1. **Calculate the order of reaction for decomposition of CH_3CHO from the following experimental data. (20%)**

Rate (torr/min)	**2.30**	**4.31**	**6.74**	**8.53**
Conversion	**0.5**	**0.3**	**0.1**	**0**

2. **Define the efficiency (ε) of the reversible Carnot cycle and calculate ε for the hot reservoir at T_{hot} = 800 K undergoing to an adiabatic expansion until the temperature falls to T_{cold} = 400 K and the amount of heat that is extracted from the hot reservoir to do 1000 J of work in the surroundings. (30%)**
3. **Calculate the dissociation degree of $CO_{2(g)}$ into $CO_{(g)}$ and $O_{2\,(g)}$ at 1000 K. (20%)**
4. **A syngas (CO (35%), H_2 (45%), O_2 (5%), H_2O (5%), N_2 (5%) and CO_2 (5%)) is burned with 5% excess air (20% O_2 and 80% N_2) at 320 K. Calculate (a) the exit temperature (20%) and (b) the off gas composition (10%).**

	ΔH° (kJ/mol)	ΔG° (kJ/mol)	d (J/Kmol)	e (J/K^2mol)	f (JK/mol)
O_2	0	0	30	4.2×10^{-3}	-1.7×10^{5}
CO	-110.5	-137.2	28	4.1×10^{-3}	-4.6×10^{4}
N_2	0	0	28	3.8×10^{-3}	-5.0×10^{4}
$H_2O(g)$	-241.8	-228.6	31	10.3×10^{-3}	0
CO_2	-393.5	-394.4	44	8.8×10^{-3}	-8.6×10^{5}
H_2	0	0	27	3.3×10^{-3}	5.0×10^{4}

$$C_p = d + eT + fT^{-2}$$