

## Lesson plan, Temperature Inside and Out

### Objectives

Students will be able to measure ambient temperature inside and outside the school.  
Students will be able to recognize on a graph whether temperature is going up or down.  
Students will appreciate the protective function of the building envelope.

### Prior knowledge

Students will know what temperature means as a number and a measurement, in terms of how their body feels. Students will know what temperatures are comfortable for themselves.

### Materials

HOBOWare lite software  
USB HOBO pendant coupler  
Two HOBO pendant temperature loggers



HOBOWare buttons:  
From left to right,  
Launch, Readout,  
Status, Stop

### Procedure

Launch HOBOWare lite on a classroom computer.  
Attach USB pendant coupler to computer.  
Attach HOBO temperature pendant to coupler.  
Click Launch button.  
In Description field, type "Inside Temperature". Make sure Temperature is checked in "Channels to Log". Set Logging Interval to 1 minute; make sure seconds are set to 0. Set Launch Options to "Now". Press Launch button at bottom right.  
Wait for a few seconds while software is launching...  
Remove the pendant from the coupler, and tie a label to the hole in the HOBO with the word "Inside". If you don't have a string and a label, attach a piece of masking tape with the word "Inside".  
Attach a second HOBO temperature pendant to the coupler. This time do everything the same, except in the Description Field, type "Outside Temperature", and label this HOBO "Outside".  
Place the "Inside" HOBO somewhere in the building, somewhere where direct sunlight will not fall on the HOBO for the rest of the experiment.  
Place the "Outside" HOBO somewhere outside the school building, somewhere where direct sunlight will not fall on the HOBO for the rest of the experiment. It's OK if the HOBO gets wet. It shouldn't be on bare ground, nor should it touch the building.  
Observe the weather. Observe the indoor weather (how it feels to be inside).  
Keep notes on how the weather changes during the time the HOBOS are measuring.

After one hour/morning/school-day, observe the weather one last time. Collect the HOBOS. Connect each HOBO to the computer, as before. Click the Readout button. The software might ask if you want to stop the logging. Click "Stop". A typical save-dialog will appear; notice that the name of the file will be what you typed as the description. Save the file with that name or something more unique, maybe including the date as YYYYMMDD, like "TemperatureInside20081012.hobo". You will be asked how to plot the data. Choose the "Temp" series, and choose the proper temperature scale for your class, Fahrenheit or Celsius. Click "Plot." Print the graph. Repeat the readout, save, and plot, with the other HOBO. Be careful to keep track of which HOBO was inside and which was out.



### **Analysis**

You can see both plots at the same time by clicking the horizontal tiling icon at the bottom of the window.

What happened to the temperature outside?

What happened to the temperature inside?

What was the weather like?

Is there any connection between the two temperature graphs?

Is there any connection between either graph and the time of day?

Is there any connection between either graph and the weather?

HOBOWare buttons:  
From left to right, Tabbed layout, Horizontal Tiling, Vertical Tiling

### **Inferences**

Why were patterns inside and out different or similar?

How well is the building protecting the people inside from the weather?

### **Inquiry Extensions, Temperature Inside and Out**

1. Try putting the two HOBOs next to each other outside; insulate one with some form of insulation, leave the other exposed.
2. Try putting the two HOBOs next to each other outside; keep one in a plastic cup full of water. Don't use glass, which might break if the water freezes.
3. Leave the HOBO for a minute in different parts of the school, to find out what parts of the school are colder and warmer. Take a watch, synchronized to the computer, and a journal, and mark where the HOBO is when. After printing a graph, use the journal to mark the graph with where the measurements were taken.
4. Have one person hide the HOBO somewhere where no one else in the class knows; maybe the teacher can be trusted with this secret task. The next day, that person should bring back the HOBO, print out a graph of temperature, and have the rest of the class guess where the HOBO was.