

## How much can air temperature change during a day?

### Teaching and Learning Focus

Your students now have an understanding of how a thermometer works and the way in which they can be use to measure temperature. In this investigation question, your students use a thermometer to measure and record the temperature of air outside and inside their school over a period of time.

### Materials Needed

*For each group:*

- Thermometer calibrated in Fahrenheit and Centigrade
- Recording chart (see blackline master)
- Clipboard (optional)
- Pencil
- Clock or watch

### Safety

This investigation is considered generally safe to do with students. Please review the investigation for your specific setting, materials, students, and conventional safety precautions.

### Setting the Scene

Using data from a local newspaper or almanac, show students several very different temperature reports for your location all attributed to the same date. Without telling the students you have done so, include a daily high, daily low, record high, record low, noontime temperature and so on, so that while all of the temperatures are truly for your location, they are actually somewhat different in what they tell. Ask the students how it can be that so many temperatures can be attributed to the same place and on the same date. As the idea of the temperatures being for different times (among other differences) emerges, introduce the investigation question.

### Presenting the Investigation Question

Introduce your students to the investigation question: "*How much can air temperature change during a day?*"

Have your students discuss the question in pairs, then in groups, and then as a whole class. Record their answers on the flipchart.

Have your students brainstorm ideas about how this investigation question could be investigated.

1. Design an experiment that could be used to test the investigation question.
2. What materials would be needed?
3. What would you have to do?
4. What would be measured?
5. How long would the experiment take?

### Assessing What Your Students Already Know

Your students will know that outside temperature can vary. They will certainly know of seasonal differences and most will know that it's usually warmer in the daytime and cooler at night. Many will know that it is usually cooler in the morning and evenings. They may connect this idea with the position of the Sun in the sky. What they may not know is the extent to which temperature can rise and fall over a period of time in one day (i.e. the typical daily temperature range). Ask you students to consider these

questions, first in pairs, then in groups and then as a whole class:

- Does the outside air temperature change during a day?
- When during the day is it the coolest outside?
- When during the day is it the warmest outside?
- Does the air temperature inside the school (or home) change during a day?
- How could you find answers to these questions?

## Exploring the Concept

1. In the classroom, give each group its thermometer. Have your students check it and read the temperature it is showing in both degrees Fahrenheit and Centigrade.
2. Ask each group to report their measurement. *(This can be a reality check for you: they should all be roughly the same. If not, then either a thermometer is faulty or the group does not know how to read the measurement.)*
3. Now tell your students that they are going to do this again every hour for the rest of the day. Tell them also that they will be measuring the outside temperature every hour as well. Ask them what would be a good way of recording these measurements. *(Some may say to write them up on the board, or onto a piece of paper. Accept all ideas - do not say any method a student offers is incorrect. Hopefully, somebody will suggest using a chart or table. If this does not happen steer your students toward that idea.)*
4. Work with your students to build a table that will fit the observational task. If they come up with a workable chart or method accept it and proceed. If not you can lead them toward the one shown below. *(It is important that students learn about tables and how they can be constructed. Point out the features.)*  
Adobe PDF (13 KB) | Word Document (30 KB)
5. Help your students to see how the symbols "°C" and "°F" can be used to simplify recording. *(You do not necessarily need to spend time trying to explain what a degree means in this context - that can come later.)*
6. Now ask your students to think about today's weather. You can use questions like this to promote discussion:

- Is it warmer or cooler outside right now than it was yesterday?
- Do you think it will remain the same all day - get warmer/cooler?
- Will it be different in different places - sunny place, shaded place?
- What about inside the building - will the temperature vary there?

7. Have your student groups develop predictions based on what they already know about daily weather. Encourage them to be as precise as they can be with these. Here are some likely candidates for predictions:

- The outside air temperature will rise at first then begin to fall.
- The outside air temperature will continue to rise.
- The outside air temperature will fall throughout the day.
- The outside air temperature will be different in different places *(sunny place, shady place.)*
- The outside air will have a wider range of temperature than the inside air over time.
- The inside air temperature will remain the same all day.
- The inside air temperature will be different in different places *(sunny window, shady cupboard.)*

*(You will need to decide just how wide you want this investigation to be. You could have all students follow just one prediction. Everyone can make the same observations and measurement with regard to the same prediction. The advantage here is that it is easy to organize and data can be pooled to check reliability - a common scientific practice. On the other hand, you could broaden this out so that different groups are observing and recording different aspects of air temperature. For example, if each group records temperature in a different place in the schoolyard, it is likely that their results will differ somewhat. This is why, for example, the National Oceanic and Atmospheric Administration-NOAA-has established standards for the siting of thermometers used for official measurements-see the NOAA website for details. Varying the sites at which measurements are taken allows the class to cover a much wider range of factors and allows different groups to specialize then share their findings - another common scientific procedure. You decide!)*

8. Make sure that each student group writes down its prediction(s) and the reasons for them. Tell them that they will look again at these when they have made and recorded their observations.
9. Find a way for students to test their predictions by taking their temperature measurements on an hourly basis throughout the school day. This may need some organizing ahead of time. Individual students within the groups can take turns in doing this - slipping outside, or within the building, to take and log a reading. *(It might be good to alert your administration and colleagues that this is going to happen, just to avoid misunderstandings.)*
10. When all measurements have been taken, have each group revisit the prediction(s) it made. The group can then judge whether the prediction(s) is/are supported or not supported by the data. *(Either way is important. If a prediction is proved correct, it confirms the reasoning. Even if a prediction is not supported, it is still useful - it helps to rule out the reasoning so "we know that's not the explanation, it must be something else." Help your students to see that all results can be helpful in science.)*

## Applying Students' Understanding

To check how well students have grasped the concepts of air temperature measurement, you could have them apply it more broadly. Ask them to construct a table into which they could enter daily temperatures over a longer period of time (*a week, a month, three months, a year, etc.*) Challenge them to come up with a plan to put temperature measurement into a school weather center. Here is an example chart for you to consider.

[Adobe PDF \(13 KB\)](#) | [Word Document \(30 KB\)](#)

## Revisiting Investigation Question 3

Complete this investigation question by asking your students to reflect on "How much can air temperature change during a day?" and how their answers may have changed as a result of what they have learned. The range of temperature extremes (daily high temperature compared to daily low temperature) varies considerably for different locations. A record of the daily highs and lows for some U.S. locations can be found on the NOAA website.

## Weather Unit Sections

Introduction

Air

Temperature

How can we put things in a sequence by how hot they are?

How warm or cool is it?

**How much can air temperature change during a day?**

Revisit the concept of Temperature

Wind

Clouds

Weather

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