

Experiment - 5

Aims:

To verify Newton's law of cooling of different materials for water and draw the cooling curve.

Theory:

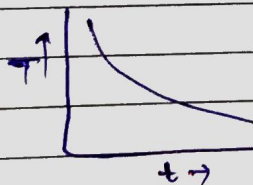
Newton's law of cooling states that the rate of temp. of the body is proportional to the difference between the temperature of the body and that of the surrounding medium.

$$\frac{dT}{dt} = -K(T - T_2) \quad (1)$$

$$T - T_2 = C e^{-Kt} \quad (2)$$

where $C = T_1 - T_2$.

Newton's equation, $T = T_2 + (T_1 - T_2)e^{-Kt}$.



Temp. of body approaches that of its surrounding as time goes.

$$T(t) = T_A + (T_H - T_A)e^{-Kt}$$

$T_A \rightarrow$ surrounding temp.

$T_H \rightarrow$ hot object temp.

Newton's Cooling

BRASS		COPPER		ALUMINIUM		SILVER	
t (min)	Temp	t (min)	Temp	t (min)	Temp	t (min)	Temp
0	81	0	80	0	81	0	91
5	72.22	5	54.35	5	64.22	5	57.83
10	64.55	10	40.31	10	52.28	10	41.49
15	58.56	15	33.36	15	44.09	15	33.37
20	53.31	20	29.28	20	38.21	20	28.83
25	48.87	25	27.4	25	34.37	25	27.03
30	44.9	30	26.25	30	31.51	30	26.02
35	41.97	35	25.65	35	29.63	35	25.52
40	39.2	40	25.35	40	28.19	40	25.23
45	36.93	45	25.18	45	27.23	45	25.12
50	34.9	50	25.1	50	26.56	50	25.06
55	33.45	55	25.05	55	26.08	55	25.03
60	32	60	25.02	60	25.76	60	25.01
65	31.06	65	25.01	65	25.52		
70	30			70	25.37		
75	29.27						

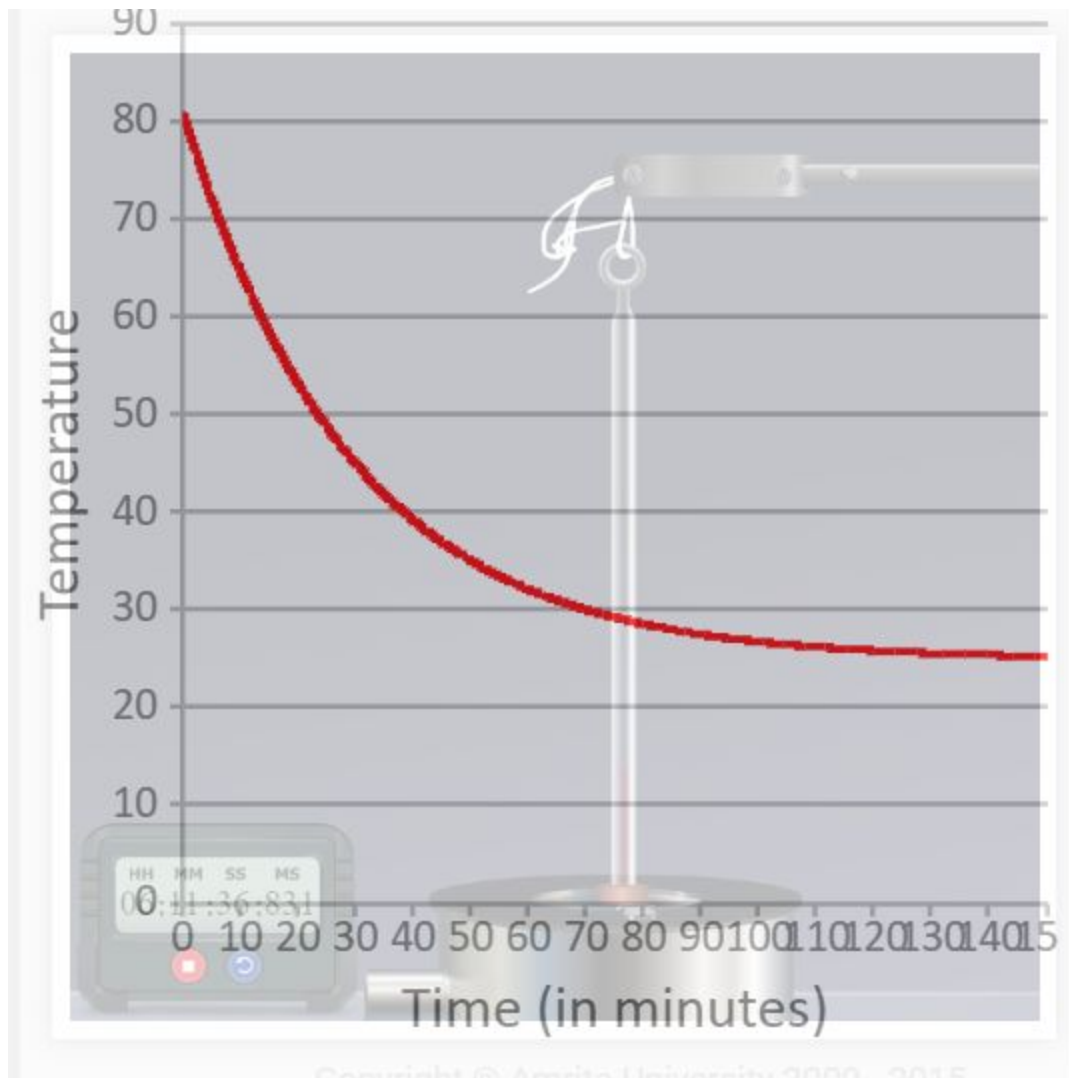
Procedure :

- The calorimetric meter is filled $\frac{2}{3}$ rd with the given liquid and is heated to a temperature of 80°C . This liquid will act as a hot body which is subjected to cooling.
- The thermometer is inserted in to calorimeter. When the temperature reading is 70°C stopwatch is started.
- The time readings are noted for every 5° fall of temperature up to the room temperature. A graph is drawn with temperature θ along Y axis and time (t) along X-axis.
- $\frac{d\theta}{dt}$ is found by taking slopes to tangents at various temperatures on cooling curve.

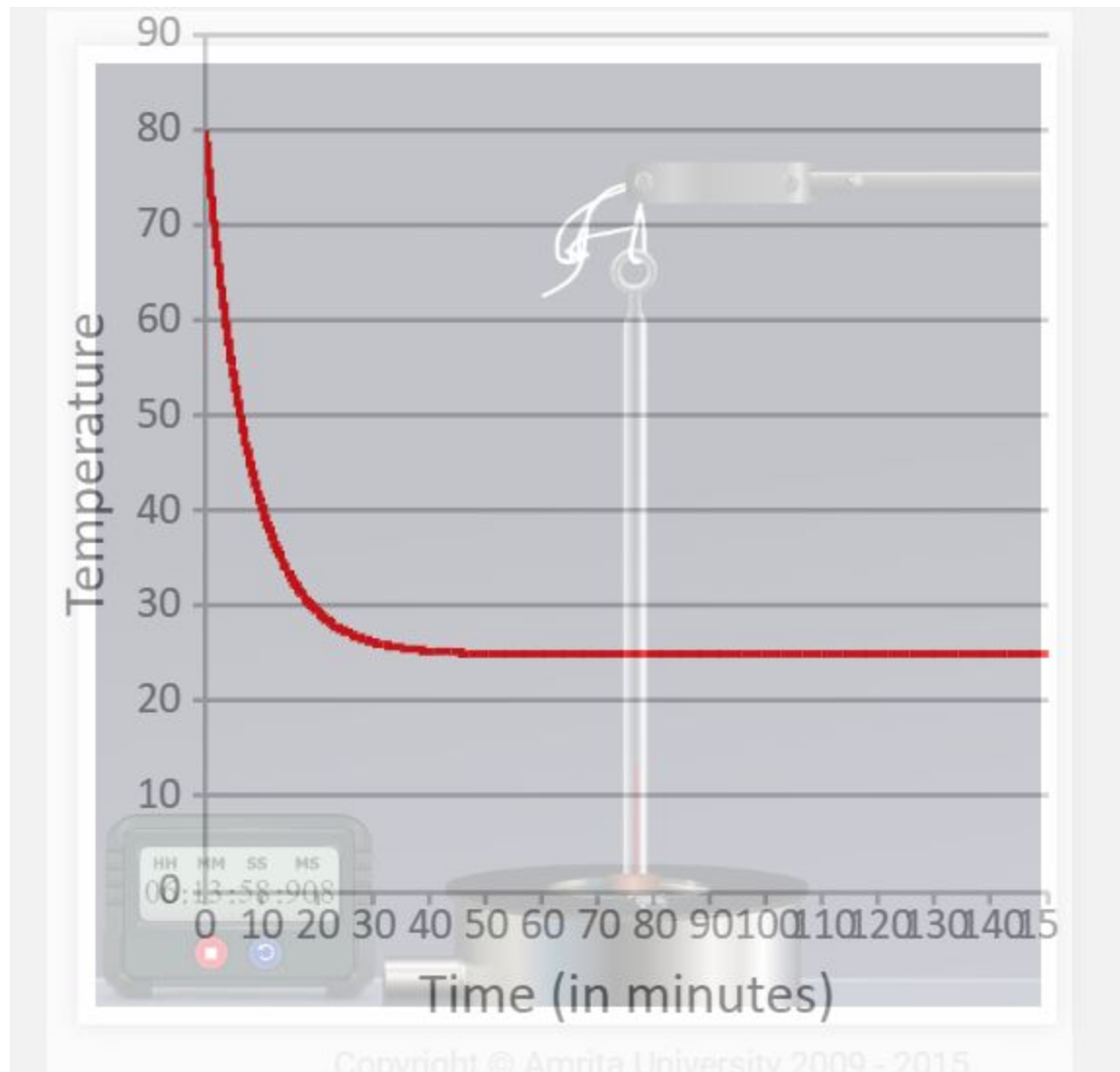
Result :

Newton's Law of Cooling is verified.

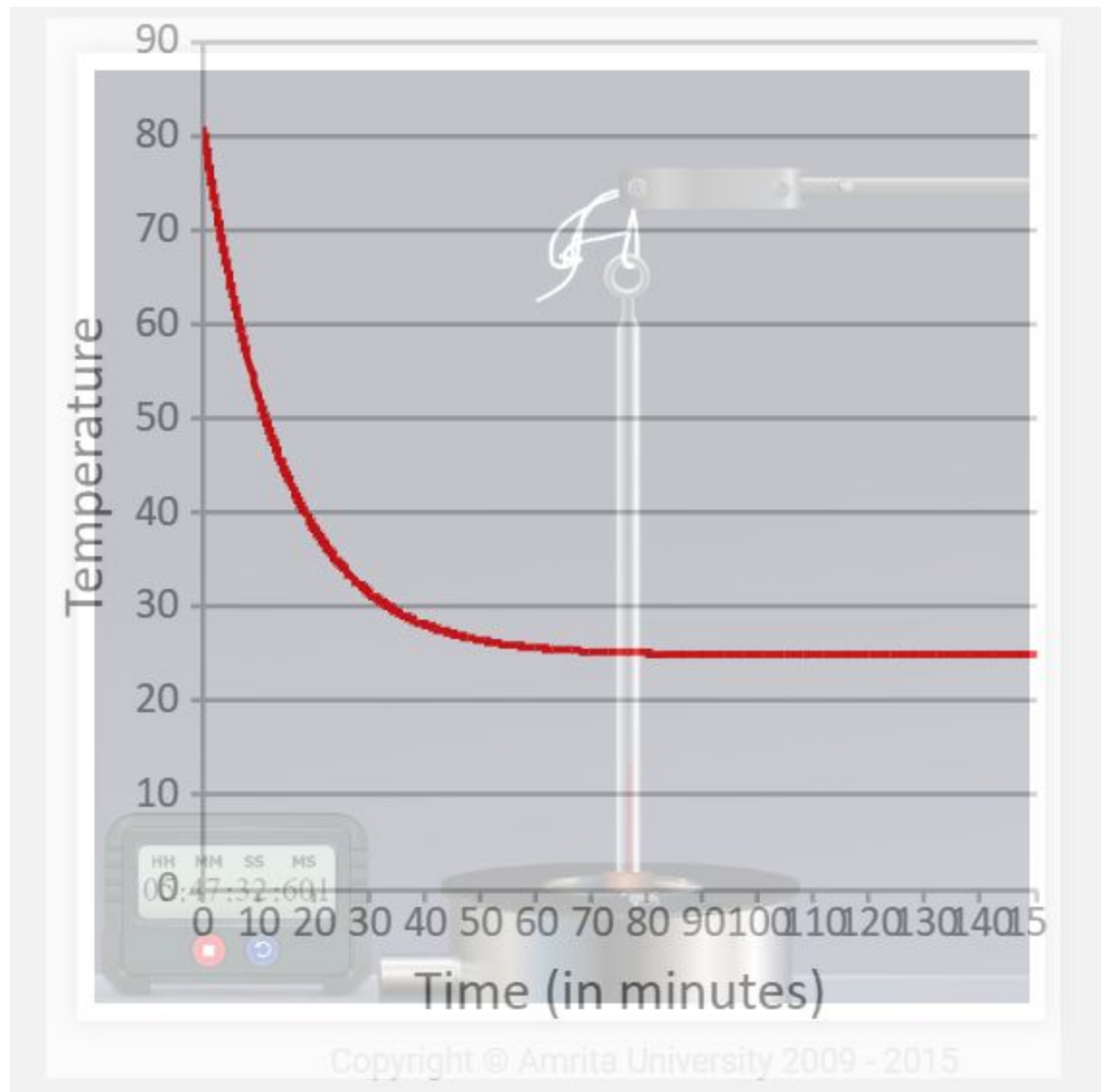
Brass



Copper



Aluminium



Silver

