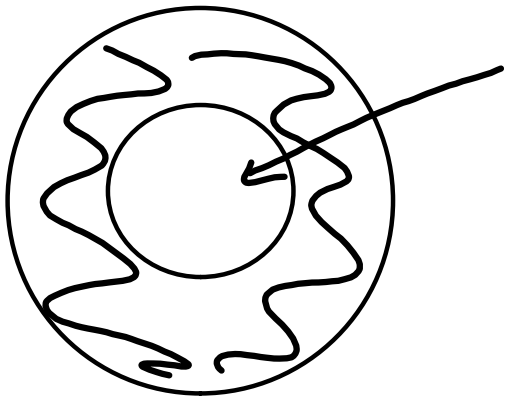
Volume Expansion

When expansion occurs will it always be in one direction?

The particles gain more energy, move faster, and spread out. The whole object is spreading out in each direction

May 25-11:05 AM

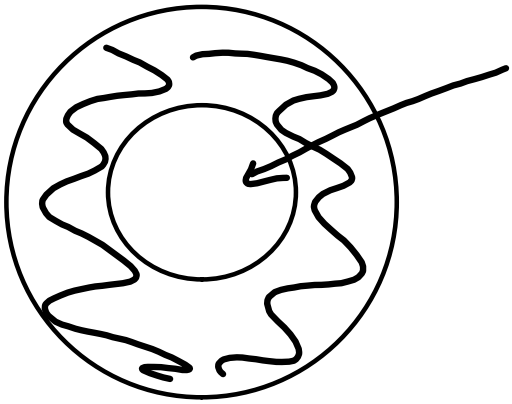


What will happen to the hole in the middle when the ring is heated?

Gets Bigger ? 7

Gets smaller? 11

May 31-9:25 AM



Hole gets bigger too! As the particles heat up and move faster they spread out. To spread out they have to move away from the middle.

May 25-8:06 AM

Solids, liquids, and gases expand in this way

Volume expansion (ΔV) depends on:

1. Change in Temperature ΔT
2. Original Volume V_o
3. The substance β
   (coefficient of Volume expansion)

$$\beta = 3\alpha$$

May 25-11:05 AM

All of these come together to give us an equation that looks like

$$\Delta V = V_o \beta \Delta T$$

May 25-11:08 AM

Ex: A 4.0 x 10^2 mL pyrex (hard glass) bottle is full of methanol at 288 K. How much spills if the bottle is left out and the temperature increases to 307 K?

$V_o = 4.0 \times 10^2 mL$

$T_1 = 288 K$

$T_2 = 307 K$

$\beta_G = 9 \times 10^{-6} K^{-1}$

$\beta_M = 1100 \times 10^{-6} K^{-1}$

$\Delta V = V_o \beta \Delta T$

Glass

$\Delta V = 4.0 \times 10^2 mL \times 9 \times 10^{-6} K^{-1} (307 - 288 K)$

$= 0.0684 = 0.068 mL$

Methanol

$\Delta V = 4.0 \times 10^2 mL \times 1100 \times 10^{-6} K^{-1} (307 - 288 K)$

$= 8.36 = 8.4 mL$

Spills →

$8.4 mL - 0.068 mL$

$= 8.332 mL = 8.3 mL$

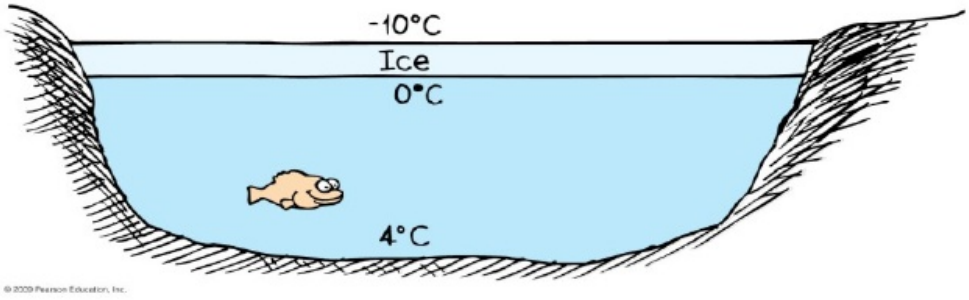
May 31-9:32 AM

Thermometers use this idea to allow us to measure the temperature by measuring the amount of expansion that occurs

May 25-11:08 AM

Strange Thermal Expansion

- Water contradicts this idea when it is heated from 0°C to 4°C – it actually CONTRACTS.
- Water is the most dense at 4°C!
  - This is why fish can live in a lake that has ice on top – the water at the bottom is 4°C.



May 25-11:09 AM

p 362 #41 & 42
p 369 #72 & 73
p 370 # 95, 98

Oct 4-9:40 AM