

Observing Exercises

You will complete **Exercise 1** and an **additional 3** of the following exercises:

Exercise 1: Sketching the North Circumpolar Cap (**mandatory**)

Exercise 2: Seasonal Constellations

Exercise 3: Telescope Observations

Exercise 4: Observing the Moon or Planets amongst the background stars

Exercise 5: Sketching the Moon

Exercise 6: Observing the Sunrise/Sunset point

Before you observe:

1. Read "Notes on Observing" thoroughly.
2. Use Starry Night, Stellarium, or other planetarium program to identify and locate your targets.

Exercise 1, Sketching the North Circumpolar Cap, must be completed and handed in during one of the four observing sessions that will take place throughout the term. You are responsible for attending one of these sessions. See further details in your Notes on Observing handout.

Exercise 1: Sketching the North Circumpolar Cap (mandatory)

As soon as you get to the observatory **sketch the Big Dipper, the Little Dipper and Cassiopeia** on one full page diagram making sure that their relative positions to each other and to the horizon are drawn as accurately as possible - this means completing the sketch in about 15 minutes. Draw the horizon and label the applicable cardinal points. Include details of the observation: date, time, location, sky conditions. **You need to repeat the sketch one hour later.**

Using these two full page sketches answer the following questions:

- Did the positions of these constellations change with respect to each other over the one-hour period? Is this what you expected? Why or why not?
- Did the positions of these constellations change with respect to the horizon over the one-hour period? Is this what you expected? Why or why not?

Ursa Major (Ursae Majoris) UMa: (The Great Bear, The Big Dipper, The Plow)

Through all ages, Ursa Major has been known under various names. It is linked with the nymph Kallisto, the daughter of Lycaon, a king of Arcadia in Greek mythology. Moving along the asterism of the dipper from the lip identify the stars Dubhe (α UMa), Merak (β UMa), Phecda (γ UMa), Megrez (δ UMa), Alioth (ϵ UMa), Mizar (ζ UMa), and Alkaid (η UMa).

Show the relative position and brightness of these stars on your drawing, identifying each with its Greek letter.

Locate and record Mizar's faint companion: Alcor.

Estimate and record the angular distance between

- a) the pointer stars, α UMa and β UMa,
- b) α UMa and Polaris (α UMi),
- c) between the stars, Mizar and Alcor.

Ursa Minor (Ursae Minoris) UMi: (The Little Bear, The Little Dipper)

The origin of this group is uncertain and in some ages has been referred to as the Little Dog belonging to Kallisto.

Label β UMi and γ UMi (the "Guardians of the Pole"). Estimate the altitude of Polaris, α UMi, above the horizon.

Cassiopeia (Cassiopeiae) Cas: (The Queen, The Chair, or, The Throne)

Cassiopeia is one of the oldest and best known of our constellations. The Chair or Throne is quite familiar to most observers. It is also known as the celestial W when below the Pole and the celestial M when above it. In mythology, Cassiopeia was the wife of Cepheus, king of Ethiopia, and the mother of Andromeda.

Identify in the sky and sketch the 6 major stars making up "Cassiopeia's Chair". Locate β Cas and label it on your diagram. Note that references to stars such as α UMa, spoken as alpha Ursae Majoris, literally means alpha of Ursa Major. The Greek letters are usually assigned in order of brightness in the constellation (α -- brightest). Note that the constellation, Ursa Major, is a major exception to this rule.

----- End of Exercise 1 -----

Exercise 2: Seasonal Constellations

The following 3 constellations should be sketched on a full page diagram making sure that their relative positions to each other and to the horizon are drawn as accurately as possible. Draw the horizon and label the applicable cardinal points. Include details of the observation: date, time, location, sky conditions.

Lyra (Lyrae) Lyr: (The Lyre) Brightest star is Vega, α Lyr.

Cygnus (Cygni) Cyg: (The Swan, The Northern Cross)

Locate the main stars outlining this constellation. Mark Deneb, α Cyg, and, the binary star, Albireo, β Cyg, on your diagram. Can you see the Milky Way? If yes, indicate its position through Cygnus by shading.

Aquila (Aquilae) Aql: (The Eagle) Brightest star is Altair, α Aql.

Note how the 3 stars: Vega, α Lyr; Deneb, α Cyg; and Altair, α Aql, form a conspicuous triangle. This is known as the Heavenly Triangle or the Summer Triangle.

After you have completed the above observations, look at all the stars in the sky to **find the brightest star that you can see. Then locate the faintest stars that you can see.** Assign the number 1 to the brightest star and the number 5 to the faintest. Then the brightness of all stars can be assigned numbers between 1 and 5. Note that the brighter stars are assigned smaller numbers.

Beside the stars in your sketches of the above constellations, indicate the number, between 1 and 5, corresponding to the brightness of the star. You will have to compare brightness of stars: first with the brightest and faintest, then with stars in between.

Before marking down any numbers, try several stars and see how you progress. The aim of this exercise is to note that you can subdivide the range in brightness of stars into 5 groups.

Exercise 3: Telescope Observations

During the observing sessions, your teaching assistants may set up telescopes and you may have the opportunity to observe some celestial object. Alternatively, you may use your own telescope or a telescope available at a public observing event.

For your exercise, include the following:

1. Include details of the observation: date, time, location, sky conditions.
2. Write down a detailed description of the equipment used. This includes the brand and size of the telescope and the focal length of the eyepiece. You may need to ask for this information!
3. Make a careful sketch of what you observe through the eyepiece. Label your sketch with the name of the object you are observing! Comment on the orientation of the object.

Exercise 4: Observing the Moon or Planets amongst the background stars

The position of the Moon and Planets amongst the background stars is constantly changing as these objects move in their orbits around their parent body.

1. Include details of the observation: date, time, location, sky conditions.
2. **Make a sketch of the object (Moon or planet)** including the surrounding star background. Label this sketch with the name of the object, the horizon and the applicable cardinal points.
3. After your observations, use Starry Night, Stellarium, your star charts or other planetarium program to help you label the relevant constellations and the bright stars that appear in your sketch.

4. Now set the planetarium program for a date in the future: in the case of the Moon, look at the following day, and in the case of a planet, look at the following month. Now draw the position of the Moon/planet on your sketch at this future date. Label with the date.

Exercise 5: Sketching the Moon

At a time when the Moon is visible in the sky, **make a careful sketch including shading to indicate the phase and any dark craters/features visible**. This may be done using only your eyes, or with the assistance of binoculars or other optical aid. Include details of the observation: date, time, location, sky conditions. Include details of the equipment used for this observation (i.e. naked eye or otherwise). Indicate the phase of the Moon. **Using a map of the Moon, label the prominent dark features that you included in your sketch.**

Exercise 6: Observing the Sunrise/Sunset point

Using Starry Night, Stellarium, or other planetarium program look up and record the time of sunrise (or sunset) on the day you plan to observe.

1. Include details of the observation: date, time, location, sky conditions.
2. Find a location with a flat horizon and go to that location before the time of sunrise/sunset.
3. Make a sketch or take a photo of the horizon and indicate the position of the Sun as it is rising or setting.
4. Using a compass/GPS/phone app, and as precisely as you can, locate the position of East (sunrise) or West (sunset) and indicate this on your drawing or on a printout of your photo. Where is the Sun with respect to this position?
5. Using Starry Night, Stellarium, or other planetarium program set the date for the day you observed at sunrise (or sunset). Note the azimuth of the Sun. Now set the date for the Winter Solstice at sunrise (or sunset) and note how the position of the Sun has changed. Mark this position on your diagram as best you can. What direction has the Sun moved?