

36.77 A Brayton cycle uses a $30KW$ compressor and a turbine that produces $100KW$. Fuel burned in the combustor adds $5 \times 10^5 \frac{Btu}{hr}$. What is the maximum efficiency of the cycle?

- A. 20%
- B. 30%
- C. 48%
- D. 68%

Use the **Brayton Cycle** schematic and efficiency formula. The work out applies to the turbine, work in applies to the compressor, and the heat in from State 2 to State 3 refers to the combustor.

$$\eta = \frac{\dot{W}_{net}}{\dot{Q}_{in}} = \frac{\dot{W}_{out} - \dot{W}_{in}}{\dot{Q}_{23}}$$

Convert the heat added in the combustor to KW to align with the units in the numerator. Solve for the efficiency of the cycle.

$$\dot{Q}_{23} = \left(5 \times 10^5 \frac{Btu}{hr} \right) \left(\frac{1KW}{3412 \frac{Btu}{hr}} \right) = 146.5KW$$
$$\eta = \frac{100KW - 30KW}{146.5KW} = 0.478$$

Answer C