Thermal Expansion (Heat) – Teacher Notes

Onion skin weathering develops in many homogenous rocks. As they were being uplifted from deep burial, the decrease in pressure caused cracks to form. Soil processes and uneven heating and cooling weathers them to rounded boulders and tors. The outside of the rock heats and cools faster than the inside. At night the outside can be contracting whilst the inside is still expanding. Stress produces curved cracks.

Onion skin weathering in igneous rock at John Forest National Park

Expansion can be demonstrated by stretching a balloon and then pulling it over an empty cool drink bottle. The balloon will flop down. If the bottle is placed into hot water the air will heat and expand causing the balloon to rise.

Thermal Expansion (Heat) – Teacher Notes

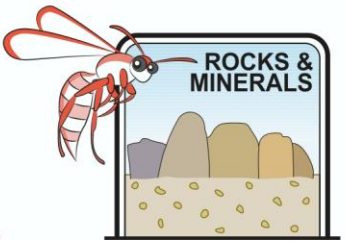
Materials per student or group

- A large ball of plasticine (modeling clay) or potter's clay
- A laboratory thermometer
- Access to outside the classroom (preferably on a sunny day)
- Graph paper

Experimental set up

1. Roll the plasticine into a round ball. With a pencil, make a hole into the center of the plasticine ball
2. Measure the ambient temperature (surrounding air temperature), the temperature on the surface of the plasticine and the temperature at the center of the plasticine ball. Enter these readings in the table provided. Care should be taken to avoid parallax by making sure the student's eyes are level with the gradations of the thermometer.
3. Place the ball outside in the sunshine with the thermometer remaining within.
4. Take readings every 5 minutes and enter them into the table provided.
5. After 20 minutes bring the ball and thermometer inside and repeat as above.
6. Compare your readings with those of other students

Time Mins.	Ambient temperature ^{0}C	Temperature of outside of ball ^{0}C	Temperature of center of ball ^{0}C	Location
0	25	25	25	Inside
5	35	27	25	Outside
10	35	29	25	Outside
15	35	31	26	Outside
20	35	33	27	Outside
25	35	36	30	Outside
30	25	30	30	Inside
35	25	27	30	Inside
40	25	25	30	Inside
45	25	25	29	Inside



Thermal Expansion (Heat) – Teacher Notes

These readings were taken on a 35°C day in Perth. My readings have been provided if you have an excitable class or a rainy cold day. It took almost 90minutes for the centre of the ball to return to 25°C. In our inland deserts temperatures can range from -6°C to 42°C over 24 hours.

When a rock in the desert is heated during the day it expands. At night it cools. The outside cools more rapidly than the inside which remains warmer longer.

7. Graph you results after deciding which type of graph to use

HINT If you are comparing one thing with another you use a line graph. If you compare different things you use a bar graph

8. Why did we keep taking the ambient temperature? To act as a control to make sure that we were only measuring the effect of heat or cold on the plasticine. If the ambient temperature had changed that would have added another variable and not made the experiment a "Fair Test".
9. What measurements will you use for the vertical axis of your graph? Temperature
10. What measurements will you use for the horizontal axis of your graph? Time

The title of your graph should contain both the X axis label and the Y axis label e.g. A graph comparing the change of temperature of the core and surface of a ball of plasticine over time.

Marking Key

Title	1 mark
Labelled axes	2 marks
Units on axes	2 marks
Ruler used	1 mark
Sharp pencil used	1 mark
Accurate plotting	2 marks
Presented on time	1 mark