# Newton's Law of Cooling

**AIM**: To study the rate of cooling by drawing time-temperature graph

**APPARATUS**: Calorimeter and stirrer, thermometer, stop watch, hot water etc

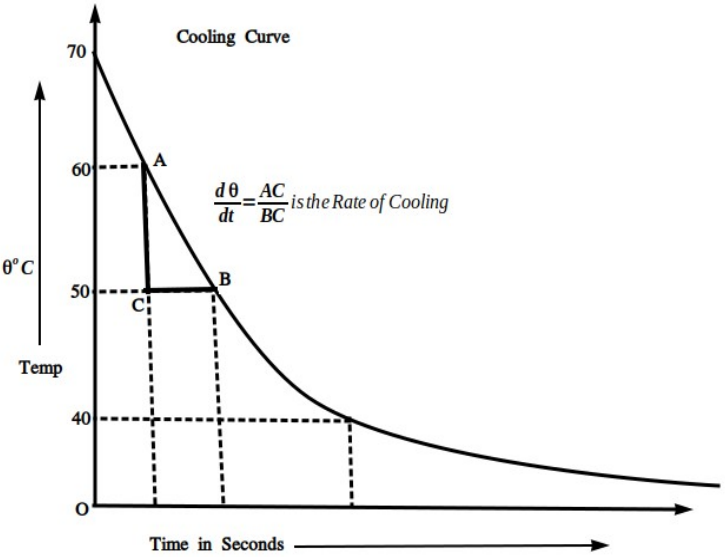
**THEORY**:

According to Newton's Law of Cooling, rate of cooling of an object is directly proportional to mean temperature difference between the cooling substance and the surrounding

That is $\frac{d\theta}{dt} \alpha (\theta - \theta_0)$

where $\theta$ is the temperature of the hot substance and $\theta_0$ is the temperature of the surrounding.

$\frac{d\theta}{dt}$ is the rate of fall of temperature.




**OBSERVATIONS**:

Room temperature $\theta_0$ = $^oC$

| Sl No | Temp. of hot water in the Calorimeter $\theta^0 C$ | Time (sec) |
|---|---|---|
| 1 | 70 | |
| 2 | 65 | |
| 3 | 60 | |
| 4 | 55 | |

| Sl No | Temp. of hot water in the Calorimeter $\theta^0 C$ | Time (sec) |
|---|---|---|
| 5 | 50 | |
| 6 | 45 | |
| 7 | 40 | |
| 8 | 35 | |

From the Graph

| Temp Range $(\theta_1 - \theta_2)$ $^oC$ | Mean Temp $\theta = \frac{\theta_1 + \theta_2}{2}$ $^oC$ | Rate of Cooling $\frac{d\theta}{dt} = \frac{AC}{BC}$ $^oC$ | Difference of Temp $\theta - \theta_0$ $^oC$ | $\frac{\left(\frac{d\theta}{dt}\right)}{(\theta - \theta_0)}$ $s^{-1}$ |
|---|---|---|---|---|
| **70 – 60** | 65 | | | |
| **60 – 50** | 55 | | | |
| **50 – 40** | 45 | | | |

It is found that rate of fall of temperature $\frac{d\theta}{dt}$ is proportional to temperature difference between the cooling substance and the surrounding $\theta - \theta_0$

**RESULT**:

1. Verified Newton's Law of Cooling
2. It is found that the rate of decrease of temperature of the water is quickly at higher temperatures and slowly at lower temperatures.