

[A8]

$$1) \underline{C_p - C_v = R}$$

$$2) (b) P_1 V_1^\gamma = P_2 V_2^\gamma$$

∴ $\frac{T_1^\gamma}{P_1^{\gamma-1}} = \frac{T_2^\gamma}{P_2^{\gamma-1}}$

$$\frac{T_1^\gamma}{P_1^{\gamma-1}} = \frac{T_2^\gamma}{P_2^{\gamma-1}} \quad \text{∴} \left(\frac{T_2}{T_1}\right)^\gamma = \left(\frac{P_2}{P_1}\right)^{\gamma-1} \quad \text{∴} \left(\frac{T_2}{T_1}\right) = \left(\frac{P_2}{P_1}\right)^{\frac{\gamma-1}{\gamma}}$$

$$P_2 = \frac{1}{2} P_1, \quad \gamma = \frac{C_p}{C_v} = \frac{C_v + R}{C_v} = \frac{3.5R}{2.5R} = 1.4$$

$$\text{∴} \frac{T_2}{T_1} = \left(0.5\right)^{\frac{1.4-1}{1.4}} = 0.82, \quad T_2 = 0.82 T_1 = \underline{656 \text{ K}}$$

$$(c) Q = \Delta U + W, \quad Q = 0,$$

$$\text{∴} W = -\Delta U = -C_v \Delta T = -2.5R (656 - 800) \\ = 3 \times 10^3 \text{ J} = \underline{3 \text{ kJ}}$$

$$3) (d) dW = p dv$$

$$\text{∴} W = p \Delta V = p (V_1 - V_4)$$

$$V_1 = \frac{nRT_1}{P_1} = \frac{1 \times 8.31 \times 800}{2 \times 10^6} = 3.32 \times 10^{-3} \text{ m}^3$$

$$\frac{V_4}{T_4} = \frac{V_1}{T_1} \quad \text{∴} V_4 = \frac{T_4}{T_1} \times V_1 = \frac{300}{800} \times 3.32 \times 10^{-3} = 1.25 \times 10^{-3} \text{ m}^3$$

$$\text{∴} W = p \Delta V = 2 \times 10^6 \times (3.32 - 1.25) \times 10^{-3} = \underline{4.14 \text{ kJ}}$$

$$(e) \Delta U = C_v \Delta T$$

$$= 2.5R \times (T_1 - T_4) = \underline{10.4 \text{ kJ}}$$

[A9]

(5) < (6)