



What is Hot? - Teacher's Notes

What is Hot?

Our Sun is a giant thermo-nuclear reactor.

When we investigated light from the Sun, we noted that there were parts of the spectrum (spread) of radiation that humans could not see such as ultra violet and infra red radiation. Infra red radiation lies just beyond the red end of the visible spectrum and although it cannot be seen it can be felt by thermo (heat) receptors in the skin. Our bodies and the bodies of plants and animals are powered by enzymes, which require heat to function well. Life on Earth depends on just the right amount of heat reaching us.



Heat can be transferred in three ways:

Radiation Waves of heat can radiate through empty space. This is how heat from the sun enters our atmosphere.

Convection Heat is transferred from one place to another by the movement of fluids (liquids and gasses) such as wind and water currents.

Conduction Heat is transferred between solids such as walking on a hot road with bare feet.

About 23% of incoming heat energy is retained within the atmosphere and is moved around by convection currents such as wind and ocean currents. The rest is directly radiated back into space.

When experimenting we try not to use subjective words such as hot, cold, warm or chilly as their meaning is not precise. Hot weather in northern Europe is very different to hot weather in Western Australia.

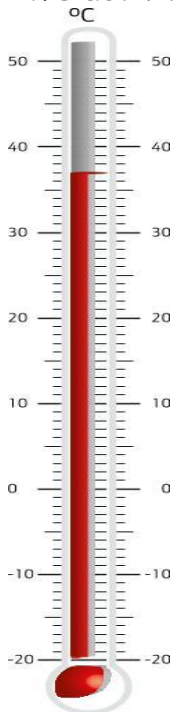
Heat is measured by a thermometer (thermo = heat, meter = measurer)





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This activity is to encourage students to use standard measurements rather than subjective words such as hot or cold.



I have always lived in Marble Bar so I find 33°C in Geraldton in summer, rather cold.

We left Albany in winter and drove northwest to Perth where the temperature was a much warmer 16°C.

In Marble Bar the temperature overnight in summer fell to a cool 28°C. I had to put on a jumper.

During the heat of summer in Kalgoorlie the temperature can rise to 38°C in the day and fall to 16°C at night. I enjoyed the evening cool.

In Broome the average temperature of 30 to 33°C is always pleasantly warm.

I was told the weather in Esperance was chilly so I took my snow boots. The lowest temperature was 8°C!

Mark each temperature on the thermometer on your worksheet. Cool temperatures mark with a blue cross and hot temperatures with a red cross

How can the same temperature be hot to one person and cold to another?
The words only describe what it feels like to each person. Each person has had different experiences and they are describing if there is more or less heat than what they are used to.

Why do you think that weather reports always include the temperature in degree Celcius?

Then everyone knows exactly what is the actual temperature. The number means the same thing all around the world.





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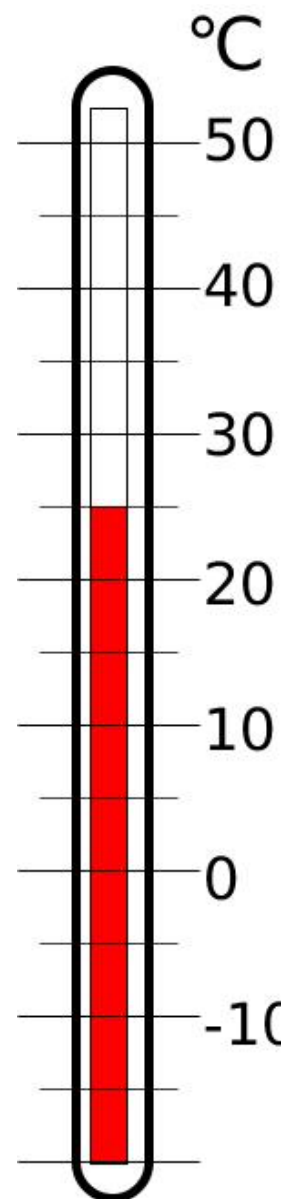
Historical background

The word "thermometer" comes from the Latin "thermo" meaning heat and "meter" to measure. If we describe something as hot or cold it may mean different things to different people. People in Scotland describe the weather as hot if it rises over 18°C whereas in WA that would merely be "warm" because we are used living in a higher range of temperature. Heat makes the coloured fluid expand.

The idea of having a numerical scale for temperature was first mentioned by the Roman physician Galen. He measured equal volumes of ice and cold water and suggested that the mix was "neutral" temperature. He added four degrees of heat and four degrees of cold on either side.

In 1612, an Italian inventor called Santorio Santorio added a wider numerical scale and the thermometer could measure changes in temperature for humans. By 1715 the German inventor Daniel Fahrenheit made a thermometer that measured changes between the boiling point of water and its freezing point using a scale of 180 degrees. Slightly later a Swede called Anders Celcius used the same maximum and minimum but had a scale of 100 units or degrees Celcius. Some people use the term "centigrade" which means "divided by 100". (Chemists use a scale which extends well below and above this which was invented by the Scot, William Kelvin).

Students need to be reminded that when they take "the temperature" of a location they are really measuring air temperature. Although air often cannot be seen, felt smelled or touched, it is a gas and is responsible for moving heat around our environment. On hot summer days the air temperature may be 40°C when the dark surface of the playground





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can reach 50°C and above. On freezing cold days the air temperature can be well below ground temperature. Official weather reports use the temperature of air inside a Stevenson screen which shelters the thermometer from rain, snow, wind, leaves and animals.

Of course, you never hold a thermometer by its bulb as that would mean that you are really measuring your skin temperature not air temperature.

Most school thermometers rely on an enclosed liquid, often alcohol or mercury that expands on heating and contracts on cooling. The famous astronomer Galileo Galilei was the first person to try using wine in a thermometer. Alcohol is more sensitive to heat and expands much more than water. The thermometers are calibrated using the boiling point and freezing point of water so that a reading in Australia will be the same as another on the other side of the world if the temperature is the same.

