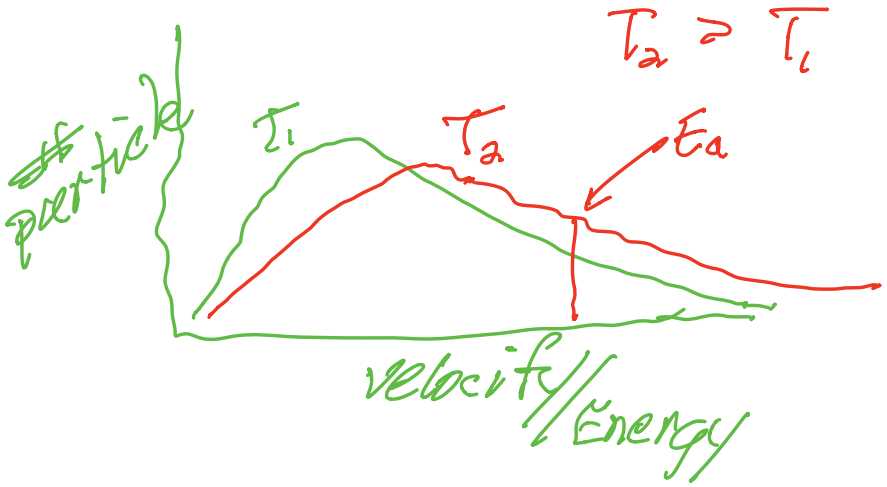
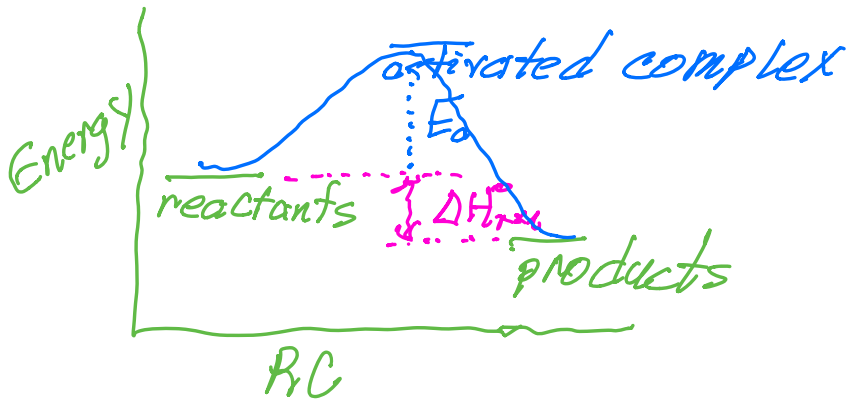

$T_2 > T_1$
particle
T_1
T_2
E_a
velocity/Energy

$A + B \rightarrow C + D \quad \Delta H_{rxn}$

reaction with 2 step mechanism

step 1: $A + B \rightarrow AB$ slow

step 2: $AB \rightarrow C + D$ fast



reaction coordinate diagram

TEMPERATURE DEPENDENCE OF THE RATE CONSTANT

NAME _____ SECTION _____

activated complex

activation energy

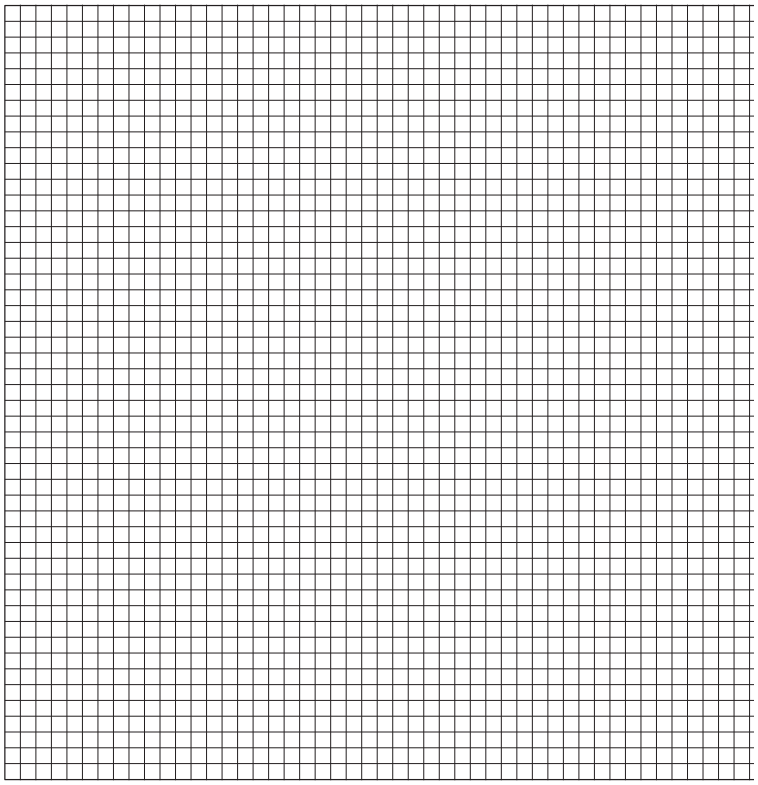
E_a

1. a. The following rate data was obtained at different temperatures for the reaction

$$O_3(g) + NO(g) \rightarrow O_2(g) + NO_2(g)$$

Temperature (K)	$^1/_T$	k ($M^{-1} \cdot sec^{-1}$)	*ln* k
600		0.28	
650		0.22	
700		1.30	
750		6.00	
800		23.0	

Sketch the plot of *ln* k (*y*-axis) versus $\frac{1}{\text{temperature}}$ (*x*-axis)

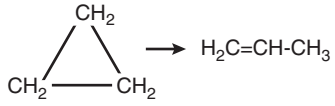


b. Write the Arrhenius equation and identify each term.

c. Define the term *activation energy*.

d. Determine the activation energy using the plot you made in 1a.

2. a. At 300 °C the rate constant for the reaction



is 2.41×10^{-10} sec^{-1}. At 400 °C the rate constant is 1.16×10^{-6} sec^{-1}. Calculate the activation energy for the reaction.

b. Estimate the rate of the rearrangement reaction at 800 °C.

c. If the activation energy for the decomposition of N_2O_5 is $1.0 \times 10^2 \frac{kJ}{mol}$, calculate the temperature change necessary to double the rate at room temperature.

3. Sketch the energy profile diagram for the exothermic reaction

$$NO(g) + O_3(g) \rightarrow NO_2(g) + O_2(g)$$

90 143 34 0

$\Delta H^\circ_{rxn} = -199\ kJ/mol_{rxn}$

and label the important features, including reactants, products, activated complex, the energy of activation, and the enthalpy of the reaction.