

TOPIC

Thermodynamics – Section XII – Question 5

QUESTION

2 kg of air in a closed-rigid vessel at 1 bar and 25°C is heated until its temperature is 100°C. The heat added to the air (in kJ) most nearly is

- (A) 0
- (B) 108
- (C) 120
- (D) 150

HINT

- Apply the closed system energy balance
- Note that since the vessel is rigid, there is no work
- The constant volume heat capacity of air is 0.717 kJ/kg-K

SOLUTION

For a closed system

$$m\Delta U = Q - W$$

and since it is a rigid vessel,

$$W = 0$$

Assuming air to be an ideal gas,

$$\Delta U = C_v \Delta T$$

Thus

$$\begin{aligned} Q &= mC_v \Delta T \\ &= 2\text{kg} \times 0.717\text{kJ/kg-K} \times 75\text{K} \\ &= 108\text{kJ} \end{aligned}$$

Note that $\Delta T=75$ whether in K or centigrade.

ANSWER

(B)

CONTRIBUTOR

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