Astronomy Kit Contents

Included in this Kit:

- 4 sets of binoculars, including:
  - 4 binocular tripods
  - 4 mobile phone adaptors
  - 4 manuals
  - 4 lens cloths

- 2 reflector telescopes, including:
  - 2 tripods
  - 6 eyepieces (2 each of 20mm, 12.5mm, and 4mm)
  - 2 erect mirrors (1.5X magnification)
  - 2 Barlow lenses (5X magnification)
  - 2 finder scopes
  - 2 moon filters
  - 2 mobile phone adapters
  - 2 accessory trays
  - 2 user manuals

- 2 *Explore the Moon with Binoculars* workbooks
- 2 *Explore the Moon with a Small Telescope* workbooks
- 2 *50 Things to See with a Telescope* workbooks

- 3 Planispheres

Telescope Setup

Please read through the included manual for setup, it is very thorough and will guide you through each step. For a visual walkthrough, scan the QR code inside the manual, or visit:

- Setup: **https://bit.ly/43eDVlF**
- Using the telescope: **https://bit.ly/43AxxF1**

They will take you to Amazon, but this is just where the videos are hosted by the seller.

Workbooks

You are welcome to photocopy any of the workbook sheets as long as you are copying less than 10% of the book. Please refrain from writing in the instruction areas of the books, as they are intended for everyone to use.

Additional Resources

- Crash course in astronomy: **https://www.discovertheuniverse.ca/educators**
- Introduction to Stargazing and Nighttime Photography from Nature Conservancy of Canada (recorded webinar): **https://youtu.be/v2Ez959PjsU**
- Royal Astronomical Society of Canada: **https://rasc.ca/**

Program Ideas

- Stargazing 101: host a basic introduction to using the telescope and planisphere. This would make a great program for all ages. If you plan to host with children, make sure to have extra help in using the equipment.
- Nighttime photography program: using the smartphone attachments for the binoculars and telescopes, have your patrons take photos of the different stars and planets they see
- Stargazing at dusk: if you want to bring kids in but won't have a great turnout past bedtime, why not have families try stargazing at dusk? You might not see all of the stars, but you'll be able to get a great view of the moon and any early stars before night sets in

IMPORTANT: You will see this warning in the telescope and binocular manuals, but DO NOT POINT YOUR INSTRUMENTS DIRECTLY AT THE SUN. Not only can this damage your eyes, but the lenses of the telescopes and binoculars can become damaged if they are aimed directly at the sun.

Tips & Expectations for Visual Observers - Royal Astronomical Society of Canada

Making and Recording an Observation

There are three steps to making an observation: **Locate**, **Examine**, and **Record**.

LOCATE:

This first step involves finding the object that you wish to observe. Using star charts, identify the constellation that contains your target object.

In order to preserve your "night vision" (and the night vision of those you may be observing with), be sure to cover any white lights with red film and use "night mode" on computers or tablets or smartphones.

Once you are outside, a pair of binoculars can be quite useful for a preliminary sweep of the area you are going to search. They will allow you to familiarize yourself with the locations of the fainter stars that appear in the atlas. And as a bonus, depending on how dark your skies are, you may be able to see the object you are searching for using binoculars alone.

Having identified the approximate location of the object in question, you then centre that part of the sky in your main telescope by means of your telescope's finder scope. In other words, the fainter stars in your atlas will serve as a road map to your target. In practice, by starting at a known bright star, you employ the technique of "star-hopping" to trace your way through the patterns of fainter stars, employing them as guideposts to the object you seek.

Centering the suspected location of your target object in the finder of your telescope should bring you very close to the object you are searching for. If you don't see your target object immediately, nudge your telescope back and forth, and then up and down. Make sure you use the lowest power possible in your main telescope; it will provide the widest field of view.

Remember that while star-hopping might seem difficult at first, and may require two or three tries before you locate your target object, it quickly becomes second nature.

EXAMINE:

Once you've located your target, you can begin to study it in more detail. Your goal is to see as much as you can. A basic observation should include a consideration of such things as:

- The size and shape of the object
- The visibility and brightness of the object
- The gradations or details associated with the object.
- Anything that you think is unique (what impresses you) about the object or its surroundings (such as coloured stars in the same field of view)
- You could also consider creating your own 5-star rating scale for future reference. If you are observing planets, you might want to consider the following questions:
    - How steady/sharp is the view (the seeing)?
    - How does magnification affect the view? Is there an optimum magnification?
    - How large does the planet appear? Can you see any colour?
    - Are any moons visible? Are any stars visible in the same field?
    - Can you detect any clouds or surface features?

RECORD:

A log is an essential component of any observation in that provides a record of what you saw that is sufficient to (figuratively) allow others to look over your shoulder and see what you've done. This is optional, of course, but for anyone who wants to pursue observation after the library program, these are some things you might like to record:

- your location
- date and time
- instrument used
- magnifications used
- general sky conditions
- a basic description and/or annotated sketch for each of the objects that you observed

Using the Planisphere

adapted from https://lovethenightsky.com/how-to-use-a-planisphere/

What is a planisphere?

A planisphere is comprised of two discs. The rear disc shows all the stars visible from your location, while the front one has a window showing only part of the rear disc. Set the front disc to any date and time to see where the stars are at that moment. For Saskatchewan, we are located north of the 49th parallel, so the 50-60° degree north edition of the planisphere is the best choice for us.

How Planispheres Work

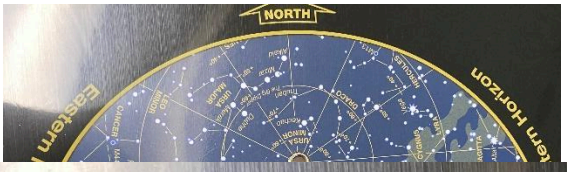
A planisphere is basically two big circles of plastic riveted together at their centres.
The back circle has a complete star map printed on it, whilst the front has an oval window which only lets you see that part of the sky visible at a time you choose. The first thing you need to do with planisphere is learn how to set it.

How to Set a Planisphere for a Date and Time

To understand how to use a star chart like this, let's pick a time and date that we're planning to look at the night sky.

For the rest of this guide, let's assume we plan to do some observing on the 20th of November at around 10pm.To set this date and time, rotate the top disc so that the time (accompanied by an arrow or a dot) will be pointing at the date and month on the bottom disc, as shown in the picture above.

The chart inside the oval window is the night sky as it will appear at 10pm on 20th November.



What You See on a Planisphere Chart

- The rivet in the centre marks the location of the north celestial pole. All the stars appear to rotate around this point, and it's where the pole star – Polaris

- Constellations are written in BOLD CAPS, Orion is circled as an example in the picture. Notice that lines join stars in the constellations to make their shapes easier to identify.

- The stars themselves are shown with different sizes of dot. A bigger dot means a brighter star.

- Only naked-eye stars are shown, down to magnitude 5. Keep in mind that you may not be able to see the faintest stars if you live under light pollution.

- Planispheres are designed to show the whole, vast night sky above your head in a really small oval. To do that effectively, they only show *some* objects of interest, like M31 (the Andromeda Galaxy) and the double cluster, both highlighted in the picture.

- The Milky Way is shown in gray spreading along the night sky.

- The ecliptic is shown as a dotted line tracing a circular track across the planisphere window (the label is circled in the picture). This is the line which the sun traces against the sky over the course of a year. It's also the line along which the planets appear to move.

- Planets move across the sky so much faster than the static stars, so they can't be plotted into the planisphere window. There are some guidelines to finding planets

- The final highlighted part of the window is the declination markers. Declination is the measure from celestial north (the rivet) at 90°, to the celestial equator at 0° and on down to the celestial south pole at -90°. Declination is used together with right ascension (equivalent to longitude on Earth and marked in hours on the outer ring), to give coordinates for any object in the night sky.

History Repeating?

What you might find surprising is that this exact view of the sky we've dialled in for 10pm on the 20th November can be seen at many different times of the year.

We set the planisphere for 10pm on the 20th November, but if you look around the rim of your own planisphere, you'll see that it's also set for 11pm on the 5th November, midnight on the 21st October and even 10am on the 21st May!

At some of these times and dates, the sun will be up of course and so we can't *actually* see any of the stars in the planisphere's window – but they are there nonetheless.

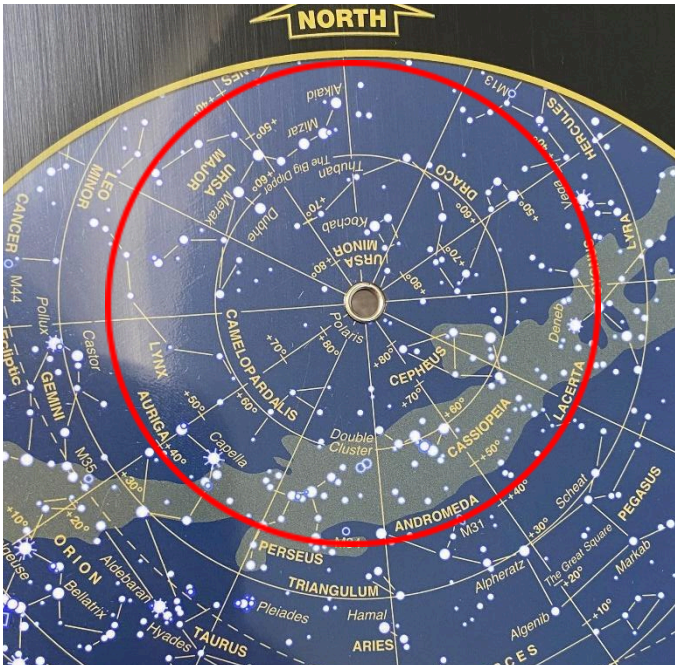
This demonstrates the fact that the night sky moves on about four minutes every day. So, at 10:00pm on 20th November, the sky looks exactly the same as it does at 9:56pm on the 21st November, 9:52pm on the 22nd November, and so on.

After a month, the sky 'moves forward' 2 hours (30 days x 4 minutes = 120 minutes = 2 hours) so 10pm on 20th November is also exactly the same as 8pm on the 20th December.

The great thing about this is that, sooner or later, the part of the northern hemisphere night sky that you want to look at will come into view at a time that works for you to see it.

Using Your Planisphere to Learn Circumpolar Constellations

Learning the constellations is a handy skill that any new astronomer should focus on.



Once you recognise the main northern hemisphere constellations, such as Cassiopeia, finding your way around the night sky becomes a lot easier and you can focus on finding the specific object you're looking for.

Let's return to the planisphere with the time we set earlier – 10pm on the 20th November. Remember that the rivet in the centre is the northern celestial pole (NCP), right where you'll find Polaris in the night sky. Around the NCP are the circumpolar constellations, or the constellations that circle the pole.

If you turn your planisphere a full loop, you'll see there are some constellations that are always in the window – they never get covered over.

On the planisphere being used for our example, the constellations inside the red circle are circumpolar, i.e., they never set.

If you learn to recognise the constellations within that circle, you'll always be able to find them at night because they are *never* hidden from view by the horizon.

The further south you are, the fewer circumpolar constellations there are because the north celestial pole is closer to the horizon.

Using Your Planisphere to Locate Other Constellations

All other constellations are visitors to our night sky for a periods of time across the night / year. The further south they are, the more fleeting the visit. Look at Orion as an example.

Set the planisphere so that Orion is at its highest point in the sky, which is noon on 15th June. We obviously can't see it at that time, because the sun is up, but looking around the rim of the planisphere you can see that Orion is this high in the sky at 7pm on Feb 01, 10pm on Jan 15, 2am on November 16 and 5am on October 01. With a clear sky, all of these times work for observing (even if they don't match up with your sleep requirements!)

Now, turn the planisphere's front wheel a half circle so that noon is aligned with 14th December and Orion is no longer visible in the window. Looking around the rim, note that Orion is not visible at 7pm on August 30, 10pm July 15, midnight June 15, 2am May 14, 5am March 29, etc

Orion is clearly not a circumpolar constellation as there are many times of the year it is not visible to be observed. This simple demonstration shows that Orion is known as a winter constellation because there are so many more opportunities to see it then.

How to Use a Planisphere for Stargazing

Use the following steps out in the field to get the best results from your planisphere:

1. Face approximately north
2. Hold the planisphere in front you like a reading book
3. Rotate it so that 'North' on the planisphere is pointing towards the northern horizon you're facing
4. Now compare the your northern horizon view with what is on the planisphere
5. Repeat the same steps facing different horizons but, when facing east, for example, rotate the planisphere so east is facing forwards

Following these simple steps will quickly help you become comfortable with how to use your planisphere to find constellations. For a visual demonstration of setting the planisphere: https://www.youtube.com/watch?v=kP2b3S5gqvE

There's a lot of sky in that little window!

Every star between the overhead point and the horizon fits into just two inches of the planisphere's star window, and that can take some getting used to.

There's an added challenge to matching what's in the planisphere's star window to what's above your head: the design of a standard planisphere for the northern hemisphere stretches the constellations further south in the sky, making them appear more spread out on the planisphere window than they are in reality.

That's why it's easiest to start learning the constellations above your head and down to around midway between overhead and the horizon. They're simpler to compare with the image in the planisphere's window than constellations on the horizon.

Using a Planisphere to Find Planets

We've already mentioned that the planets are not printed on the planisphere. This is because they are not static against the background of stars but constantly moving across the night sky.

Turn your planisphere over and on the back you will see charts of numbers for the years 2020-2025. Our chart uses the constellations of the Zodiac as a guide along the ecliptic (see the photo at the start of the guide to locate the ecliptic), so if you can locate these constellations, you'll be able to find the planets listed.