

How does temperature affect the size of an object?

1. Do-now question: What is the density of a metal sphere with mass of 23.50 grams at room temperature? The sphere was placed into a graduated cylinder containing 40.00 mL of water which caused the water level to rise to 48.07 mL. Insert your answer into the data table below:

$$d = \frac{m}{V}$$

(Table T)

$$d = \frac{23.50g}{8.07ml} = 2.912 = 2.91g/ml \text{ (measured)}$$

How many significant figures are in 23.50 : 4

How many significant figures are in 8.07 : 3

How many significant figures should be in your final rounded answer: 3 least # of S.F.

2. The accepted density of the metal sphere (at room temp) is 2.87 g/mL. What is the percent error of the measured value you calculated? Insert your answer into the data table below:

$$\% \text{ error} = \frac{m_v - a_v}{a_v} \times 100 = \frac{(2.91 - 2.87)}{2.87} \times 100 = 1.39\%$$

Data Table:

Volume of metal sphere (room temp.)	8.07 ml
Density of metal sphere (room temp.)	2.87 g/ml or 2.91 g/ml
Percent error (density of sphere at room temperature)	1.39%
Density of metal sphere (heated to 500 degrees Celsius)	2.62 g/mL
Volume of metal sphere (heated to 500 degrees Celsius)	8.97 ml

3. If the mass of the metal sphere remains the same after being heated to 500 degrees Celsius and its density changes to 2.62 g/mL, what is the volume of the heated sphere? Insert your answer into the data table above.

$$V = \frac{m}{d} = \frac{23.50g}{2.62g/ml} = 8.97ml$$

density decreased

Predict: Will the sphere fit into the metal ring after being heated? Explain your answer.

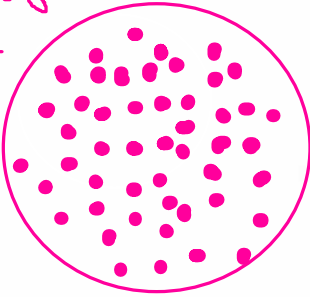
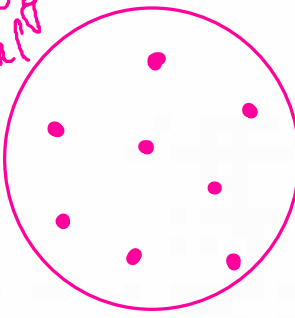
No; the metal will expand.

Yes; the molecules when heated move faster, keeping it w/ its current state. The metal won't expand that much.

Observe: What did you observe during the demonstration? Did the heated sphere fit into the metal ring?

The sphere did not fit.

Draw a particle model showing the spacing of the particles within the metal sphere before and after it was heated.

Before Heating	After Heating
$d = 2.87 \text{ g/cm}^3$ $m = 23.50 \text{ g}$ $V = 8.07 \text{ ml}$ 	$d = 2.62 \text{ g/cm}^3$ $m = 23.50 \text{ g}$ $V = 8.97 \text{ ml}$ 

Explain: Why did this phenomenon take place?

- Your answer should include the terms mass, volume, and density.
- How does temperature affect the density of a material?
- How does temperature affect the volume of a material?

Once heat was applied, the particles started to expand. As more heat was added, the volume increased/expanded, since the volume expanded it no longer fit into the ring. The object was now less dense since mass stayed constant as volume increased.