USING RATIOS TO ESTIMATE SHADOW LENGTH

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GOALS AND OBJECTIVE

- To be able to measure the length of your shadow by using a ruler/measuring tape.

- To observe how your shadow's length varies throughout the day.

- Collect data your height, the length of your shadow, and the time of day.

- Create a ratio of height to length of shadow based on the data collected.

- Use ratio to estimate the length of various tall objects' shadows.

- The students will be able to create a height to length of shadow ratio for the different times of day and estimate the length of shadow of various tall objects at specific times by using the ratio found.

BACKGROUND INFORMATION

Throughout the day the position of the sun in the sky changes because of the Earth's rotation around the sun. The sun rises in the East and sets in the west.

As shown in the photo below, as Earth revolves around the sun, the sun is at different angles throughout the day.
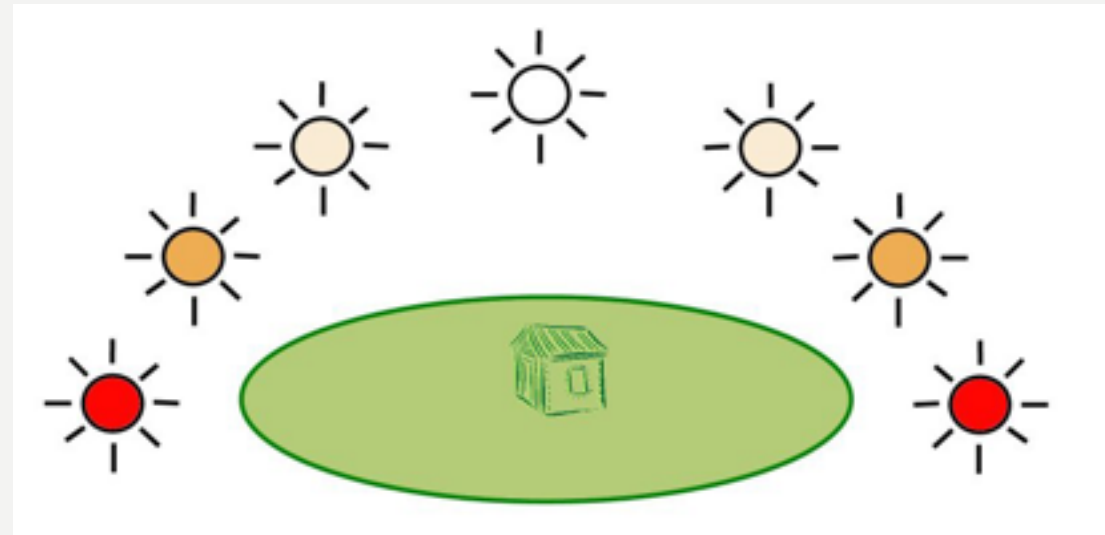
BACKGROUND INFORMATION (CONTINUED)

As the angles of the sun changes throughout the the day and an object is standing in the sun, a shadow is projected below the object on the opposite side of the object than the sun is.

Since the angles of the sun increase and decrease, this results in different

shadow lengths, of the same

object, throughout the day,

(As shown to the right).

The Shadow Stick
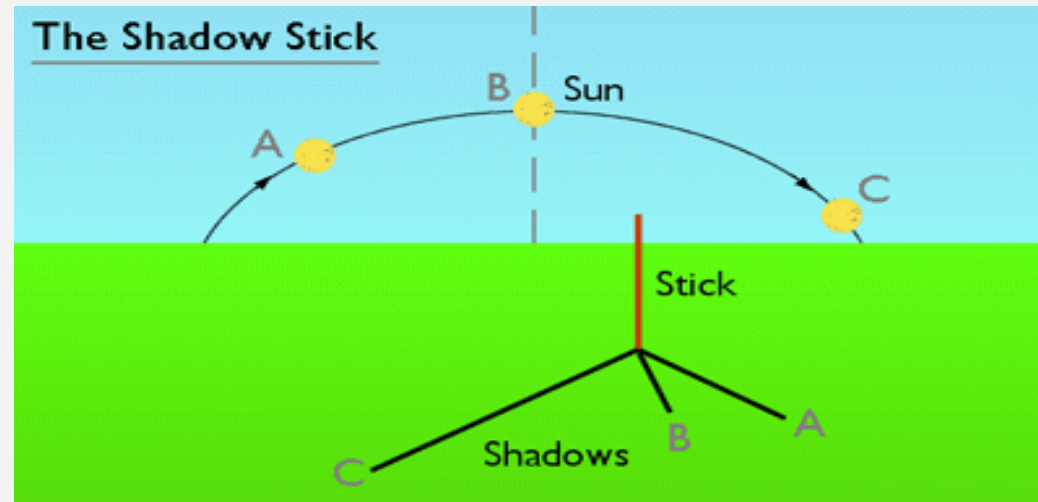
MATERIALS

- Ruler or measuring tape

- Paper

- Pencil

- The sun *This must be done on a sunny day to be able to see your shadow"

- Compass

- Chalk(optional)

DIRECTIONS

1. Starting at 8:00 am on sunny day, go outside a with ruler or measuring tape. *This can be done by yourself or with help.*

2. If you have help, while standing in one place, I recommend having a person mark on the ground where the top of your shadow and your feet are. Using those two marks on the ground, measure the length of your shadow in inches.

3. If you are doing this alone, extend and lock the measuring tape to about 15 ft. Standing at the beginning of the measuring tape, observe where on the measuring tape the top of your shadow is to find the length of your shadow in inches.

DIRECTIONS (CONTINUED)

- Continued steps 1 & 2 or 3, every two hours of the day until the sun goes down. Data should be collected for 8:00am, 10:00 am, 12:00pm, 2:00 pm, 4:00 pm, and 6:00 pm.

- Create a table that includes the time, your height in inches, and the length of your shadow in inches at each time.

DATA EXAMPLE

Time	Your Height (in inches)	Length of Shadow (in inches)
8:00am	59in	156in
10:00am	59in	65in
12:00pm	59in	39in
2:00pm	59in	41in
4:00pm	59in	75in
6:00pm	59in	148in

Ratio for each hour collected:

8:00am: $\frac{59}{156}$

10:00am: $\frac{59}{65}$

12:00pm: $\frac{59}{39}$

2:00pm: $\frac{59}{41}$

4:00pm: $\frac{59}{75}$

6:00pm: $\frac{59}{148}$

USING RATIOS

These ratios can be used to estimate the length of shadows of other objects such as very tall items such as trees or buildings, when the height of the object is known, because the taller the object is, the longer the shadow will be compared to a shorter object's shadow.

This can be done by using Algebra.

Let x represent an objects shadow length. Create a fraction with a given height of an object in the numerator and x (representing the objects unknown shadow length) in the denominator.

MATHEMATICS

Using the fractions from the previous slides, which would be your every two hour ratios found by your data collected and the fraction with a given object's height in the numerator and "x" representing its unknown shadow length in the denominator.

The shadow length of various tall objects at a certain time of the day will be estimated.

This will be done by setting the ratio for the hour being asked about equal to the fraction that contains the height of the object being asked and "x" and finding "x".

REFERENCES

Position of shadow at different times of the day? (n.d.). Retrieved May 04, 2021, from https://www.blurtit.com/4543976/position-of-shadow-at-different-times-of-the-day

Welcome to Adobe GoLive 5. (n.d.). Retrieved May 04, 2021, from https://www.naturalux.com/Sun%20Kelvin%20Temperature.html