Answer on Question #51931-Physics-Field Theory

16 A student tries to determine the specific latent heat of vaporisation of a liquid by an electrical method. A heater is used to boil the liquid and when the liquid is boiling, the mass of liquid vaporised per second is measured at two different powers for the heater. At the power of 40 W and 80 W, the liquid is vaporised at the rate of 0.0417 kgs−1 and 0.0893 kgs−1 respectively. What is the best estimate of the specific latent heat of vaporisation of the liquid?

840Jkg−1

896Jkg−1

928Jkg−1

959Jkg−1

Solution

We know that

$$W = L\frac{dm}{dt}.$$

We can see that the specific latent heat of vaporisation of the liquid is the slope of the graph of the power depending on $\frac{dm}{dt}$. Therefore, the best estimate of the specific latent heat of vaporisation of the liquid is

$$L = \frac{W_2 - W_1}{\frac{dm}{dt}_2 - \frac{dm}{dt}_1} = \frac{80 - 40}{0.0893 - 0.0417} = 840\ \text{Jkg}^{-1}.$$

Answer: $\mathbf{840\ Jkg^{-1}}$.

17 The temperature 47.12 °C is equivalent to

320.28 K

320.27 K

-226.03 K

-226.04 K

Solution

$$(47.12\ + 273.15)\text{K} = 320.27\text{K}.$$

Answer: $\mathbf{320.27K}$.

18 A gas cylinder is fitted with a safety valve which releases a gas when the pressure inside the cylinder reaches 2.0x106Pa. Given the maximum mass of this gas that the cylinder can hold at 10 °C is 15 kg, what would be the maximum mass at 30◦C?

5 kg

14 kg

20 kg

45 kg

Solution

In this process the volume is constant, so

$$\frac{p_2}{T_2} = \frac{p_1}{T_1}.$$

We know

$$p = \frac{mRT}{MV}.$$

The maximum pressure is

$$P = m_1 T_1 \frac{R}{MV}.$$

Thus,

$$m_2 = m_1 \frac{T_1}{T_2} = 15\ kg \frac{(10 + 273.15)K}{(30 + 273.15)K} = 14\ kg.$$

Answer: $14\ kg$.

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