Q. 02

Three copper blocks of masses M_1, M_2 and M_3 kg respectively are brought into thermal contact till they reach equilibrium. Before contact, they were at T_1, T_2, T_3 ($T_1 > T_2 > T_3$). Assuming there is no heat loss to the surroundings, the equilibrium temperature T is (s is specific heat of copper)

1) $T = \frac{T_1+T_2+T_3}{3}$
2) $T = \frac{M_1T_1+M_2T_2+M_3T_3}{M_1+M_2+M_3}$
3) $T = \frac{M_1T_1s+M_2T_2s+M_3T_3s}{M_1+M_2+M_3}$
4) $T = \frac{M_1T_1+M_2T_2+M_3T_3}{3(M_1+M_2+M_3)}$

Sol. 2) $T = \frac{M_1T_1+M_2T_2+M_3T_3}{M_1+M_2+M_3}$

It is given that there is no heat loss in the surrounding
and equilibrium temperature in the system is T.
It is also given s is the specific heat of the copper
Let us assume $T_1, T_2 < T < T_3$
$\therefore$ heat loss by M_3 = heat gain by M_1+ heat gain by M_2
$\Rightarrow M_3\, s(T_3-T) = M_1\, s(T-T_1)+M_2\, s(T-T_2)$
$\Rightarrow T(M_1 + M_2 + M_3) = M_3T_3 + M_1T_1+ M_2T_2$
$\therefore T = \frac{M_1T_1+M_2T_2+M_3T_3}{M_1+M_2+M_3}$