



Science Focus 9

Unit E

Space Exploration

Space Link: NASA <http://www.nasa.gov/home/index.html>

Topic 1

For Our Eyes Only

- Frames of Reference
- What Our Ancestors Saw
- Ancient Myths
- Sky Co-ordinates
- The Stars as a Frame of Reference
- The Earth-Centred Model
- The Sun-Centred Model

Topic 2

Stronger Eyes and Better Numbers

- Telescopes
- Galileo's Approach to Inquiry
- Resolving Power
- Copernicus's Sun-centred Revolution Continues
- Universal Gravitation

Topic 3

The Spectroscope: New Meanings In Light

- Spectral Lines
- Spectroscopy: The Science of Colour
- Diffraction Gratings
- Spectroscopy for Astronomers
- The Doppler Effect
- An Amazing Tool

Topic 4

Bigger and Smarter Telescopes

- New Discoveries
- Combining telescopes
- Adaptive Optics
- Distance to the Stars

Topic 5

What Channel Is This?

- Radio Telescopes

Topic 6

Above the Atmosphere and Under Control

- Rockets – Getting Up There
- Computers – Making Adjustments
- Global Positioning System (GPS)

Topic 7

The Solar System Up Close

- The Sun
- Traveling through The Solar System
- Data Cards for the Inner Planets
- Data Cards for the Outer Planets
- Exploring the Outer Planets
- Voyager Today

Topic 8

People In Space

- Breaking Free of Earth's Gravity
- The Apollo Program
- Meeting in Space
- The Space Shuttle
- The International Space Station

Topic 1 - For Our Eyes Only

What are the two **frames of reference** we use on the Earth to identify locations?

Myths, folklore and legends were used to explain what ancient people observed in the night sky. Describe what people believed about objects in the sky.

First Nations people of the Pacific Northwest

Aboriginal tribes -
Algonquin, Iroquois and
Narragansett

Inuit in the high Arctic

Ancient Egyptians

Identify the culture that built each of the following structures to understand the way objects in the sky behave in predictable ways.











Identify the devices used to make observations in the sky, or determine position.







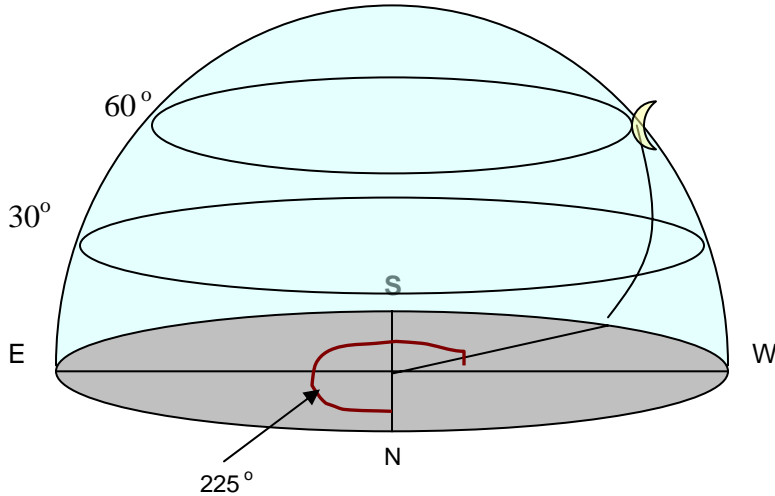


Explain what each of the following mean in describing position from a frame of reference on the Earth.

Altitude _____

Azimuth _____

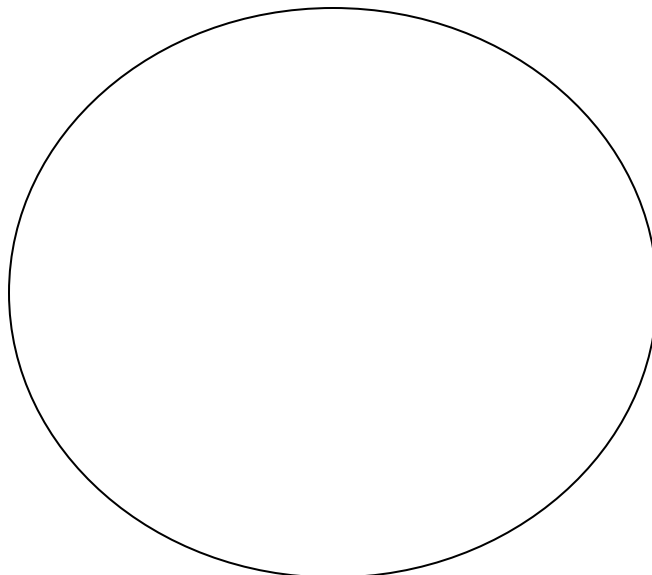
Zenith _____



What are the sky co-ordinates for the Moon in the illustration above?

Azimuth _____ Altitude _____

Illustrate the **Celestial Sphere** - the very large imaginary '*sphere of sky*' surrounding the Earth.



How can you use the stars as a **frame of reference**?

Illustrate and explain the different models of the solar system identified below.

Geocentric - The Earth-Centred Model

Heliocentric - The Sun-Centred Model

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<hr/>	<hr/>
<hr/>	<hr/>
<hr/>	<hr/>

Animation of the Geocentric and Heliocentric Models - <http://www.astro.utoronto.ca/~zhu/ast210/both.html>

Topic 2 - Stronger Eyes and Better Numbers

Explain the difference between an **ocular lens** and an **eyepiece lens**.

Using his telescope, describe 5 observations **Galileo** made that nobody else had made?

- 1. _____
- 2. _____
- 3. _____
- 4. _____
- 5. _____

Galileo's observations helped to prove which model of the solar system and why it should be believed over the other model.

How is it possible to see planets in other solar systems, when their Sun (the bright star) interferes with our observations?

Illustrate with light rays, how each type of optical telescope works:

Refracting telescope	Reflecting telescope
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How can the **resolving power** of a telescope be increased?

How do **combination telescopes** work?

What did Johannes **Kepler** contribute to the Copernicus Model?

Use the two points below to draw an **ellipse**.



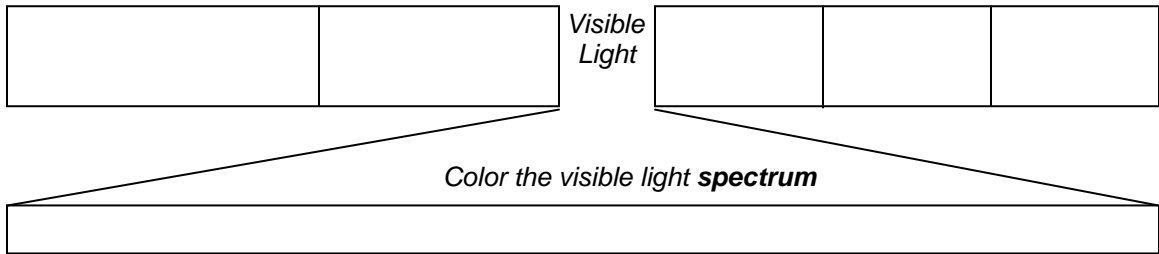
Explain Isaac Newton's **universal law of gravitation**.

Topic 3 - The Spectroscope: New Meanings In Light

What did Isaac Newton discover when he used a **prism**?

Identify the different forms of energy present in the **electromagnetic spectrum** and put arrows at the end of the frequencies and wavelengths lines to identify whether they increase or decrease.

_____ Frequencies _____



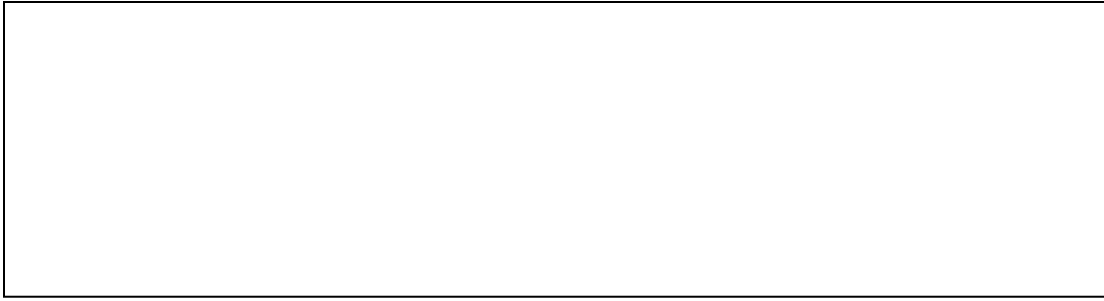
_____ Wavelengths _____

Explain how **spectral lines** can be formed and observed and what device is used to achieve this effect.

The significance of spectral lines was only discovered some 50 years after they were first observed. What is the science of **spectroscopy**?

Illustrate and explain how each of the three types of spectra is observed.

1. Emission or Bright Line Spectrum



2. Continuous Spectrum



3. Absorption or Dark Line Spectrum

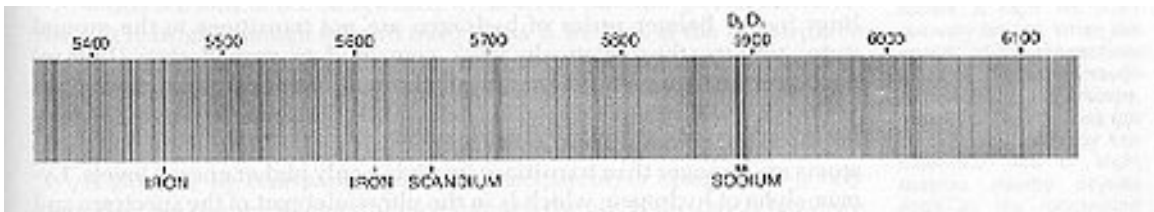


How do astronomers use a **spectrometer** to determine a star's composition?

How does a **diffraction grating** work? Why is it used?

What do astronomers use **spectral analysis** to determine?

Identify what elements are present in each **MYSTERY STAR** in the Think and Link Investigation Activity on **page 381** in **Science Focus 9**



Mystery Star # 1 _____

Mystery Star # 2 _____

Mystery Star # 3 _____

Describe what the **Doppler effect** is, and identify **3 practical applications** for its use.



Application 1 _____

Application 2 _____

Application 3 _____

Explain the difference between a **red shift** star and a **blue shift** star.

Topic 4 – Bigger and Smarter Telescopes

Identify important discoveries made using telescopes in the following years:

1773 (1781) _____

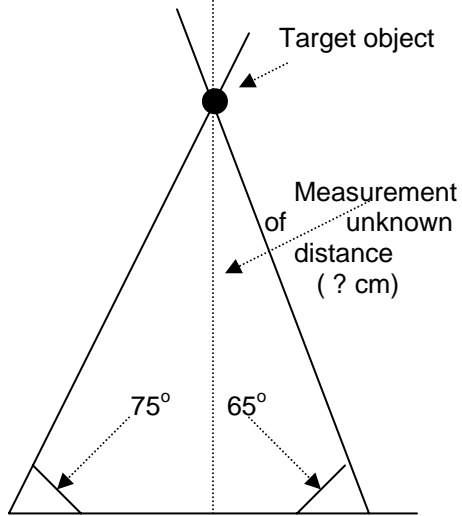
1948 _____

late 19th Century _____

1990 (HST) _____

What is **adaptive optic** technology (NTT) able to do and how is it possible?

Measure the 'unknown distance' in the illustration using the **triangulation** technique.

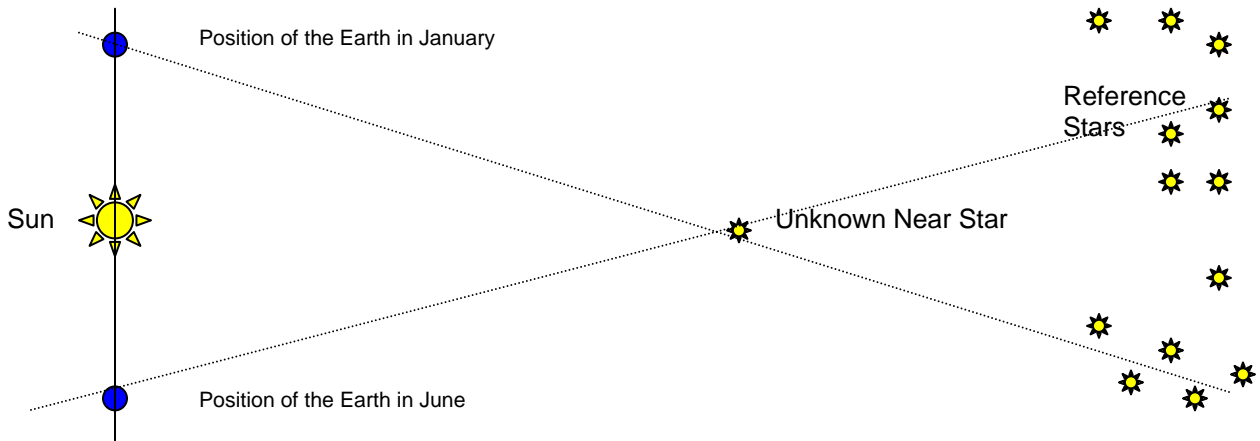


Show your work

Baseline (6.0 cm)
Scale of drawing: 1 cm = 20 m

There are also two activities in the Textbook p. 387, 388 for practice

Solve the following **parallax** problem



How do scientists determine how far a particular star is away from the Earth using **parallax**?

What is the difference between an **astronomical unit**, a **light year**, and a **parsec**?

Topic 5 - What Channel Is This?

What is the advantage of **radio telescopes**?

How can astronomers see radio waves?

Explain radio **interferometry**.

What is **VLBI** and what advantage does it have?

Topic 6 - Above the Atmosphere and Under Control

Illustrate and label the **parts of a rocket** outlining in your illustration what the function of each part is.



Briefly describe the important achievement in **Rocketry** that took place on each date.

400 B.C	-	
1926	-	
Oct. 4, 1957	-	
1962	-	
1969	-	
1981	-	

What is **gravitational escape velocity**?

Briefly describe how **NASA** began

What is a **ballistic missile**?

Explain what **gravitational assist** is – include a diagram.

Explain the difference between **natural** and **artificial satellites**.

What are main categories for which **satellites** are used (give an example for each category).

How many **GPS satellites** are orbiting the Earth and how many are needed to pinpoint a specific location on the Earth?

Topic 7 - The Solar System Up Close

What protects the Earth from the Sun's **solar winds**?

Briefly explain the **protoplanet hypothesis**.

Where is the only place humans have landed in space and when did it happen?

Complete the table (Use the data from <http://www.edquest.ca/content/view/208/>)

	Inner Planets	Outer Planets
<i>Planet names</i>	<hr/> <hr/>	<hr/> <hr/>
<i>Composition</i>	<hr/>	<hr/>
<i>Total # of Moons</i>	<hr/>	<hr/>
<i>Average Diameter</i>	<hr/>	<hr/>
<i>Average Temperature</i>	<hr/>	<hr/>

What **space probes** are the most recent ones to land on Mars and explore the surface?

How can astronomers **trace and predict** where bodies in space are, have been and will be in the future?

What is the difference between an **astronomical unit**, a **light year** and a **parsec**?

How long does it take for **light** to reach us from the Sun?

What did **Hertzsprung** and **Russell** compare when they studied stars?

How long does it take for transmissions from **Voyager 1 and 2** to reach the Earth?

Topic 8 - People In Space

What factors affect the **launch** and **flight** of a spacecraft from the surface of the Earth and in space?

Briefly describe **three tragedies** that occurred, reinforcing the dangers of space travel.

When did each of the following **Space Achievements** occur and which **country** achieved it?

Sputnik _____

Vostok _____

Freedom 7 _____

Apollo 11 _____

Apollo/Soyuz joint mission _____

Canadian Contributions to Space Exploration and Observation <http://www.spacenet.on.ca/>
Canadian Space Agency Website: <http://www.space.gc.ca/asc/eng/default.asp>

What contribution to the Space Program did Canada make in each of the following years?

1839

1972

1973

1981

1984

2001

What are the functions of **life-support systems** on board the International Space Station?

How is **oxygen** produced on the International Space Station?

How does **microgravity** in space affect the human body?

Explain how an **ion drive** works.

Explain how **solar sails** work.
