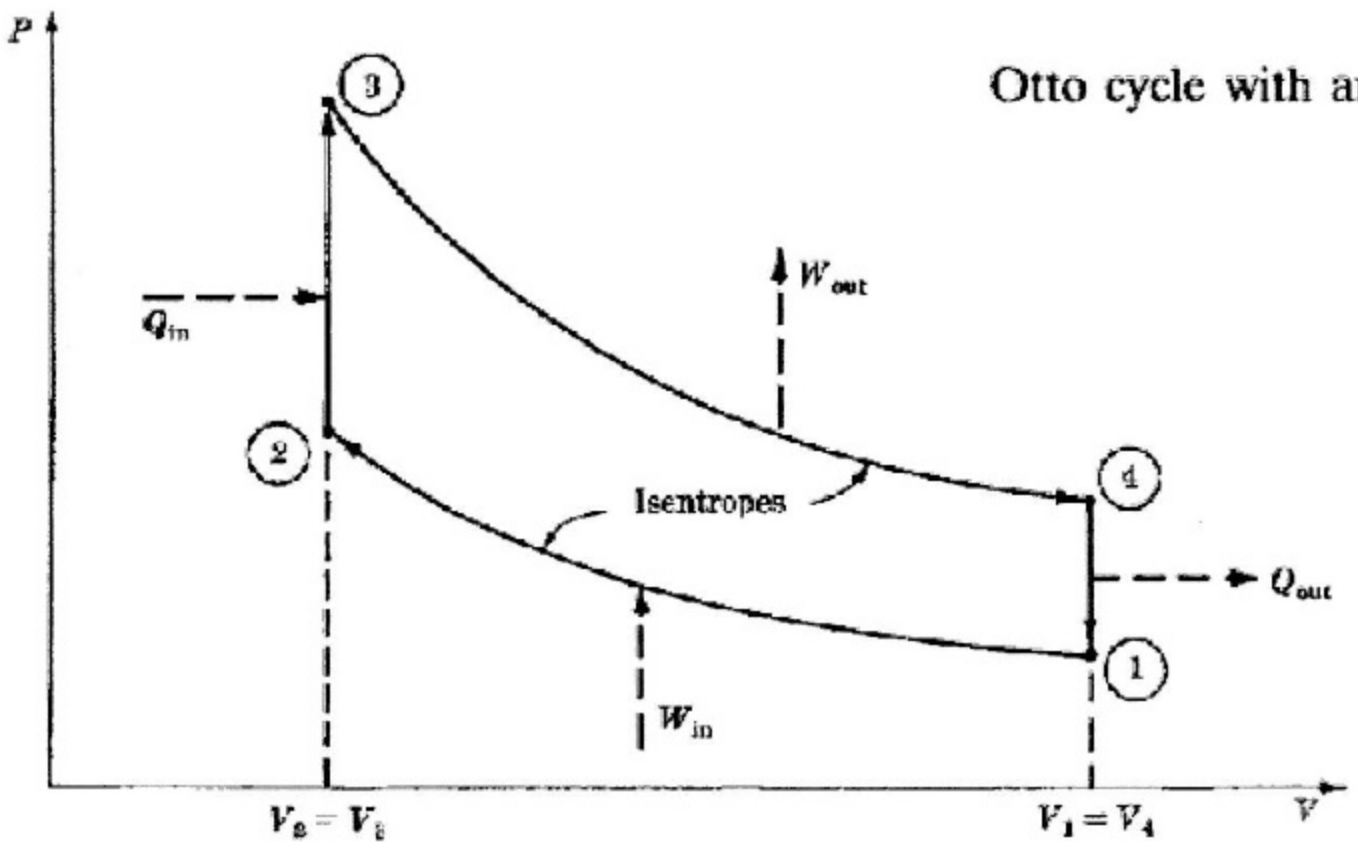
1 If 2 kg of liquid water at 90 °C is mixed adiabatically and at constant pressure with 3 kg of liquid water at 10 °C, what is the total entropy change resulting from this process? For simplicity, take the heat capacity of water to be constant at $C_p = 4184\ \mathrm{J \cdot kg^{-1} \cdot K^{-1}}$.

$$\boxed{\Delta S_{\text{total}} = 157.6\ \mathrm{J \cdot K^{-1}}}$$

2



Otto cycle with an ideal gas of constant heat capacity

$$\boxed{\eta = 1 - \frac{T_1}{T_2} = 1 - \left(\frac{V_2}{V_1}\right)^{\gamma - 1}}$$

3 Prove that a substance for which $U = B + CV^{-R/\delta}e^{S/\delta}$ obeys the ideal-gas law, if B, C, and δ are constants.