

A calorimeter of water equivalent 20 g contains 180 g of water at  $25^{\circ}\text{C}$ . 'm' grams of steam at  $100^{\circ}\text{C}$  is mixed in it till the temperature of the mixture is  $31^{\circ}\text{C}$ . The value of 'm' is close to :  
(Latent heat of water =  $540 \text{ cal g}^{-1}$ , specific heat of water =  $1 \text{ cal g}^{-1} \text{ }^{\circ}\text{C}^{-1}$ ) (JEE MAIN 2020)

A 2.6

B 2

C 4

D 3.2

Given,

$$\text{Heat lost by steam in calorimeter} = \text{Heat gained by calorimeter} + \text{Heat gained by water}$$

$$\begin{aligned} \Rightarrow \text{Latent heat to convert steam to water at } 100^\circ\text{C} &= \text{Heat gained by calorimeter reaching } 25^\circ\text{C} \rightarrow 31^\circ\text{C} + \text{Heat gained by } \overset{\text{water}}{\text{reaching}} \text{ } 25^\circ\text{C} \rightarrow 31^\circ\text{C} \\ &+ \text{Heat lost in reaching } 100^\circ\text{C} \rightarrow 31^\circ\text{C} \end{aligned}$$

$$\Rightarrow m(540) + m(1)(100-31) = 20(31-25) + 100(1)(31-25)$$

$$\Rightarrow 540m + 69m = 120 + 1000$$

$$\Rightarrow m = \frac{1200}{609} =$$

$$\boxed{m = 1.97} \rightarrow \text{Closest answer is option (b) (i.e. } m=2 \text{)}$$