

## Hand Clocks

### Purpose

By learning to use a hand clock, students will investigate the regular rotation of the Earth.

### Objectives

- Introduce a simple sundial
- Explore the way a sundial works

### Related Standards and State Goals

Illinois State Goals:

Early Elementary

- *12.F.1b* Identify daily, seasonal and annual patterns related to the Earth's rotation and revolution.
- *13.B.1d* Identify and describe ways that science and technology affect people's everyday lives

Late Elementary

- *12.F.2a* Identify and explain natural cycles and patterns in the solar system (e.g., order of the planets;

moon phases; seasons as related to Earth's tilt, one's latitude, and where Earth is in its yearly orbit around the sun)

- *13.B.2b* Describe the effects on society of scientific and technological innovations

Middle/Junior High School

- *12.F.3b* Describe the organization and physical characteristics of objects in the solar system.

### Integrated Subjects

- Social Studies
- Math (estimation)

### Audience

3<sup>rd</sup> – 12<sup>th</sup> grade

### Time Recommended

20-30 minutes

### Materials and Preparation

*For each student*

- Pencil
- Protractor (optional)
- Hand Clock image
- Sundial examples or images (You can use the Pocket Sundial Template)

### Procedure

1. Ask students how they tell time. How do they think people told time before we had watches, clocks, and cell phones? Introduce students to the idea of using the Sun as a tool for telling time. Show students image or example of a sundial.
2. In the early 1500's a method to roughly tell time using a person's hand as a sundial was developed. A small rod or stick and the palms of a person's were all that was needed for this method. For mid-latitudes (those between approximately 35 degrees N and 50 degrees N), the proportion of the human hand corresponds roughly with the location of the hours on the sundial hour scale.
3. In the **morning**:

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a) Face west. Hold your left hand so that your palm is facing up and your fingers are pointing west. Hold a stick (a pencil will do just fine) tightly between your thumb and the side of your palm so that the stick is held above your palm (make your hand look like a sundial). The angle between your palm and the stick should be roughly equal to your latitude. Chicago's latitude is 42 degrees, so the angle between your palm and the stick should be somewhere around 42 degrees. A protractor may be useful for this portion of the activity.

b) The shadow of the stick will fall on your hand (make sure your hand is far enough away from your body so that you can see the shadow). The following is a rough approximation of the times:

<u>Shadow falls on the:</u>	<u>Time</u>
index finger	5 am
middle finger	6 am
ring finger	7 am
pinky finger (end knuckle)	8 am
pinky finger (middle knuckle)	9 am
pinky finger (third knuckle)	10 am
joint below pinky finger	11 am
spot opposite where stick meets palm	12 pm

#### 4. In the **afternoon**:

a) Face east. Hold your right hand so that your palm is facing up and your fingers are pointing east. Hold a stick (a pencil will do just fine) tightly between your thumb and the side of your palm so that the stick is held above your palm (make your hand look like a sundial). The angle between your palm and the stick should be roughly equal to your latitude. Chicago's latitude is 42 degrees, so the angle between your palm and the stick should be somewhere around 42 degrees. A protractor may be useful for this portion of the activity or you may want to demonstrate 42 degrees for the class. The corresponding clock times are:

<u>Shadow falls on the:</u>	<u>Time</u>
spot opposite where stick meets palm	12 pm
joint below pinky finger	1 pm
pinky finger (third knuckle)	2 pm
pinky finger (middle knuckle)	3 pm
pinky finger (end knuckle)	4 pm
ring finger	5 pm
middle finger	6 pm
index finger	7 pm

These times are good for standard time. **For daylight saving time (2nd Sunday in March to 1st Sunday in November), add one hour to the times above to get the approximate clock time.**

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## Assessment

1. Observe students using their hand clocks. Students can check their use of the hand clock by comparing their estimate to the actual time. Ask students to explain where they would find 3:30 or 4:45.
2. Pose the question, “Although the Sun appears to move across the sky, is the Sun really moving?” Students should use knowledge about the Solar System to determine that the Sun’s movement does not cause the change, rather, it is the Earth moving, or rotating, that causes the changes in shadow length and location. The rotation of the Earth on its axis causes day and night, which is what a sundial measures.

## Optional Activities

- The Human Sundial lesson plan introduces many concepts that support this lesson

## Adler Planetarium Field Trip Connections

The following experiences\* at the Adler can enhance the content covered in this lesson.

### Shows:

- *One World, One Sky: Big Bird’s Adventure* (Grades PreK-2)
- *Earth, Moon & Sun* (Grades 3-6)

### Guided Gallery Experiences:

- *Look Up! One World, One Sky* (Preschool-Kindergarten)
- *In Our Solar System* (Grades 2-7)
- *Understanding the Universe* (Grades 8-12)

### Exhibitions:

- See astronomical tools including sundials in the *Universe in Your Hands* gallery located on the lower level.
- Explore how different cultures around the world have used astronomy in the *Bringing the Heavens to Earth* gallery located on the lower level.

\* Please note that shows, classroom programs, and guided gallery experiences are available for an additional cost.

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