Answer on Question #55640-Physics-Mechanics-Relativity

The resulting temperature when 1kg of ice at 0 degrees Celsius is mixed with 9kg of water at 50 degrees Celsius is ---------- to the nearest whole number. The specific capacity of water is 4200J/kg/K, the specific latent heat of fusion of ice is 330 000J/kg

A. 24 degrees Celsius

B. 37 degrees Celsius

C. 46 degrees Celsius

D. 56 degrees Celsius

Solution

Let the final temperature of the water be x and imagine that there is sufficient energy to melt all the ice so that $x > 0$.

The ice requires 330000 J to melt plus $4200 \cdot x$ to raise the temperature to x.

This energy comes from cooling the remainder of the water:

$mass \cdot temperature\ change \cdot specific\ heat = 9(50 - x)4200;$

Hence

$$330000 + 4200 \cdot x = 9(50 - x)4200.$$

Now solve

$$330000 + 4200\,x = 450 \cdot 4200 - 9x \cdot 4200$$

$$x = \frac{450 \cdot 4200 - 330000}{10 \cdot 4200} = 37℃.$$

Answer: B. 37 degrees Celsius.