# Purpose

What we see in the sky changes. For example, the position we see the Sun in changes over the course of each day. You may also have noticed some changes in the night sky.

In this activity, we’ll investigate what causes these changes in the appearance of the sky over the course of a day and how we can understand them.

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| --- | --- |
|  | What changes in the sky can we observe over the course of a day and how can we understand them? |

# Initial Ideas

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| --- | --- |
| Suppose you go outside at midnight tonight and see that the bright star Vega (a member of the constellation Lyra) is almost directly overhead.  icon_predict Do you think Vega would be in this same position if you looked at 2 a.m. tonight instead? Briefly explain why, or why not. |  |

 Participate in a short class discussion about everyone’s ideas.

# Collecting and Interpreting Evidence

You will need:

 Bright light bulb to represent the Sun (shared with whole class)

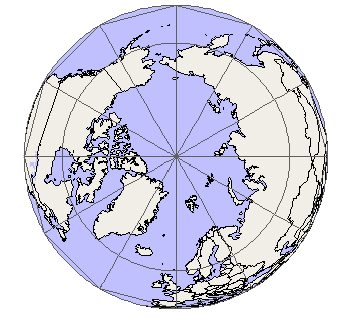
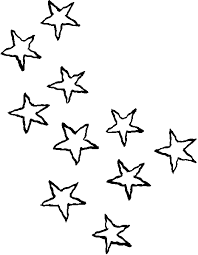
 Constellation star charts mounted on walls around the room

 Earth globe and small picture of person

## Exploration #1: What causes day and night?

**STEP 1:** Attach your small person to the Earth globe somewhere close to your actual current location.

Now place the globe so it is in between the 'Sun' and one of the star charts on the wall, with the 'person' facing the 'Sun'. Below is a 'top down' view of the arrangement.



SUN

EARTH

STARS

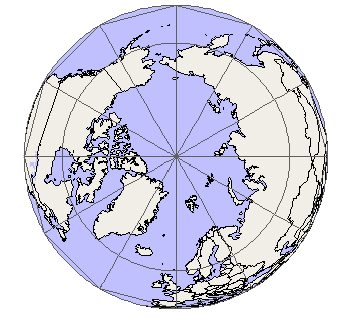
Person

 In this position, is your 'person' experiencing daylight or nighttime? How do you know?

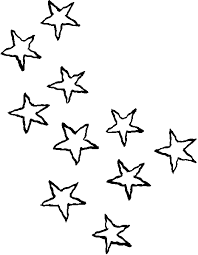
Which parts of the Earth are experiencing daylight and nighttime in this position?

 To show your thinking, on the diagram above, shade in the part of the Earth you think is experiencing nighttime. Label this part 'Night' and label the non-shaded part 'Daylight'.

**STEP 2:** Rotate the Earth globe so your 'person' is facing toward the star chart on the wall closest to you, as shown in the 'top view' below.



Person



SUN

EARTH

STARS

 In this position, is your 'person' experiencing daylight or nighttime? How do you know?

 On the diagram above, shade in the part of the Earth you think is experiencing nighttime. Label this part 'Night' and label the non-shaded part 'Daylight'.

**STEP 3:** In every 24-hour day, we experience one period of daylight and one period of nighttime and these repeat over and over again.

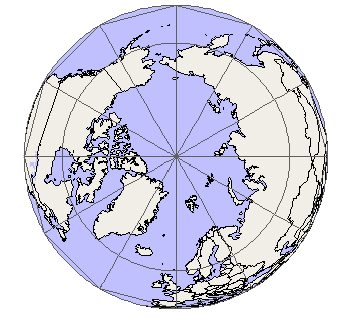
 Describe how you could arrange for the 'person' on your Earth globe to experience a continuing series of days and nights.

 Participate in a short class discussion about everyone’s ideas and make any notes you want to below.

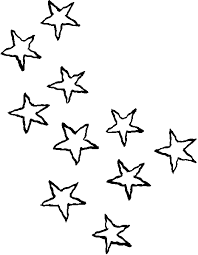
## Exploration #2: How does the sky change during the day?

For your 'person' to experience daylight and nighttime, your class probably agreed that the Earth needed to rotate once for each day that passes. In this exploration, we'll investigate how this rotation affects what we see in the sky.

**STEP 1:** Rotate your Earth globe so your person is facing directly away from the 'Sun', as shown in the 'top view' below. As you deduced earlier, for your person it is now nighttime.



Person



SUN

EARTH

STARS

Let us first consider what direction we should make the Earth rotate so that our person sees the Sun move in the same way that we do in real life.

In real life, we know that it becomes daylight for people on the east coast of the USA (for example, in Florida) about three hours before it does for people on the west coast (for example, in California)

Work with your group to figure out which direction you should turn the Earth globe so that it becomes daylight on the east coast before it does on the west coast.

 Indicate the appropriate direction of rotation by drawing a curved arrow (⤴) around part of the Earth on the diagram above.

**STEP 2:** Rotate your Earth globe in the appropriate direction so that it is just before your person passes from nighttime to daylight.

 As your person looks at the sky and the Earth continues to rotate slowly passing into daylight, in which direction would your person have to look to see the Sun as it slowly comes into view, eastward or westward?

 About what time of the day is it for your person at this point, sunrise, noon, or sunset?

Rotate the globe so that the person is now facing directly toward the Sun.

 Where would the Sun appear to be in the sky for your person now, close to the horizon or high in the sky above them?

 About what time of the day is it for your person at this point, sunrise, noon, or sunset?

Now rotate the globe so that the person is just about to pass from daylight to nighttime.

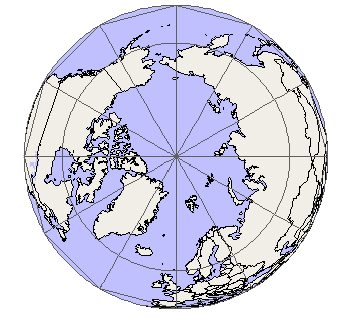
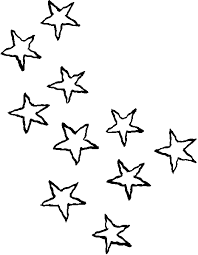
 As your person looks at the sky and the Earth continues to rotate slowly passing into nighttime, in which direction would your person have to look to see the Sun as it slowly disappears from view, eastward or westward?

 About what time of the day is it for your person at this point, sunrise, noon, or sunset?

**STEP 3:** Now consider how your person would see the Sun change position in the sky as the Earth rotates.

 Describe how your person would see the position of the Sun change in the sky from the time they first see it until the time it disappears from view.

 On the diagram below mark and label the position of people on the Earth for who it would currently be sunrise, noon, sunset, and midnight. (You should have four separate marks and labels.)



SUN

EARTH

STARS

 Participate in a short class discussion about everyone’s ideas and make any notes you want to below.

## Exploration #3: How does the sky change during the night?

In this exploration, you will investigate some changes that can be seen in the sky during the nighttime.

**STEP 1:** Rotate your Earth globe so that it is just after sunset for your person. Now that the sky is getting dark, they will be able to see stars in the sky.

Look at the constellation star charts on the wall.

 At this position, what constellation is closest to being directly overhead as viewed by your person?

 As the Earth continues to rotate, would this constellation always seem to be overhead to your person? If not, what other constellations would take its place?

**STEP 2:** Now consider how your person would see the stars change position in the sky as the Earth rotates.

 As the Earth rotates, from which direction would new constellations appear to rise? As this happens, in which direction would other constellations appear to set?

 Describe how your person would see the position of the stars change in the sky from the time they first see them until the time they set.

# Summarizing Questions

**S1:** Very often we will talk about how the Sun and stars 'move' across the sky. Is it really the Sun and stars moving that causes us to see them change positions? If not, what does cause us to see these changes?

**S2:** Does everyone on the Earth have day and night at the same time? Why, or why not?

**S3:** Does the night sky look exactly the same no matter what time you look at it? Why, or why not?

 Participate in a class discussion about everyone’s ideas and make any notes you want to below.

# Common Misconceptions *(for teachers only!)*

Quite a lot of research has been done on common ideas children (and some adults) have about the topics addressed by this activity. Many are based on common experience that is simply misapplied to these situations. You may encounter some these in your classes.

***Night is caused by clouds / hills / the Moon blocking the Sun.***

* Students know from personal experience that blocking a source of light causes shadows and makes it darker. They simply apply this reasoning to the Sun as well. Experience of seeing the Sun set behind clouds or mountains may reinforce this.

***The Sun turns into the Moon at night.***

* Experience of light from a full moon shows that there can be a significant source of light at night. Some students may assume the day and night sources are the same but at a different power (like a dimmed light bulb).

***The Sun stops shining at night.***

* All students have experience that turning off a light causes it to get dark. They simply apply this reasoning to the Sun as well.

***The Sun goes around the Earth.***

* It is therefore easy to understand this idea because simple observation of the Sun's motion in the sky gives the appearance that it is going around us. In fact, this was the prevailing scientific view for over 2,000 years!