For the flow of gas in a nozzle,

$$h_2 = h_1 + \frac{1}{2}(V_1^2 - V_2^2),$$

where h_1 and h_2 are the gas's specific enthalpies at the inlet and outlet of the nozzle, respectively, and V_1 and V_2 are the gas speeds at the inlet and outlet, respectively. For the current case, h_1 = 300 kJ/kg, V_1 = 100 m/s, and V_2 = 200 m/s.

Using the given formula, calculate the value for h_2 in kJ/kg.

SOLUTION:

Substitute the given parameter into the equation to solve for h_2, including appropriate unit conversions,

$$h_2 = \left(300\,\frac{\text{kJ}}{\text{kg}}\right) + \frac{1}{2}\left[\left(100\,\frac{\text{m}}{\text{s}}\right)^2 - \left(200\,\frac{\text{m}}{\text{s}}\right)^2\right]\left(\frac{1\ \text{kJ}}{1000\ \text{N.m}}\right)\left(\frac{1\ \text{N.m}}{1\ \text{kg.m}^2/\text{s}^2}\right), \quad (1)$$

$$h_2 = \left(300\,\frac{\text{kJ}}{\text{kg}}\right) + \frac{1}{2}(-30000\ \text{m}^2/\text{s}^2)\left(\frac{1\ \text{kJ/kg}}{1000\ \text{m}^2/\text{s}^2}\right), \quad (2)$$

$$h_2 = \left(300\,\frac{\text{kJ}}{\text{kg}}\right) - \left(15\ \frac{\text{kJ}}{\text{kg}}\right), \quad (3)$$

$$\boxed{h_2 = 285\,\frac{\text{kJ}}{\text{kg}}}. \quad (4)$$