

Labdisc activities

for Elementary School Science



Labdisc Activity

Day and Night

Supporting Labdisc Data Logger,
GlobiWorld and GlobiLab
Software

For Elementary School Science



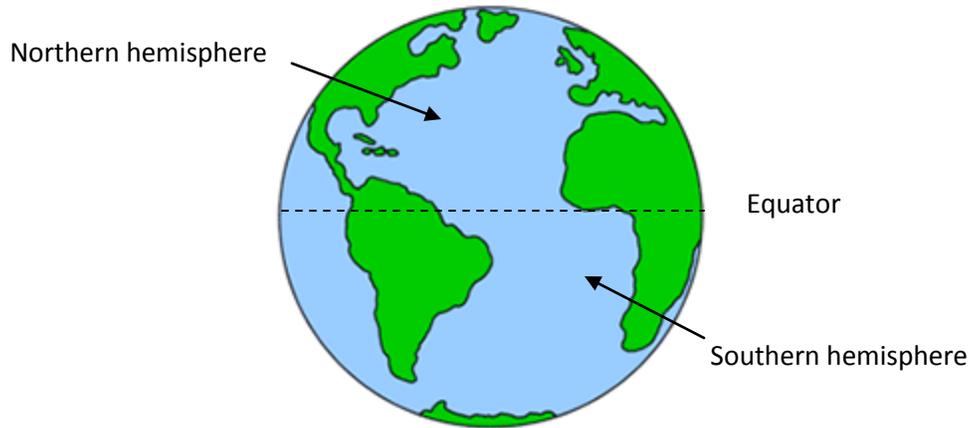
Day and Night



Introduction

Winter nights can be very cold, while summer days can be really hot. Why does temperature change so much from night to day? And why does it change throughout the different seasons during the year. It all has to do with the distance between the earth and the sun - our only heat source.

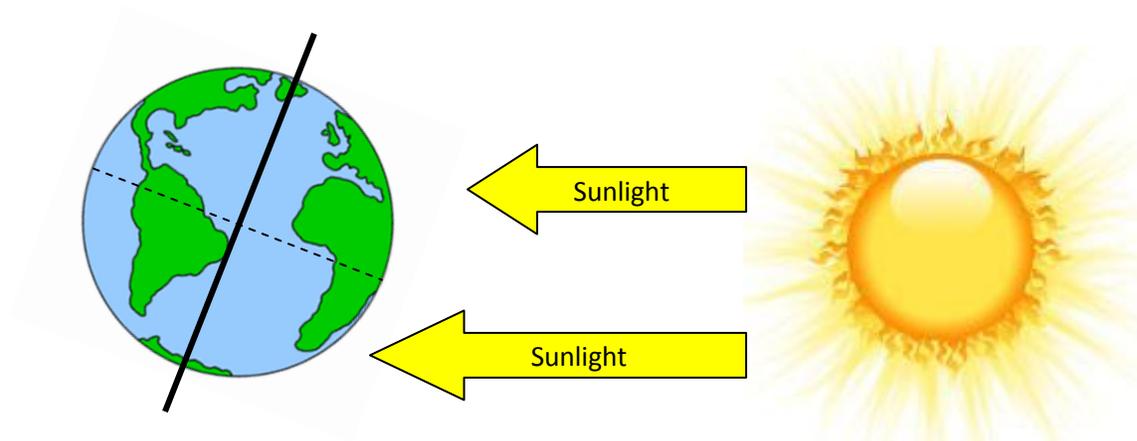
Our globe has two hemispheres: northern and southern, divided by the equator. In the northern hemisphere we can find continents such as: Europe and North America; while South America, Australia and South Africa - all belong to the southern hemisphere.



Latitude Affects Temperature

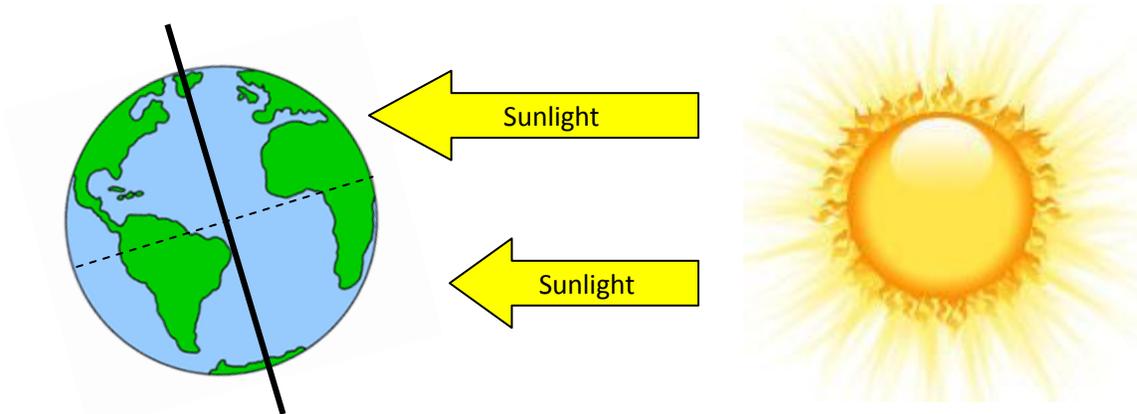
While the amount of heat coming from the sun stays the same, it is spread over a greater area during the winter than during the summer. This is due to the earth's tilt. In summer, the sun shines almost directly overhead when the northern hemisphere faces toward the sun. In winter, the sun appears to be much lower in the sky and the same amount of sunlight has to cover a much larger area.

SUMMER in the Northern Hemisphere



Here, the top part of the earth (the northern hemisphere) is leaning towards the sun, receiving more heat energy from the sunlight.

WINTER in the Northern Hemisphere



Here, the top part of the earth is leaning away from the sun, meaning it receives less energy from the sunlight.

Day Length Affects Temperature

Another important factor that has a direct impact on how earth is heated is the length of a day. The longer that a day lasts, the more time there is for Earth to absorb energy from the Sun. It makes sense then that longer summer days typically are warmer, while shorter winter days are colder.

If you lived in a country that was situated along the equator then the length of your days would change very little throughout the year. You'll have daylight and darkness for almost exactly 12 hours each. The further away that we travel from the equator however, the greater the variation we'll see in day length. Summer days get stretched out, becoming much longer than the nights, while the opposite happens in winter - it gets darker earlier and the nights lasts much longer.

The Experiment

In this activity we will examine the temperature and light changes during the day.

Equipment Needed

- No equipment is needed

Labdisc Setup

Setup the Labdisc from the Labdisc menu.

1. For this activity you'll need your Labdisc to run for more than 24 hours - so make sure that the Labdisc is fully charged before starting.

2. Turn on the Labdisc by pressing the On/Off key. 

3. To enable the Labdisc to record for a long period of time, we must turn off the GPS and Bluetooth modules, due to their high power consumption:

- a. Press SCROLL key  to open the Labdisc menu.

- b. Select the CONFIGURATION icon. 

- c. From that menu select the BLUETOOTH icon,  then SCROLL  to the "BT disabled" option and press SELECT. 

- d. Press the ESC key  to leave the Bluetooth menu

- e. SCROLL  to the GPS menu  and press SELECT, 

then SCROLL  to "GPS Disabled" and press SELECT. 

f. Press the ESC key  twice to return to the main menu.

4. SENSORS:

Press the SCROLL key  to open the Labdisc menu. Select the SETUP icon  and then the SET SENSOR icon.  Press the Light  and Internal Temperature  sensor keys and make sure that these are the only selected sensors for the activity.

5. SAMPLING RATE:

Press the ESC key  to leave the previous menu and then select the SAMPLING RATE icon.  Use the SCROLL key  to choose 1/min. Press the SELECT key  to confirm.

6. AMOUNT OF SAMPLES:

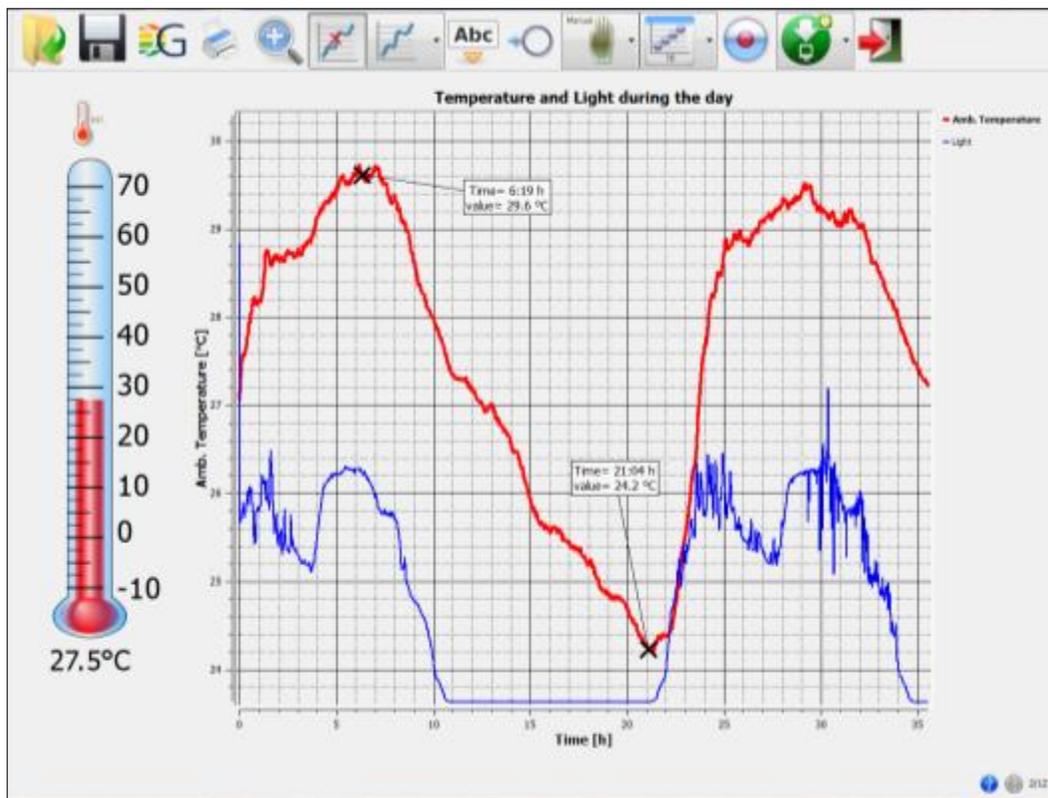
Press the ESC key  to leave the previous menu and then select the NUMBER OF SAMPLES icon.  Use the SCROLL key  to choose 10000. Press the SELECT key  to confirm.

Experiment Procedure

1. Place the Labdisc in a shaded place in an open place with the light sensor facing towards the outdoor sky.
2. Press the SELECT key to start recording temperature and light level
3. Leave the Labdisc for one to two days, to record data, and then stop recording by pressing the SELECT  and then the SCROLL keys. 

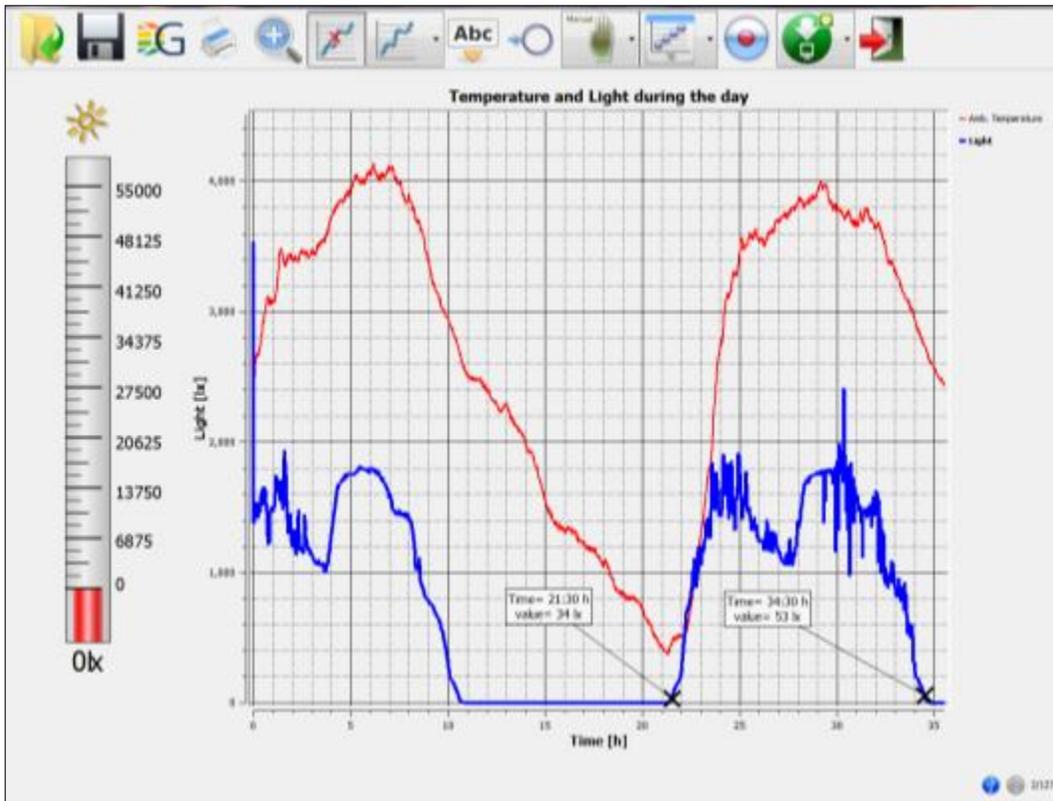
Data Analysis

1. Open the software
2. Connect the Labdisc to the computer either via wireless communication or through the USB port
3. Click on the download icon  to retrieve all measurements from the Labdisc and display them in the graph window as shown below:



4. Use the markers to verify the minimum and maximum temperature and light levels during your recording. In the above example - the maximum recorded temperature was 29.6 °C and the minimum temperature 24.2 °C.
5. Observe that the minimum temperature occurs at night time and the maximum temperature during the day.
6. This recording was done during summer in the northern hemisphere. Use the markers to measure the length of day time and night time as

measured by the Light sensor. In the below example the day was 13 hours long.



Investigation and Questions

View your measurements and try to answer the questions below.

1. In the northern hemisphere the summer nights:

- Are shorter than the days
- Last for 12 hours exactly
- Last for 14 to 16 hours

2. How many seasons are there in the equator area?
 - 4 seasons: Summer, autumn, winter and spring
 - The equator is the closest place on earth to the sun and so only has one hot season
 - 2 seasons: Summer and winter

3. Can it snow in Australia at Christmas?
 - Yes, especially in the northern parts of Australia
 - It is very cold, but it doesn't snow
 - Australia is in the southern hemisphere and experiences summer during Christmas and so it never snows at Christmas

4. Why are summer nights warmer than winter nights?
 - Because the earth is still tilted towards the sun
 - Because the ground absorbed a lot of heat during the long day and releases it at night
 - Because we still get sun heat radiation reflected from the moon

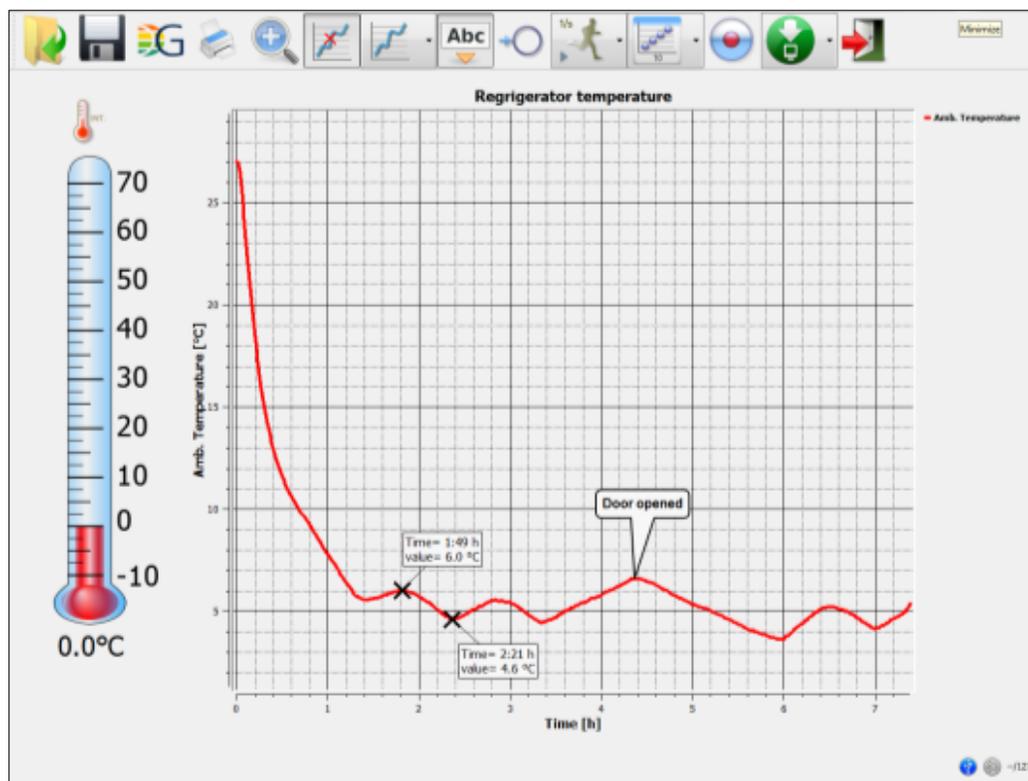
5. Why are rainy winter nights warmer than cloudless winter nights?
 - The clouds absorb sunlight and radiate heat to the ground
 - The rain clouds act as a blanket, preventing ground heat from radiating back into space
 - The water in the clouds is exposed to the sun and heats the air when falling to the ground

Further Suggestions

We can use the internal temperature sensor to monitor home appliances such as our refrigerator.

1. Set the Labdisc to record internal temperature, at one sample per minute and for 1000 samples.
2. Insert the Labdisc into a sealed plastic bag, and place it on the vegetable shelf of your refrigerator.
3. Make sure no one opens the Refrigerator door during the recording. The best time to conduct this activity is at night.
4. After recording for five to ten hours, stop recording and download the measurements.

An example of a refrigeration graph is shown below:



1. Change the graph scale to show between 3 °C to 7 °C
2. The cooling cycles of the refrigerator are clearly demonstrated. When the temperature rises above 6 °C the refrigerator compressor is turned on and starts cooling the refrigerator chamber. This continues until the temperature drops to 4.6 °C. The compressor is turned off and the chamber starts to heat again.