GAS TURBINES

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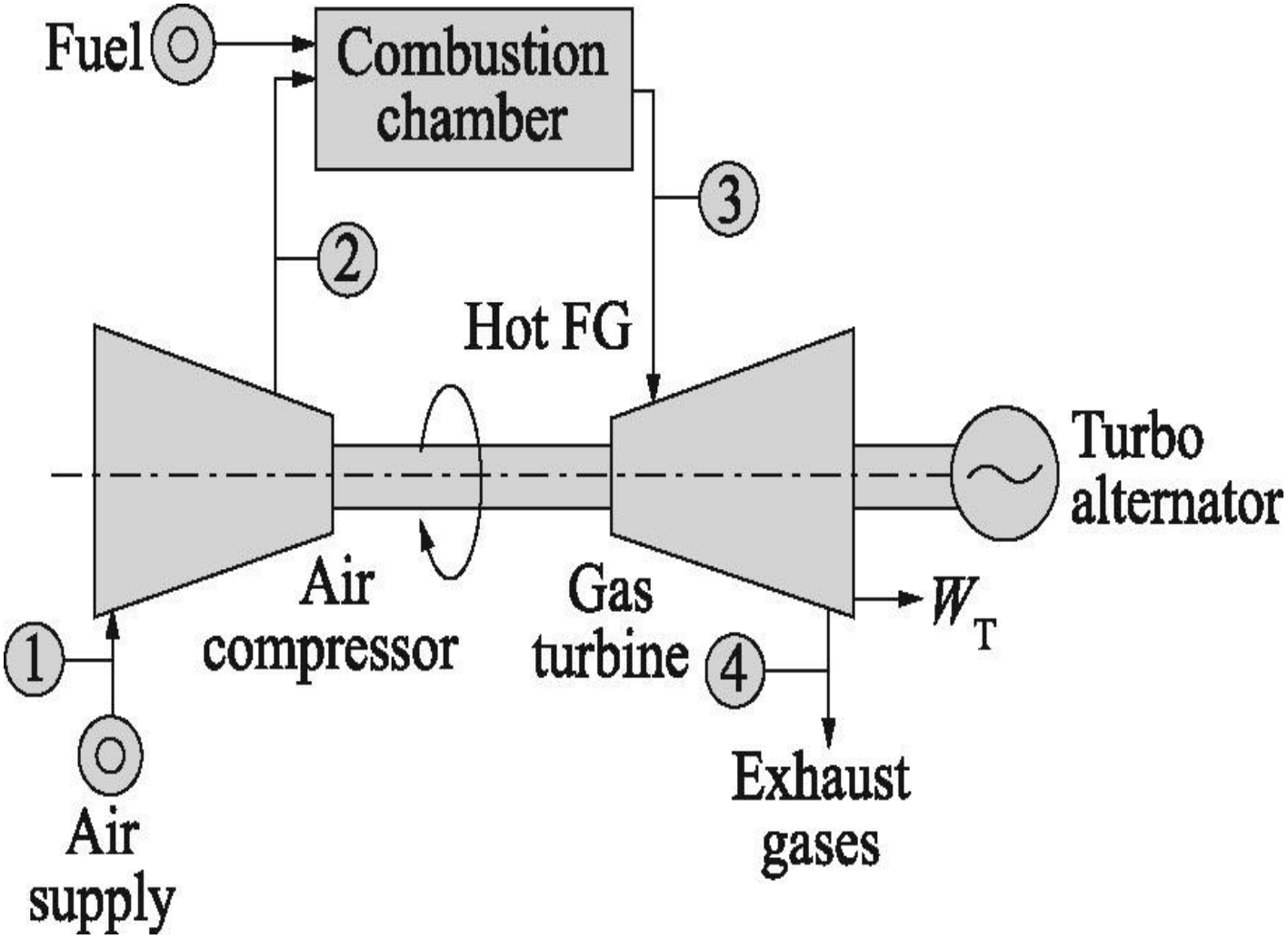
Simple Gas Turbine

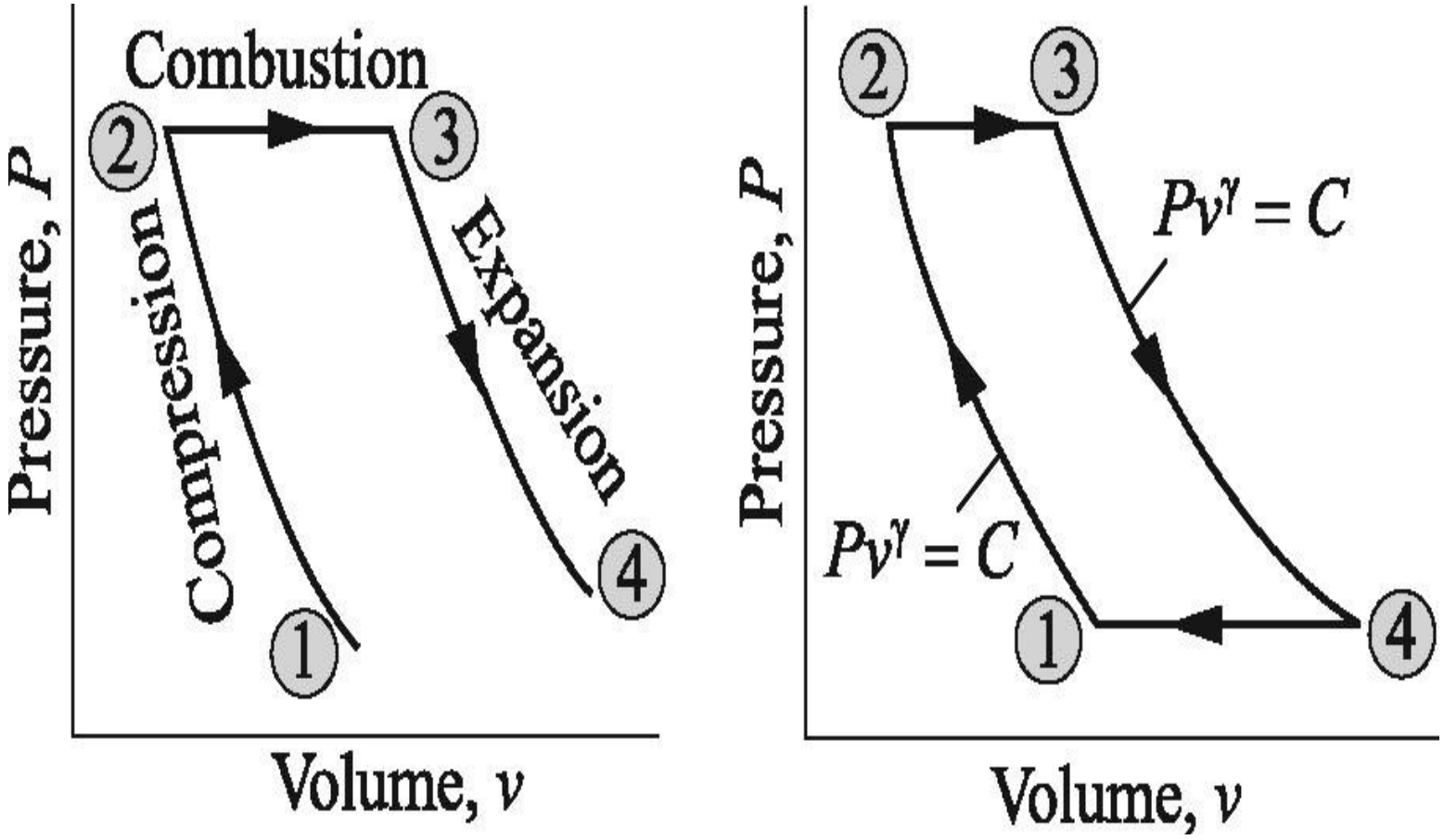


Simple Gas Turbine

- Gas turbine works on Brayton (Joule) cycle.
- The various processes are,
  - (1 – 2) Isentropic Compression
  - (2 – 3) Reversible constant pressure heating
  - (3 – 4) Adiabatic Expansion
  - (4 – 1) Reversible constant pressure cooling

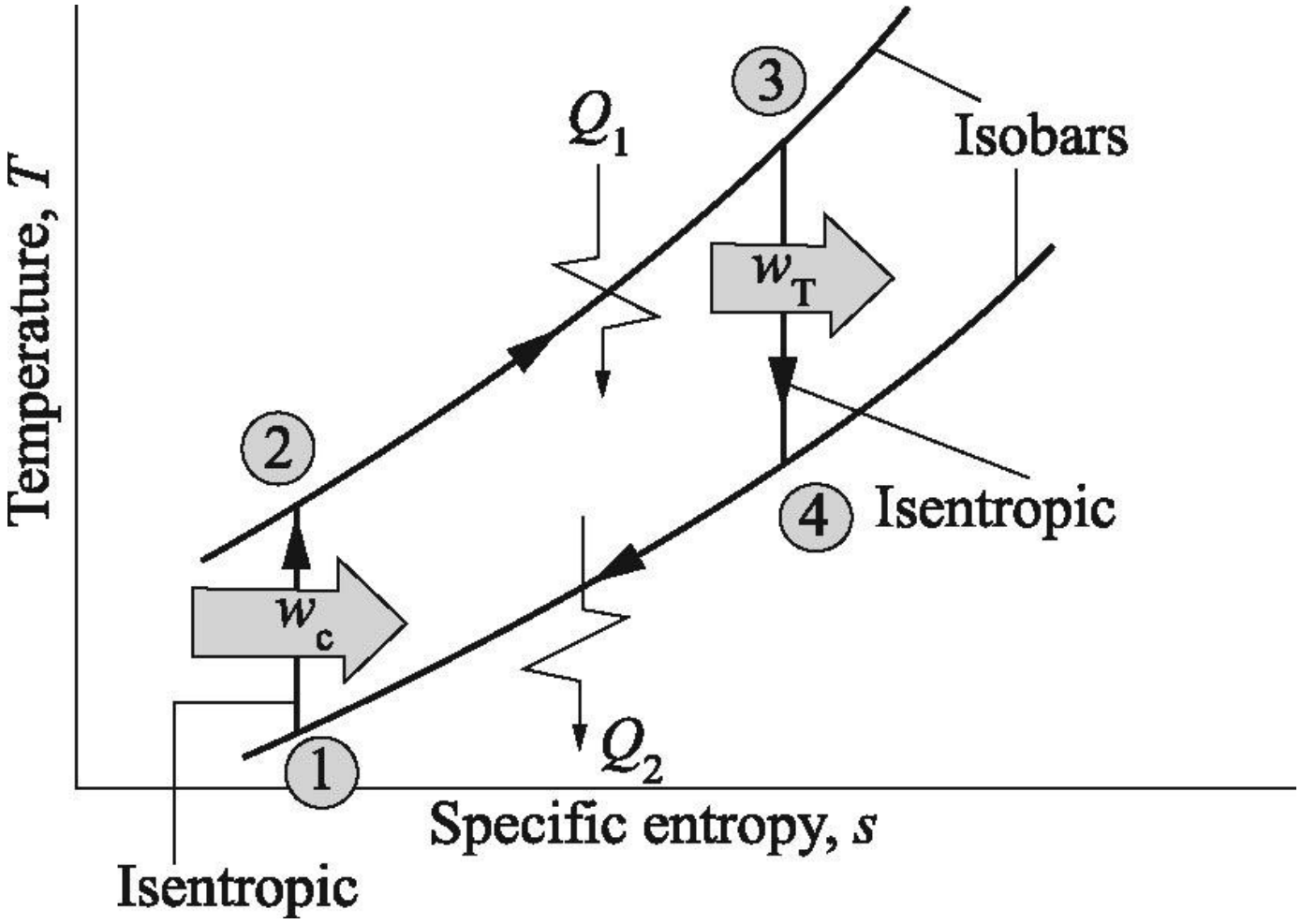
Air Standard Brayton Cyc

P – v Diagram (for open and closed cycle



Air Standard Brayton Cycle

T - s Diagram



Efficiency of Brayton Cyc

$$\eta_{Brayton} = \frac{W_{net}}{Heat\ Supplied}$$

$$W_{net} = W_{3-4} - W_{1-2}$$

$$W_{3-4} = h_3 - h_4 = c_p(T_3 - T_4)$$

$$W_{1-2} = h_1 - h_2 = c_p(T_1 - T_2) = c_p T_1\left(1 - \frac{T_2}{T_1}\right)$$

$$W_{1-2} = c_p T_1\left(1 - r_p^{\left(\frac{k-1}{k}\right)}\right)$$

where,

$$r_p = \text{pressure ratio} = \frac{p_2}{p_1}$$

$$\text{Heat Supplied} = q_{2-3} = h_3 - h_2 = c_p(T_3 - T_2)$$

$$q_{2-3} = c_p\left(T_3 - T_1 r_p^{\left(\frac{k-1}{k}\right)}\right)$$

$$Efficiency,\ \eta_{Brayton} = 1 - \frac{1}{r_p^{\left(\frac{k-1}{k}\right)}}$$