Idealized Otto cycle

Consider the four steps of the idealized Otto cycle for a classical ideal gas \( pV = nRT, \ U = C_V T \)

with \( C_V = \alpha nR \).

(a) Determine the heat transfer, \( \Delta Q \), the work performance, \( \Delta W \), and the change in internal energy, \( \Delta U \), for each of the four steps:

1 → 2 adiabatic compression of air-fuel mixture: \( S = \text{const.} \)
2 → 3 explosion of air-fuel mixture: \( V = \text{const.} \)
3 → 4 adiabatic expansion of exhaust gas: \( S = \text{const.} \)
4 → 1 isochoric release of exhaust gas: \( V = \text{const.} \)

(c) Calculate the efficiency \( \eta \) and express it as a function of the compression ratio \( K \equiv V_1/V_2 \).

Solution: