TEMPERATURE

Heat

– is the transfer of energy from one object to another as a result of a difference in temperature between the two.

Thermal Equilibrium

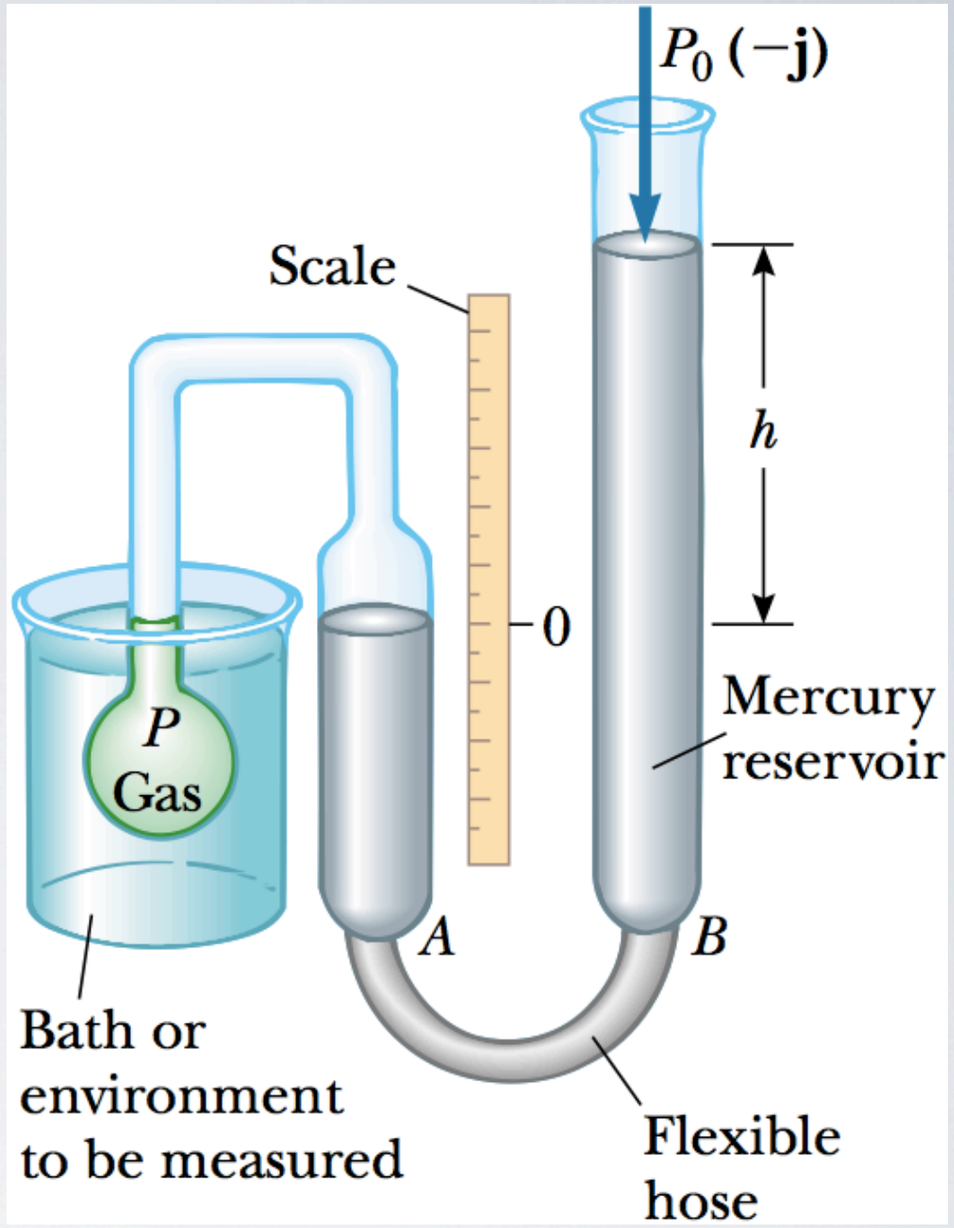
– a situation in which two objects in thermal contact with each other cease to exchange energy by the process of heat.

Two objects that are in thermal equilibrium with each other are at the same temperature.

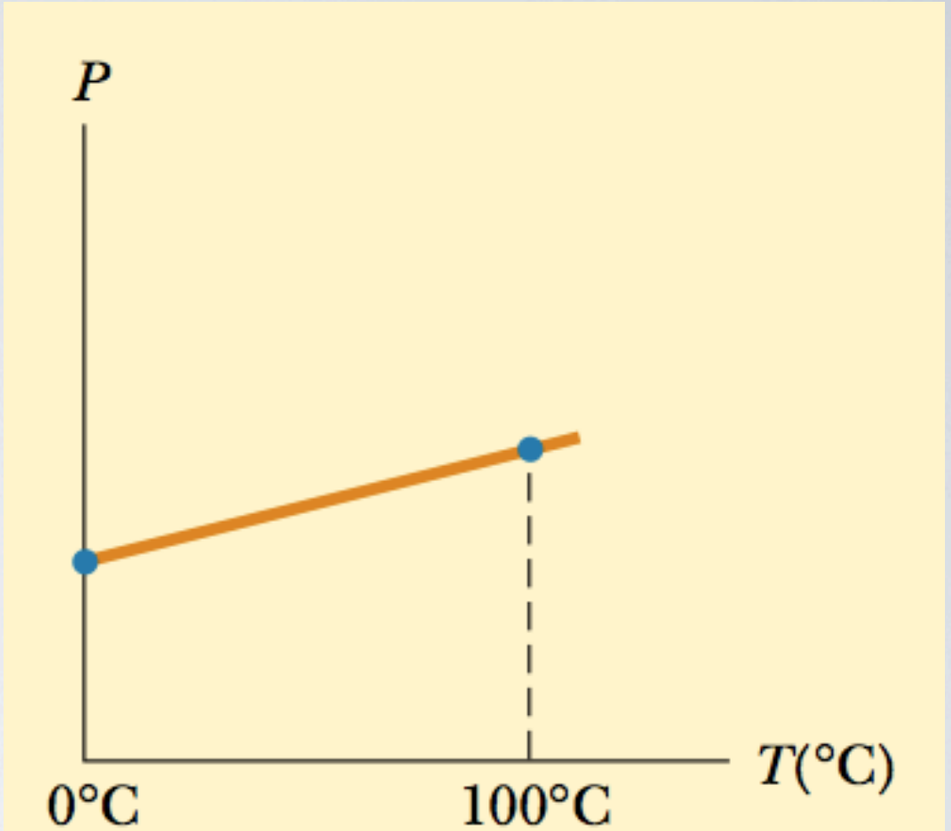
Zeroth Law of Thermodynamics

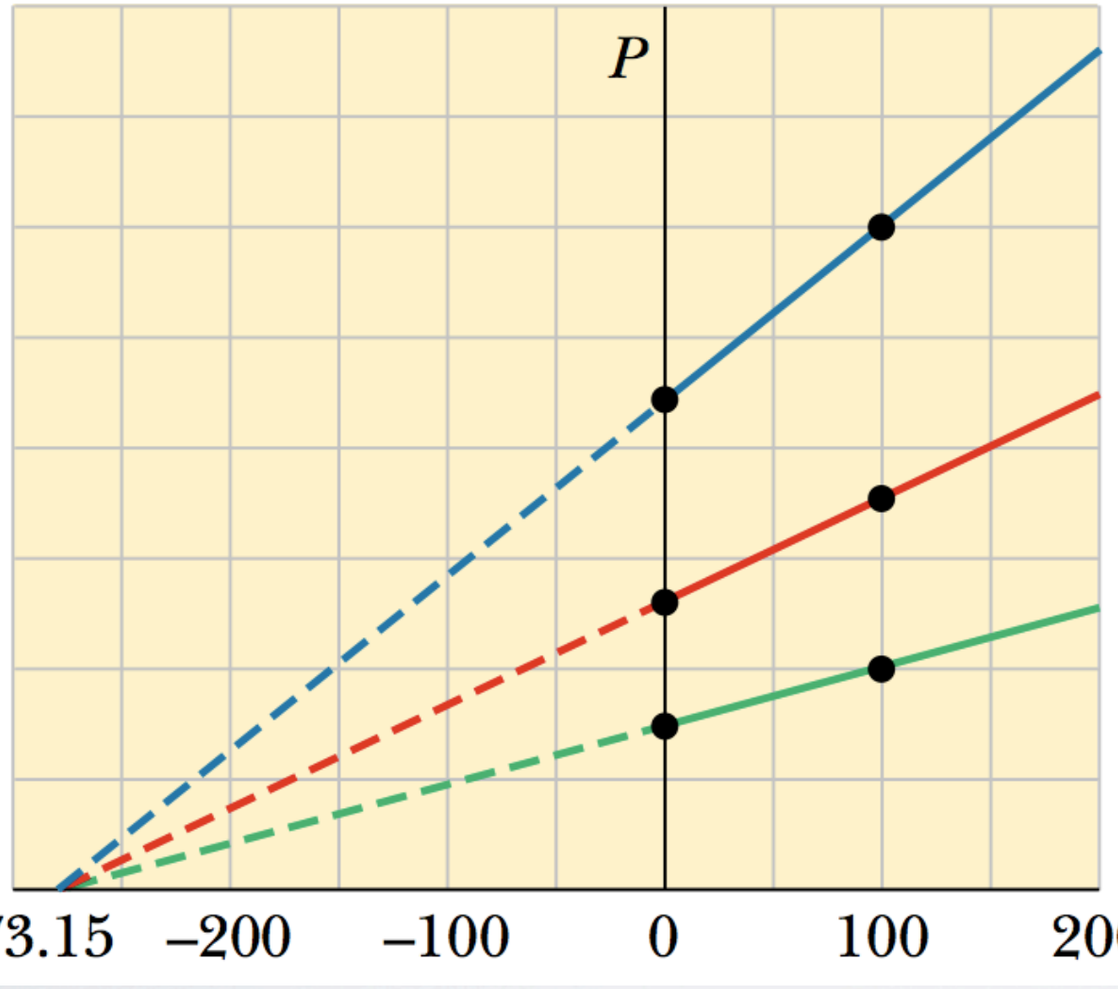
If objects A and B are separately in thermal equilibrium with a third object C, then objects A and B are in thermal equilibrium with each other.

A constant-volume gas thermometer measures the pressure of the gas contained in the flask immersed in the bath. The volume of gas in the flask is kept constant by raising or lowering reservoir B to keep the mercury level in column A constant.



A typical graph of pressure versus temperature taken with a constant-volume gas thermometer. The two dots represent known reference temperatures (the ice and steam points of water).





Pressure versus temperature for three dilute gases. Note that, for all gases, the pressure extrapolates to zero at the temperature –273.15°C.

Temperature Scales

– Celsius (or Centigrade), Fahrenheit, Kelvin

$T(°C) = 5/9\ [T(°F) - 32]$

or $T(°F) = 9/5\ T(°C) + 32$

$T(K) = °C + 273.15$

or $T(°C) = T(K) - 273.15$

Exercises

1. Rank in order, from highest to lowest, the temperatures $T_1 = 0$ K, $T_2 = 0°$ C, $T_3 = 0°$ F
2. Rank in order, from greatest to smallest, the temperature differences $\Delta T_1 = 5$ K, $\Delta T_2 = 5$ C°, $\Delta T_3 = 5$ F°
3. Liquid nitrogen has a boiling point of −195.81 °C at atmospheric pressure. Express this temperature in (a) degrees Fahrenheit and (b) kelvins.
4. There is a temperature whose numerical value is the same on both the Celsius and Fahrenheit scales. What is this temperature?