

Level - 1	JEE Mains Pattern/Solutions
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1.(D) Joule and calorie both represent energy.

2.(C) Heat and work, both have dimensions of energy.

3.(C) Total internal energy should remain same, by very principle of energy conservation.

4.(A) $Q_1 = m_1 s_1 \Delta T_1$ and $Q_2 = m_2 s_2 \Delta T_2$ So, $\frac{Q_1}{Q_2} = \frac{50 \times 420 \times 10}{10 \times 4200 \times T}$ or, $T = 5^\circ\text{C}$

5.(A) $m_1(1)(50 - 30) = m_2(1)(80 - 50)$
 $2m_1 = 3m_2, m_1 + m_2 = 40 \text{ kg}$
 So, $m_1 = 24 \text{ kg}, m_2 = 16 \text{ kg}$

6.(B) Net heat gain would be zero,

So $m_1 c_1 (T - T_1) + m_2 c_2 (T - T_2) + m_3 c_3 (T - T_3) = 0$ or, $T = \frac{m_1 c_1 T_1 + m_2 c_2 T_2 + m_3 c_3 T_3}{m_1 c_1 + m_2 c_2 + m_3 c_3}$

7.(B) Let the thermal capacity of calorimeter is C , cal/ $^\circ\text{C}$ then

$200(T - 30) + c(T - 30) = 100(60 - T)$ or, $1000 + 5c = 2500$
 or, $5c = 1500, c = 300 \text{ cal/K}$
 $= 300(4.2) \text{ J/K}, \quad = 1260 \text{ J/K}$

8.(A) $m_{SA} (15 - 10) = m_{SB} (25 - 15)$... (i)
 $m_{SB} (30 - 25) = m_{SC} (40 - 30)$... (ii)
 Find relation between SA and SC and solve.

9.(A) $\frac{mv^2}{2J} = ms\Delta T, \quad \Delta T = \frac{V^2}{2sJ} \approx 158.0^\circ\text{C}$

10.(A) $\theta = \int_0^{20} msdT = mA \int_0^{20} T^3 dT = mA \frac{(20)^4}{4} = 4 \times 10^4 \text{ mA}$

11.(C) ∞ as $\Delta\theta \rightarrow \text{zero}$

12.(A) $Q_1 = (1000)(20)0.5 = 10000 = 10^4 \text{ cal}; Q_2 = (1000)80 = 80000 = 8 \times 10^4 \text{ cal}$
 $Q_3 = (1000)100(1) = 100000 = 10^5 \text{ cal}$ and $Q_4 = (540)(1000) = 5.4 \times 10^5 \text{ cal}$

13.(A) Let final temperature be 0°C with m gram of ice melted.

Heat gained by Ice = Heat lost by water.

$\text{ice } -20^\circ\text{C} \rightarrow i_{0^\circ\text{C}} + (i_{0^\circ\text{C}} \rightarrow w_{0^\circ\text{C}}) = \text{Water } 30^\circ\text{C} \rightarrow \text{Water } 0^\circ\text{C}$

$5 \times 0.5 \times 20 + m \times 80 = 5 \times 1 \times 30, \quad m = \frac{100}{80} \text{ gm} < 5$

So, final temperature is 0°C .

14.(C) $Mgh = mL \Rightarrow m = \frac{Mgh}{L} = \frac{3.5 \times 10 \times 2000}{3.5 \times 10^5} = 0.2 \text{ kg}$

15.(C) Heat required to raise temp of ice to $0^{\circ}\text{C} = 500 \times 0.5 \times 5 = 1250 \text{ cal}$

Heat released if 100 gm of water is brought to $0^{\circ}\text{C} = 100 \times 20 \times 1 = 2000 \text{ cal}$

Final mixture will be at 0°C

$$\text{Amount of ice melted} = \frac{2000 - 1250}{80} = \frac{750}{80} = 93.75 \text{ gm}$$

$$\text{Amount of ice} = 500 - 93.75 = 406.25 \text{ gm}$$