EXPLORING TIME

Grades 3-6

Key idea:

Every method for keeping or measuring time depends upon a natural phenomenon which is constant, repetitive, and predictable.

Specific Learning Objectives

Unit 1: Time, Shadows, and Sundials

Exploration 1: Shadow Observations

- The same object may cast shadows of different shapes when its orientation to the light source is changed.
- The length and direction of outdoor shadows of an object change throughout the day.

Exploration 2: Tracking Outdoor Shadows

- The shortest shadow of an outdoor object in sunlight occurs at local (solar) noon.
- The shadow will start out long and shorten until noon. Then it will lengthen again into late afternoon.
- The shadow travels in a clockwise pattern.

Exploration 3: Building Your Own Sundial

- A sundial can be used to measure the passage of time by tracking the shadow of a gnomon throughout the day.
- A sundial cannot be used on cloudy days or at night.
- A sundial is useful for finding the hour or a fraction as small as one quarter of an hour, but cannot be used to mark significantly shorter intervals of time, such as minutes or seconds.

Exploration 4: The ARIES Equatorial Sundial

- The ARIES Equatorial Sundial is designed to improve the uniformity and the accuracy of time readings throughout a day.
- In contrast with those on an ordinary sundial, the hour lines on an equatorial sundial are uniformly spaced.
- Sundials need to be oriented along the north-south line in order to yield accurate time readings.

Unit 2: Water Clocks: Other Devices for Measuring Time

Exploration 5: Observing the Flow of Water

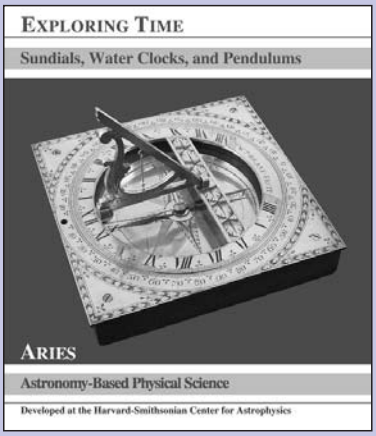
- Water flowing from one container to another is affected by the size of the opening in the supply cup.
- The larger the opening, the faster the water will flow.
- The volume of water flowing from the supply cup in a given time interval decreases as the water level in the cup drops.

Exploration 6: Measuring Small Intervals of Time

- An outflow clock works by having water flow out of a container.
- Outflow water clocks can be used to measure small intervals of time.
- Water can be used to measure time because it flows in a regular, repeating, predictable pattern.

Important content:

- Nature of shadows
- Patterns of outdoor shadows during the course of the day
- Predictability of shadow patterns as a means of telling time
- Factors affecting the flow of water as a means of telling time
- Length as the determining factor in the period of a pendulum
- Predictability of a pendulum in measuring small amounts of time



Exploration 7: Measuring Time with a Sand Clock

- Sand also can be used to measure time.

Exploration 8: Making an Inflow Water Clock

- An inflow water clock measures the amount of water that has flowed into a container.

Exploration 9: Making a Better Water Clock

- If water flows at a constant rate into a container with parallel sides, equal changes in the water level will represent equal intervals of time.

Exploration 10: Designing a New Water Clock

- Students can apply what they have learned about regular, repeating, predictable patterns to design an original water clock.

Unit 3: Exploring Pendulums

Exploration 11: A Playground Pendulum

- The period of a pendulum is a function of the pendulum's length and is constant for consecutive swings as long as the swings are small — no more than about 15 degrees either way from a vertical position.
- Changing the mass of the bob does not affect the time for one back-and-forth swing of the pendulum.

Exploration 12: Observing Pendulums

- The period of a pendulum stays the same regardless of changes in the mass of a pendulum's bob.
- The period of a pendulum depends on the pendulum's length.

Exploration 13: Experimenting with Simple Pendulums

- The period of a pendulum depends on the pendulum's length and is not changed by changing the bob.

Exploration 14: Using a Pendulum as a Timer

- The period of a pendulum can be used to keep time because it has a regular, repeating, predictable pattern.