The Zeroth Law of Thermodynamics states that if two systems are in thermodynamic equilibrium with a third system, the two original systems are in thermal equilibrium with each other. Basically, if system A is in thermal equilibrium with system C and system B is also in thermal equilibrium with system C, system A and system B are in thermal equilibrium with each other.

**Introduction**

Essentially, two systems that are in thermodynamic equilibrium will not exchange any heat. Systems in thermodynamic equilibrium will have the same temperature.

- In 1872 James Clerk Maxwell wrote: "If when two bodies are placed in thermal communication, one of the two bodies loses heat, and the other gains heat, that body which gives out heat is said to have a higher temperature than that which receives heat from it." And, "If when two bodies are placed in thermal communication neither of them loses or gains heat, the two bodies are said to have equal temperature or the same temperature. The two bodies are then said to be in thermal equilibrium." Maxwell also stated, "Bodies whose temperatures are equal to that of the same body have themselves equal temperatures."

- In 1897 Max Planck said, "If a body, A, be in thermal equilibrium with two other bodies, B and C, then B and C are in thermal equilibrium with one another."

![Diagram showing thermal equilibrium between two systems](image)

**References**


**Exercise**

1 kg of water at 10º C is added to 10 kg of water at 50º C. What is the temperature of the water when it reaches thermal equilibrium?
Answer

46.36° C