SOLUTIONS TO UNIFIED T3 (NAITZ)

\section*{b) \textit{S - Isothermal}}

\begin{align*}
T_1 &= 300 \text{K}, \quad V_1 = 1 \text{ m}^3/\text{kg} \\
T_2 &= 300 \text{K}, \quad V_2 = 10 \text{ m}^3/\text{kg} \\
\therefore \quad P_2 &= \frac{287.300}{10} \\
&= 28.73 \text{ Pa} \\
\therefore \quad P_2 &= 8610 \text{ Pa}
\end{align*}

\section*{c) \textit{S - Adiabatic}}

\begin{align*}
PV^\gamma &= \text{const.} \quad \gamma = 1.4 \\
P_1 &= \frac{287.300}{1} = 8610 \text{ Pa} \\
\frac{P_2}{P_1} &= \left(\frac{V_1}{V_2}\right)^\gamma \\
\therefore \quad P_2 &= 3428 \text{ Pa} \\
\frac{T_2}{T_1} &= \frac{P_2 V_2}{P_1 V_1} \\
&= \frac{8610 \times 10}{3428} \\
&= 24.9 \\
\therefore \quad T_2 &= 119 \text{ K}
\end{align*}

\begin{align*}
\Delta w &= \beta - w \\
\Delta w &= \frac{Q_0}{R} \\
\therefore \quad Q &= 0 \\
\Delta w &= -C_v(T_2 - T_1) \\
&= -716.5(119 - 300) \\
\therefore \quad w &= 129 \text{ KJ/kg}
\end{align*}

\begin{align*}
\text{c) } w &= RT \ln \left(\frac{V_2}{V_1}\right) \\
&= 287.300 \times \ln(10) \\
&= 198 \text{ KJ/kg}
\end{align*}
\[ \Delta h = u + pv \]
\[ \Delta h = C_p dT \]
\[ \Delta h = 1003.5 \left( T_2 - T_1 \right) \]
\[ \Delta h = 0 \]

\[ \Delta h = \frac{1003.5 \left( 119 - 300 \right)}{} \]
\[ \Delta h = -181.6 \text{ kJ} \]

Q) **HEAT IS A TRANSFER OF ENERGY ACROSS A SYSTEM BOUNDARY BY VIRTUE OF A TEMPERATURE DIFFERENCE ONLY. IT IS MEASURED IN JOULES.**

**TEMPERATURE IS A THERMODYNAMIC PROPERTY AND A FUNCTION OF THE STATE OF A SYSTEM. IT IS MEASURED IN KELVIN.**

\[ \star \text{ IT IS POSSIBLE TO HAVE AN ISOThERMAL PROCESS WITH HEAT TRANSFER} \]

\[ \star \text{ IT IS POSSIBLE TO HAVE AN ADIABATIC PROCESS WITH A TEMPERATURE CHANGE} \]

\[ \text{AS DEMONSTRATED IN THIS PROBLEM} \]