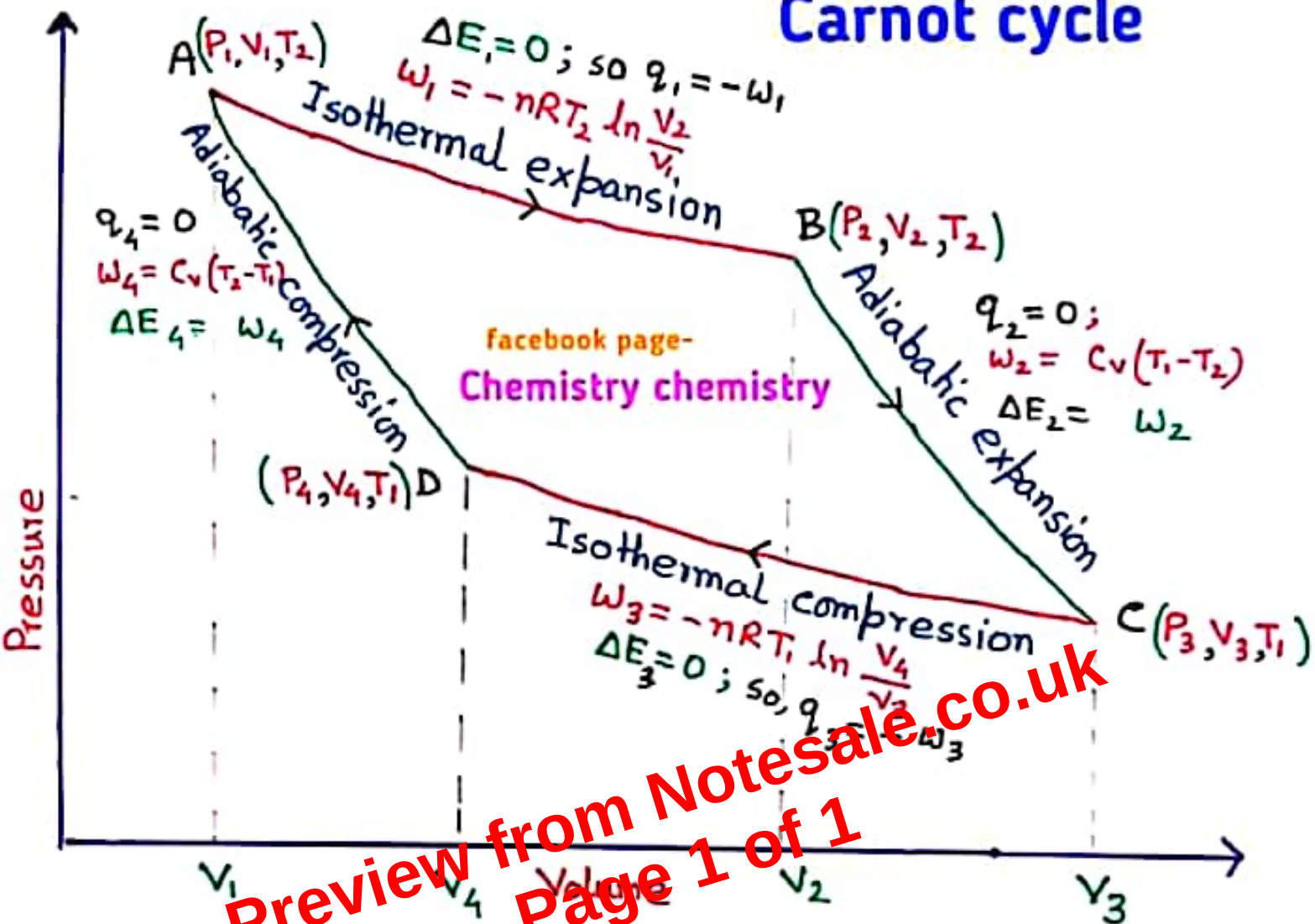


Carnot cycle



$$\begin{aligned}
 W_{\text{total}} &= w_1 + w_2 + w_3 + w_4 \\
 &= -nRT_2 \ln \frac{V_2}{V_1} + C_v(T_1 - T_2) - nRT_1 \ln \frac{V_4}{V_3} + C_v(T_2 - T_1) \\
 &= -nR(T_2 - T_1) \ln \left(\frac{V_2}{V_1} \right)
 \end{aligned}$$

As cyclic process, $\Delta E = 0$, $q_{\text{total}} = -w_{\text{total}}$

$$\text{Efficiency } (\eta) = \frac{\text{net work done } (w_{\text{total}})}{\text{heat absorbed } (q_1)} = \frac{-w_{\text{total}}}{q_1} = \frac{nR(T_2 - T_1) \ln \frac{V_2}{V_1}}{nRT_2 \ln \frac{V_2}{V_1}} = \frac{T_2 - T_1}{T_2}$$

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