

Melting Temperatures of Rocks

Measurements of temperatures in wells and mines have shown that Earth's internal temperatures increase with depth. Recall that this rate of temperature increase is called the geothermal gradient. Although the geothermal gradient varies from place to place, it is possible to calculate an average. In this lab, you will investigate Earth's internal temperatures and the temperatures at which rocks melt. You will also investigate the effect of water on the melting temperatures of rock.

Problem How can rocks melt to form magma in the crust and uppermost mantle?

Materials

- colored pencils (three different colors)
- ruler

Skills Analyzing Data, Graphing, Calculating

Procedure

1. Use the Temperature Curves graph on the next page to plot the average temperature gradient for Earth's interior.
2. Plot the temperature values from Data Table 1 on the graph. Then draw a single best-fit line through the points with a colored pencil. Extend your line from the surface to 200 kilometers. Label the line "Temperature Gradient."
3. The melting temperature of a rock changes as pressure increases deeper within Earth. The approximate melting points of the igneous rocks granite and basalt under various pressures (depths) have been determined in the laboratory and are shown in Data Table 2. Granite and basalt were used because they are common materials in the upper layer of Earth. Plot the melting temperatures from Data Table 2 on the same graph. Use a different colored pencil to plot each set of points and draw the best-fit lines.

Data Table 1 Idealized Internal Temperatures of Earth

Depth (kilometers)	Temperature (°C)
0	20
25	600
50	1000
75	1250
100	1400
150	1700
200	1800

Data Table 2 Melting Temperatures of Granite (with water) and Basalt at Various Depths Within Earth

Granite (with water)		Basalt	
Depth (km)	Melting Temperature (°C)	Depth (km)	Melting Temperature (°C)
0	950	0	1100
5	700	25	1160
10	660	50	1250
20	625	100	1400
40	600	150	1600

4. Label the two lines “Melting Curve for Wet Granite” and “Melting Curve for Basalt.”

Analyze and Conclude

1. **Using Graphs** Does the rate of increase of Earth’s internal temperature stay the same or change with increasing depth?

2. **Using Graphs** Is the rate of temperature increase greater from the surface to 100 km or below 100 km?

3. **Interpreting Data** What is the temperature at 100 km below the surface?

4. **Calculating** Use the data and graph to calculate the average temperature gradient for the upper 100 km of Earth in °C/100 km and in °C/km.

5. **Drawing Conclusions** Based on your data, at approximately what depth within Earth would wet granite reach its melting temperature and begin to form magma? Explain.

6. **Drawing Conclusions** Based on your data, at what depth will basalt have reached its melting temperature and begin to form magma?

