than the visible stars (see Figure 5). The ecliptic is the plane of the solar system on the sky and is labeled on your planisphere (dashed line).

What does your astrological sign mean to an astronomer? There is an astronomical interpretation to your astrological sign. To start, use the planisphere to view the night sky on your birthday (the exact time does not matter): **where is the constellation corresponding to your sign?**

Bonus question: what might be another useful *type* of astrological sign (not another constellation in the sky)? As in the type listed above, this type would be important and fairly unique to your birthday. Hint: the type of sign of which I'm thinking would not be as easy to pinpoint by only the month of one's birth but would require the birth day and hour.

- Figures 6 and 7 are of a full moon (the same side of the moon too). They are quite different. (This is the very tricky question, by the way.) Figure 6 is very unique (though also not an adaptive optics image), and the other is quite common. To start, clearly enumerate how the images are different.

What is so special about Figure 6?



Figure 1: Earth rising over the moon, taken on December 24, 1968, on the Apollo 8 mission (<http://antwrp.gsfc.nasa.gov/apod/ap051224.html>).



Figure 2: Mysterious moon, credited to Alson Wong
(<http://webpages.charter.net/alsongwongweb/>).



Figure 3: Mysterious moon, credited to Matt BenDaniel
(<http://www.astrographics.com>).



Figure 4: Total lunar eclipse collage
(http://www.spaceweather.com/eclipses/gallery_15may03.html).

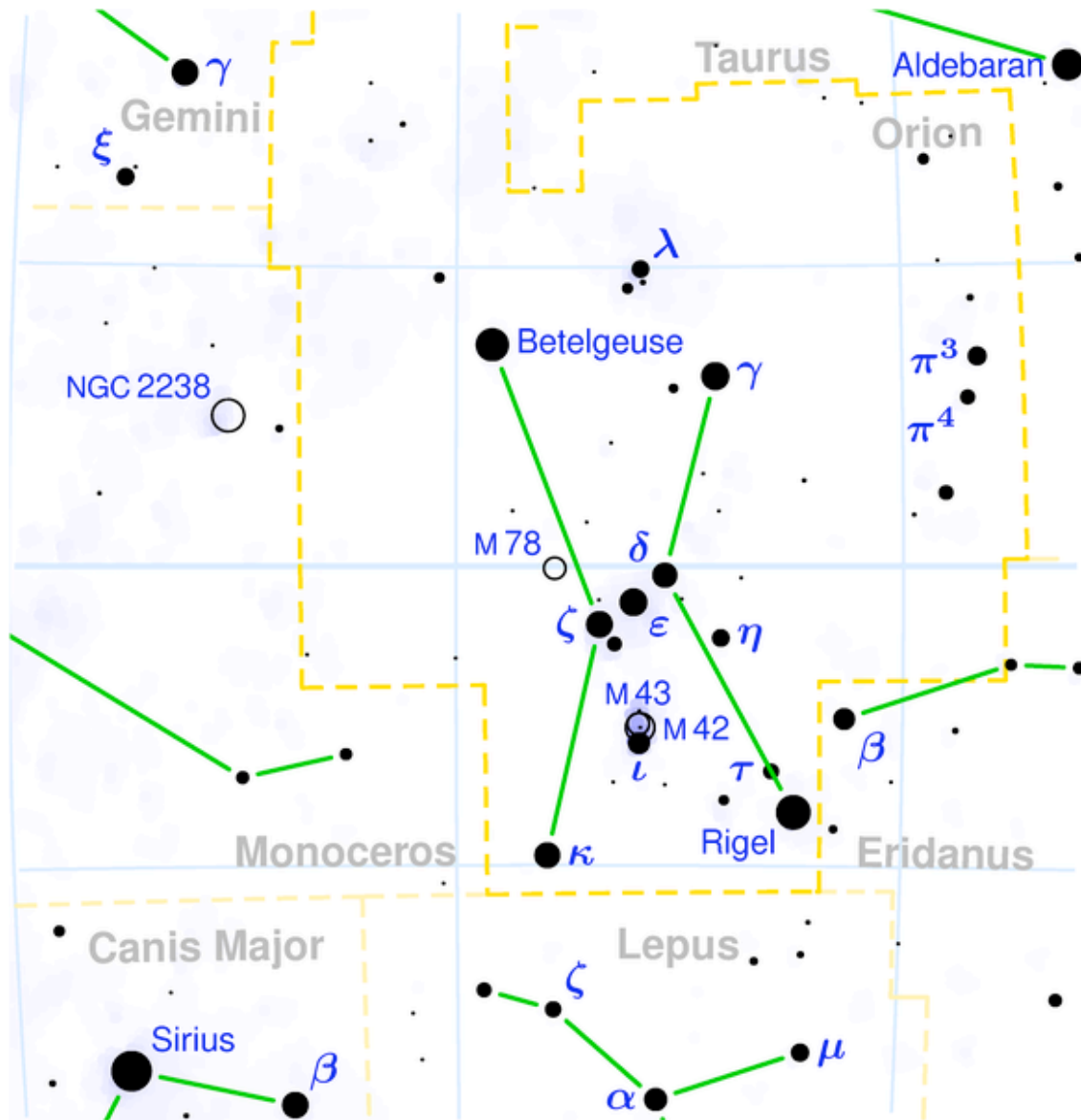


Figure 5: Orion Constellation—The stars in the shape of Orion the Hunter (shown connected with green lines) are within the Orion constellation, which is the region including the Hunter and bounded by the dashed yellow lines (<http://en.wikipedia.org/wiki/Constellation>).



**Figure 6: Full moon property of UC Regents/Lick Observatory (L9;
<http://www.ucolick.org/~pubs/photos/index.html>).**



Figure 7: Full moon, credited to Robert Gendler
(<http://antwrp.gsfc.nasa.gov/apod/ap000113.html>).