

A glass full of hot milk is poured on the table. It begins to cool gradually. Which of the following is correct?

- (a) The rate of cooling is constant till milk attains the temperature of the surrounding.
- (b) The temperature of milk falls off exponentially with time.
- (c) While cooling, there is a flow of heat from milk to the surrounding as well as from surrounding to the milk but the net flow of heat is from milk to the surrounding and that is why it cools.
- (d) All three phenomenon, conduction, convection and radiation are responsible for the loss of heat from milk to the surroundings.

From Newton's law of cooling,

$$\frac{dT_2}{T_2 - T_1} = - \left(\frac{k}{ms} \right) dt \quad \text{--- (1)}$$

where; k = positive constant depending upon surface area and nature of body

m = mass of body

s = specific heat capacity of body

T_1 = temperature of surrounding

T_2 = temperature of body

$-dT_2$ = fall in temperature of body

From eq. (1)

Option (a) (X) As milk cools, rate of cooling decreases with time. So, incorrect.

Option (b) (✓) Temperature of milk falls exponentially with time
 $\left\{ \therefore T_2 = T_1 + e^{-kt+c} \quad \left(\text{On integration of above equation} \right) \right\}$

Option (c) (✓) While cooling, very small amount of heat flows from surrounding to milk as compared to heat lost by milk to surrounding. So, correct

Option (d) When hot milk is spread on a table, it transfers heat to surroundings by conduction, convection and radiation.