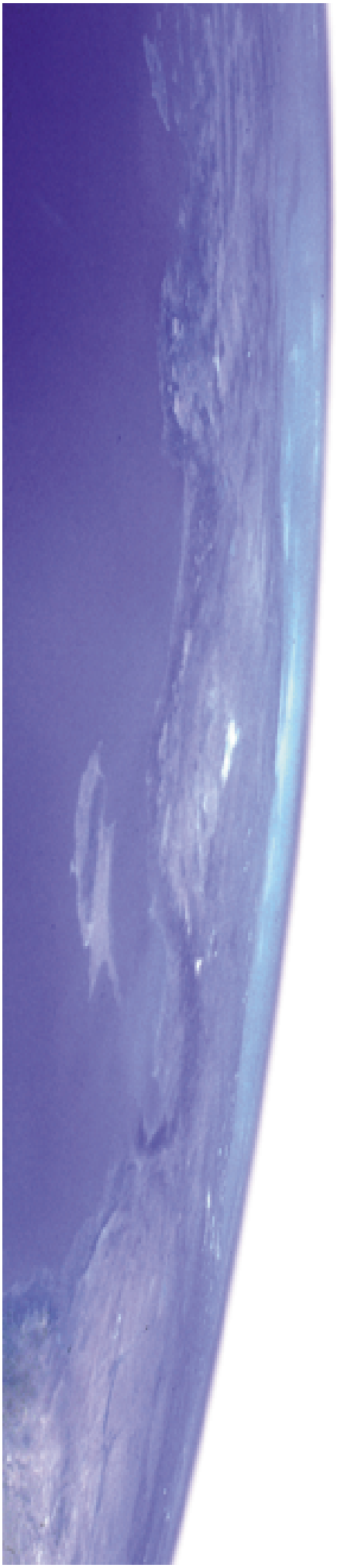

Starry Night
Teacher's Guide

FOR USE WITH THE STARRY NIGHT EXERCISE BOOK
AND STARRY NIGHT BACKYARD™
SUITABLE FOR ONTARIO GRADE 9 ACADEMIC AND APPLIED COURSES

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http://www.aavso.org

http://www.rasc.ca

Feedback

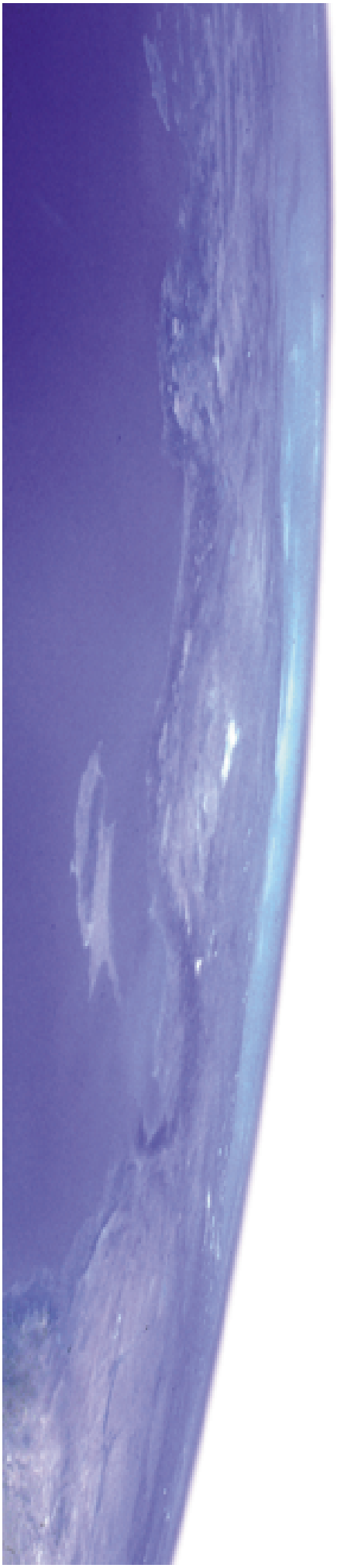
We welcome your feedback at Exercises@siennasoft.com.

Permission to Copy

Acknowledgements

Many thanks to Andrew Angus, Michael Goble, Mike Parkes and Steve Smallwood for "beta-testing" the Exercise Book, Mark Dykstra for his formatting skills and Peter Forint and the Sienna team for helping to make it all happen.

http://www.siennasoft.com



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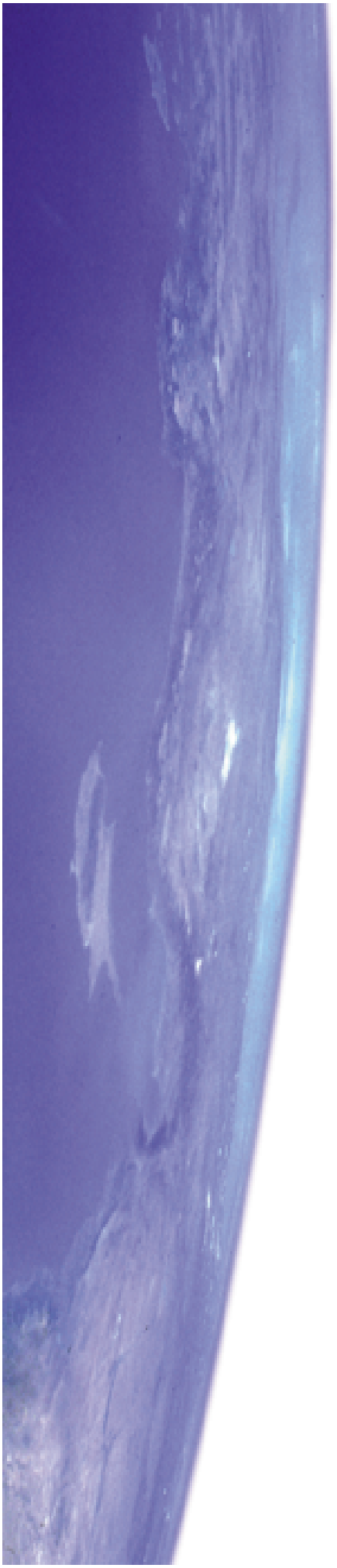


Objectives

Welcome to the Starry Night Grade 9 teachers curriculum resource. This resource consists of three parts: the Student Exercise Book, Starry Night Prepared Files and this Teachers Guide.

The Student Exercise Book and the Teachers Guide are in Adobe PDF format and the Prepared files are files recognized by Starry Night Backyard.

Getting Started

1. Load Starry Night Backyard on as many computers as your licence permits following the instructions supplied with the software.
2. The first time you run the software, it will ask you to set a location. If your city or town is not listed, choosing a nearby listed city will usually be sufficient. Or you can enter the latitude and longitude of your location if known. Make sure you also check the correct time zone.
3. The Starry Night Prepared Files should be placed in a convenient place -- the desktop or the Starry Night Backyard folder are possible choices.
4. Make a backup copy of the Starry Night Prepared Files in case students make and save changes.

Exercise 1: Using Starry Night

Objective: To practice using the time controls in the Control Panel.

Time Required: 15 - 20 minutes

Notes

1. A lot of the work in these exercises involves the use of the time controls. It is therefore critical that you and the students know how to use them. Exercise 1 should give sufficient instructions but it is a wise idea to check the users manual supplied with the software as well. Make sure students know the difference between a single step and continuous flow of time.
2. It is always a good idea to close files when they are no longer needed. If given the option, students should always choose Don't Save when closing these files. (But you do have backup copies of the prepared files — don't you?)

Exercise 2: The Constellations

Objectives:

1. To learn some constellation names
2. To be able to find Polaris

Time Required: 20 to 30 minutes

Notes

1. A small project might be to come up with a more imaginative outline for Orion. This could become a class contest!
2. Extensions are presented here for the first time. These questions and activities are optional (at your discretion) but they do allow faster students to work ahead and can serve as homework or project assignments.

Exercise 3: The Solar System

Objectives:

1. To introduce various objects in the solar system.
2. To make predictions based on orbital information.

Time Required: 30 - 40 minutes
Notes

1. The *Sun* file models the solar eclipse of July 11, 1991 as seen from South America. Students could find the actual location on an atlas by using the latitude and longitude given on the Tool Palette under Location.
2. When analyzing the orbit of Halley's comet, don't worry about getting exact dates. The simulation does not take into account planetary perturbations and the resulting orbit is only approximately correct. Nevertheless, the students should be able to make relatively decent predictions for the return of Halley's comet.
3. The Extension questions can lead to a group or class assignment or discussion on the various solar system models.

Exercise 4: Diurnal Motion

Objective: To "discover" the westward motion caused by the rotation of the earth.

Time Required: 30 - 40 minutes

Notes

1. Along with Exercise 5 and 6, this exercise allows Starry Night to "shine". (sorry!) Observations which require days, months or even years can be completed in minutes and any difficult parts can be viewed over again.
2. Encourage students to describe motions using cardinal directions rather than "left" or "right".
3. You can pass along this neat trick – turn off daylight (Display>Daylight) to see stars all day long!
4. If you wish to try question 2 of the Extensions, change location to the north pole by clicking on the latitude (e.g. 44N) shown in the Control Panel and enter 90. Enter 0 to quickly get to the equator.

Exercise 5: Direct Motion

Objective: To show that the sun and planets move against the background of the stars.

Time Required: 25 - 35 minutes

Notes

1. Students may notice that using the file Solar Motion, some (unmarked) planets tend to wander back and forth. Refer any questions about this odd behaviour to the next exercise.
2. Students may need help to change the parameters on the Time Palette from 1 sidereal day to 5 days.

Exercise 6: Retrograde Motion

Objective: To illustrate the apparent backward motion of planets as seen from earth.

Time Required: 20 - 30 minutes

Notes

1. Make sure Exercises 4 and 5 have been completed before trying this one.
2. By now students should have no difficulty manipulating the time controls to move Mars back and forth along its displayed track. Don't worry if part of the track is erased; it will be redrawn when required.
3. The file retro2 shows a top-down view of the inner solar system. The orbits of Mercury, Venus, Earth and Mars and the asteroid Vesta are shown. The main concern here is that students understand that the retrograde motion seen from Earth is caused by one planet (i.e. the Earth) passing another.

Exercise 7: Building a Deep Sky Database

Objectives:

1. To gather information in a database.
2. To introduce some of the best deep sky objects visible from earth.

Time Required: 25 - 35 minutes

3. The results of this exercise can be recorded in a computerized database manager and then sorted to help answer the questions.
4. The Internet resources given at the end of the exercise are a rich source of information on all aspects of astronomy. Check them out.

APPENDIX: Ontario Grade 9 Science Curriculum Correlation

The Starry Night Exercises will satisfy part or all of the listed expectations.

Exercise	Academic	Applied
1: Using Starry Night	ESV.02	ESV.02
2: The Constellations	ES1.01	ES1.01, ES3.02
3: The Solar System	ES1.01, ES 1.03, ES2.09	ES1.01, ES1.03, ES2.05
4: Diurnal Motion 5: Direct Motion 6: Retrograde Motion	ES1.01 ES2.01 ES2.05	ES1.01 ES2.08
7: Deep Sky Database	ES2.05, ES2.07	ES2.05, ES2.06

Answers

The following are suggested answers or answers that a student might supply. Please note that other valid answers are possible.

Exercise 1: Using Starry Night

3. Try It Out

a) Stars and Constellations have shifted from SE to SW and time has advanced by 3 minutes.

b) Stars and constellations remain in same relative place. Sun and object near top move a bit.

c) Stars and constellations shift westward.

d) When a sidereal day has elapsed, stars are in the same relative place, but after a solar day, they move slightly westward.

4. Using Prepared Files

a) Date - 3/26/1997 or 26 March 1997; Time - 2:16 am

Exercise 2: The Constellations

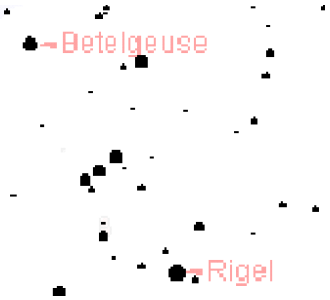
1. Ursa Major and Ursa Minor

d) The constellations seem to be moving counterclockwise around Polaris.

e) Some circumpolar constellations are Cepheus, Draco, Cassiopeia as well as Ursa Major and Ursa Minor.

2. Orion

b)



3. Winter Constellations

a) Canis Major – the great dog
Canis Minor – the little dog
Monoceros – the unicorn
Taurus – the bull
Eridanus – the river
Lepus – the hare

4. Spring Constellations

a) Virgo – the maiden
Leo – the lion
Cancer – the crab
Corvus – the raven
Crater – the cup
Hydra – the sea serpent
Libra – the scales
Coma Berenices – Berenice's hair

5. The Stars of Northern Summers

a) Aquila – the eagle
Sagittarius – the archer
Scorpius – the scorpion
Ophiuchus – the serpent bearer
Serpens Caput and Serpens Cauda – the head and tail of the snake

6. Summary

a) Some constellations cannot be seen in the summer because:

- they are in a different part of the sky
- daylight interferes.

7. Extensions

a) All constellations visible are circumpolar as seen from the poles.

b) All constellations rise and set at the equator.

c) See various references.

Exercise 3: The Solar System

1. The Sun

a) The sun provides light, energy for plants to grow and keeps the planets in their orbits.

b) A solar eclipse is taking place. With the sun covered no light reaches the earth.

2. Other Members of the Solar System

a) The four inner planets are Mercury, Venus, Earth and Mars. Completing the list are Jupiter, Saturn, Uranus, Neptune and Pluto.

b) The orbits of the planets appear to be circular more or less centred on the sun.

c) The earth appears to be closest to the sun on Jan 4. Some people find this surprising because they expect the earth to be closest to the sun in the summer.

d) Vesta's orbit seems similar to a planet's orbit.

e) Halley appears to be a comet because it has a tail like a comet.

f) The orbit of Halley's comet is much more elongated than a planetary orbit but Halley's comet also revolves about the sun.

3. Orbits

a) The planets are moving counterclockwise around the sun. The closer a planet is to the sun the faster it moves.

b) Vesta moves just like the planets.Its speed is slower than Mars.

4. The Orbit of a Comet

a) Halley's comet appears near the sun in Jan 1758.

b) The comet should reappear between 1833 and 1834.

c) Using a period of about 76 yrs, comet Halley should appear in 2062.

d) Comet Halley moves much faster when it is near the sun because the sun exerts a greater force on it.

5. Extensions

a) Heliocentric means sun-centered.

b) Geocentric models had the earth at the centre.

c) Today we believe in the heliocentric model. The sun is the most massive member of the solar system and thus all objects less massive revolve around it.

Exercise 4: Diurnal Motion

1. Looking Around

a) Ophiuchus is near the eastern horizon.

b) The bright object in Libra is the planet Venus.

2. Good Morning!

a) The constellations rise from the eastern horizon and move up and towards SE. The sky is getting brighter because it's almost daytime.

b) Yes, Venus shares the motion of the constellations.

c) The sun is just about to rise near the SE.

3. Moving On

a) The sun rises near SE and moves up and towards the south (the "right").

b) The sun and the stars all move in an arc from east to west.

c) The sun and stars sink towards the western horizon.

d) Jupiter is located in the upper left in the constellation Pisces.

e) Jupiter, like the stars moves towards the western horizon.

4. What about the Moon?

a) Yes, the moon appears to move with the stars from east to west.

5. Summary

a) Diurnal motion is the daily motion of celestial objects from east to west.

6. Extensions

a) Yes, the stars appear to rise in the east and set in the west.

b) Diurnal motion appears to change with location. At the equator the stars rise straight up from the eastern horizon and set vertically towards the western horizon. Near the poles, the diurnal motion is almost horizontal.

Exercise 5: Direct Motion

1. The Moving Sun

a) The stars forming Leo are much further away than the sun.

b) The sun appeared to move from W to SW (this is an easterly direction).

c) The earth has completed one rotation relative to the stars.

d) 24 hours minus 3 minutes and 56 seconds or about 23 h 56 m.

e) The sun should "visit" Virgo next.

f & g) The sun passes through the following 13 constellations: Leo, Virgo, Libra, Scorpius, Ophiuchus, Sagittarius, Capricornus, Aquarius, Pisces, Aries, Taurus, Gemini and Cancer.

h) All but Ophiuchus are constellations of the zodiac.

2. The Eastward Motion of the Moon

a) The moon also moves eastward among the stars but at a much greater speed.

b) The moon follows the ecliptic quite closely but does move slightly below or above.

3. Summary

a) The direct motion of the sun is caused by the earth's revolution about the sun. Direct motion of the moon is caused by its revolution around the Earth.

4. Extensions

a) The earth requires an extra 4 minutes to catch up to the sun which has "moved" along the ecliptic.

b) The phases are new moon, first quarter, full moon and last quarter.

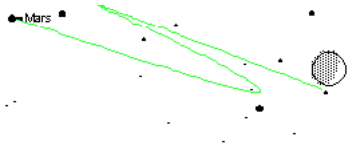
Exercise 6: Retrograde Motion

1. Mars in Motion

a) The moon passes Mars.

b) Mars moves eastward against the background of the stars.

c)



d) Mars begins retrograde loop about 3/18 and commences eastward motion about 6/4.

f) Mars passes Spica near the beginning of June 1999.

2. What causes Retrograde Motion

a) Various student answers are possible at this stage.

b) Earth is moving a little faster and, being on the "inside track", passes Mars during this time interval.

c) Mars continues moving in the same direction (counterclockwise) and never moves backwards.

3. Summary

a) Retrograde motion appears to be caused when Earth passes Mars.

Exercise 7: Building a Deep Sky Database

1. The Messier Catalog

Students should be aware that the term light year is a distance and not a time measurement.

2. Database of Deep Sky Objects

No.	Type of Object	Name or Description of Object	Distance {l.y.}	In Constellation
M1	supernova remnant	Crab nebula	6 000	Taurus
M2	globular cluster	round mass of stars	50 000	Aquarius
M6	open cluster	Butterfly cluster	2 000	Scorpius
M8	cluster with nebula	Lagoon nebula	6 500	Sagittarius
M11	open cluster	Wild duck cluster	6 000	Scutum
M13	globular cluster	Hercules cluster	25 000	Hercules
M17	cluster with nebula	Omega nebula	5 000	Sagittarius
M20	cluster with nebula	Trifid nebula	2 200	Sagittarius
M27	planetary nebula	Dumbbell nebula	1 250	Vulpecula
M31	galaxy	Andromeda galaxy	2 200 000	Andromeda
M42	diffuse nebula	Orion nebula	1 600	Orion
M44	open cluster	Beehive cluster	500	Cancer
M45	open cluster	Pleiades	400	Taurus
M57	planetary nebula	Ring nebula	4 100	Lyra
M81	galaxy	Bode’s galaxy	7 000 000	Ursa Major

3. Using the Database

a) Galaxies seem to be the farthest away from earth.

b) They are all composed of a huge number of stars.

c) Star clusters are often associated with nebulas.

d) At a distance of over 2 million light years, an object must be huge to be visible to the naked eye.

e) A lot of nebulas are associated with star clusters. The stars in these clusters should be very young.

Bibliography

Here is a short list of print resources which may be of use.

Books

Dickinson, Terence. *NightWatch , 3rd Ed.* Willowdale, ON: Firefly Books Ltd. 1998.
A superb introduction to observational astronomy. Highly recommended.

Levy, David H. *The Sky: A User's Guide*. Cambridge: Cambridge University Press 1991.
An introduction to observational astronomy by a world-famous amateur astronomer.

Motz, Lloyd and Nathanson, Carol. *The Constellations*. New York: Doubleday 1988.
This book explores the history, mythology and science of astronomy by examining the constellations for each season.

Yeomans, Donald. *Comets.* New York: John Wiley & Sons 1991.
A thorough history of the observation, myth and folklore of comets. Especially useful is a table showing all comet Halley orbital elements from 466 BC to 2134 AD.

Magazines

SkyNews. National Museum of Science & Technology Corp., Box 9724, Station T, Ottawa, Ontario, K1G 5A3.
A Canadian astronomy magazine published six times a year with feature articles, observing information, a great star map and beautiful photographs. Highly recommended for the beginner.

Sky and Telescope. 49 Bay State Road, Cambridge, MA, 02138.
A more advanced, but excellent monthly magazine on astronomy with extensive feature articles and observing information.