1. Mass of aluminium = 0.5kg, Mass of water = 0.2 kg
Mass of Iron = 0.2 kg Temp. of aluminium and water = 20°C = 297°k
Sp heat o f Iron = 100°C = 373°k. Sp heat of aluminium = 910J/kg-k
Sp heat of Iron = 470J/kg-k Sp heat of water = 4200J/kg-k
Heat again = $0.5 \times 910(T - 293) + 0.2 \times 4200 \times (343 - T)$
$= (T - 292)(0.5 \times 910 + 0.2 \times 4200)$ Heat lost = $0.2 \times 470 \times (373 - T)$
$\therefore$ Heat gain = Heat lost
$\Rightarrow (T - 292)(0.5 \times 910 + 0.2 \times 4200) = 0.2 \times 470 \times (373 - T)$
$\Rightarrow (T - 293)(455 + 8400) = 49(373 - T)$
$\Rightarrow (T - 293)\left(\frac{1295}{94}\right) = (373 - T)$
$\Rightarrow (T - 293) \times 14 = 373 - T$
$\Rightarrow T = \frac{4475}{15} = 298\ k$
$\therefore T = 298 - 273 = 25°C.$ The final temp = 25°C.

2. mass of Iron = 100g water Eq of caloriemeter = 10g
mass of water = 240g Let the Temp. of surface = 0°C
S_{iron} = 470J/kg°C Total heat gained = Total heat lost.
So, $\frac{100}{1000} \times 470 \times (\theta - 60) = \frac{250}{1000} \times 4200 \times (60 - 20)$
$\Rightarrow 47\theta - 47 \times 60 = 25 \times 42 \times 40$
$\Rightarrow \theta = 4200 + \frac{2820}{47} = \frac{44820}{47} = 953.61°C$

3. The temp. of A = 12°C The temp. of B = 19°C
The temp. of C = 28°C The temp of $\Rightarrow$ A + B = 16°
The temp. of $\Rightarrow$ B + C = 23°
In accordance with the principle of caloriemetry when A & B are mixed

$M_{CA}(16 - 12) = M_{CB}(19 - 16) \Rightarrow CA4 = CB3 \Rightarrow CA = \frac{3}{4}CB$ ...(1)

And when B & C are mixed

$M_{CB}(23 - 19) = M_{CC}(28 - 23) \Rightarrow 4CB = 5CC \Rightarrow CC = \frac{4}{5}CB$ ...(2)

When A & c are mixed, if T is the common temperature of mixture

$M_{CA}(T - 12) = M_{CC}(28 - T)$

$\Rightarrow \left(\frac{3}{4}\right)CB(T - 12) = \left(\frac{4}{5}\right)CB(28 - T)$

$\Rightarrow 15T - 180 = 448 - 16T$

$\Rightarrow T = \frac{628}{31} = 20.258°C = 20.3°C$