Física Estadística I
Tarea 01: Termodinámica Clásica

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Nombre del Estudiante: _____

Problema 1 *Diesel engine*

For an ideal Diesel cycle (see figure),

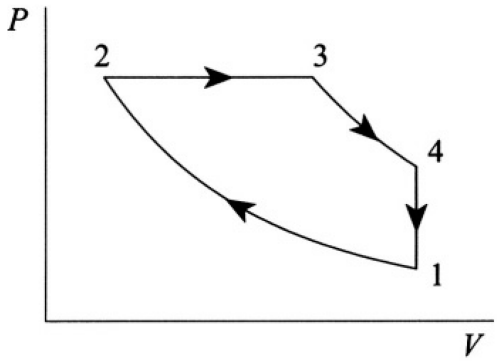
(a) Demonstrate that the internal energy is a conserved quantity, that is, $\Delta U_{tot} = 0$.

(b) Show that the thermal efficiency of this cycle is given by,

$$\eta = 1 - \frac{1}{\gamma}\frac{(1/r_E)^\gamma - (1/r_c)^\gamma}{(1/r_E) - (1/r_c)},$$

where the ratio $r_c = V_1/V_2$ is called the *compression ratio* and the ratio $r_E = V_1/V_3$ is called the *expansion ratio* for a diesel engine.

(c) Take $r_c = 20$, $r_E = 5$, and $\gamma = 1.4$ and calculate the thermal efficiency.



Hints:

1. The processes $1 \to 2$ and $3 \to 4$ are adiabatic.
2. For adiabatic process it holds $T/T_0 = (V_0/V)^{\gamma-1}$, where $\gamma = C_p/C_v$.
3. For ideal gases, $\gamma = 5/3$ and $C_p - C_v = Nk$.

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