EXPLORING NAVIGATION

Grades 5-8

Key idea:

Navigation over the surface of the Earth is possible by using the relative positions of the Sun in the daytime and the stars at night. Various types of maps document location and size.

Specific Learning Objectives

Unit 1: Navigating with Maps

Exploration 1: Making and Using a Map

- A map is a graphic representation that shows the direction of and the scaled distance between entities.

Exploration 2: A Map to Treasure

- Navigation maps rely on representations of landmarks, directions, and distances.

Exploration 3: Grids and Maps

- A map may contain a grid which can be used to locate specific points on the map.

Exploration 4: Using the Grid on a Globe

- Latitude lines are parallel to the equator and are measured in degrees north or south of the equator.
- Longitude lines are great circles extending between the North and South Poles and are measured in degrees east or west of the Prime Meridian.

Exploration 5: Using the Sun's Position to Find Out Where You Are

- Solar declination (the angle between the direction to the Sun and the plane of the Earth's equator) changes throughout the year as the Earth orbits the Sun.
- On the equinoxes, a line from the Earth to the Sun lies in the plane of the equator.
- The angular height of the Sun at noon, and its declination, can be used to determine local latitude.
- When a line from the Earth to the Sun lies in the plane of the Earth's equator, latitude = 90° minus the angular height of the Sun at noon.

Exploration 6: Building and Using the ARIES Back-Staff

- The Sun reaches its greatest angular height above the horizon at local noon.
- The noontime angular height of the Sun can be used to determine one's latitude.

Unit 2: Navigating with a Compass

Exploration 7: What Can a Magnet Tell Us About Direction?

- One end of a suspended magnet orients itself to point toward a location on Earth called magnetic north.

Exploration 8: Building the ARIES Pathfinder

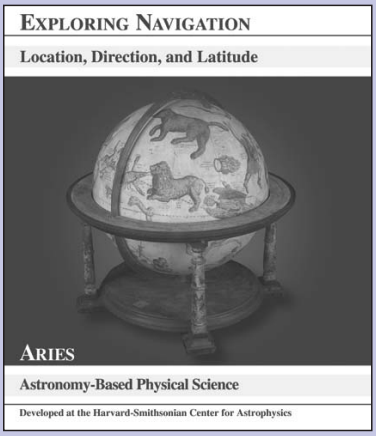
- Because a compass needle is a magnet, the north-seeking end points to Earth's magnetic north.

Exploration 9: Using the ARIES Pathfinder to Take a Bearing

- A bearing is a measurement or calculation of the direction from one position to another. Bearings can be expressed in two ways: as compass directions or degrees.

Important content:

- Map scale and aerial views
- Magnetic compasses
- Plotting a course
- Global grids
- Determining latitude
- Celestial navigation using the Sun and stars



Exploration 10: Using the ARIES Pathfinder to Navigate Without Landmarks

- Compass directions are based on a 360° circle on which magnetic north is always 0°.
- A heading is the direction of the course that a navigator is following.

Exploration 11: Navigating a Course

- A navigator can use compass directions and distances to find the way from a starting location to a series of other locations.

Unit 3: Navigating with the Stars

Exploration 12: Building and Using the ARIES Star Tracker

- Familiar constellations and stars can be used to locate and identify unfamiliar stars and star groups.
- The apparent motion of stars and star groups is predictable nightly and annually.
- Polaris, the North Star, appears to move little or not at all throughout the night and the year.
- To an observer facing north in the northern hemisphere, stars appear to move counter-clockwise around Polaris.
- Most stars appear to move from east to west throughout the night.
- The apparent motion of the stars is a result of the Earth's spin.
- Some constellations and stars appear in the night sky only at certain times of the year.

Exploration 13: Building the ARIES Nocturnal

- Stars in the northern hemisphere appear to move counter-clockwise around Polaris at approximately 15° per hour.
- Polaris itself appears to move little or not at all through the night.
- The apparent motion of stars around Polaris can be used to determine celestial, or local, time.

Exploration 14: Using the ARIES Nocturnal

- The arrangements of constellations and other groups of stars remain the same throughout the night.
- Stars in the northern hemisphere appear to move counter-clockwise around Polaris. This apparent nightly motion is predictable and amounts to approximately 15° per hour.
- The apparent motion of stars around Polaris can be used to determine celestial, or local, time.

Exploration 15: Finding Longitude

- Longitude is the angular distance east or west of the Prime Meridian (0° longitude), up to 180°.
- The Earth spins 360° on its axis every 24 hours, turning 15° per hour, or 1° every four minutes.
- The difference between local time and the time at the Prime Meridian can be used to find local longitude.