

# Catalysis

The reaction shown below can be catalyzed by a zeolite with an appropriately shaped cavity. The rate data at two temperatures for the uncatalyzed and catalyzed reaction are given in the table. How large are the energy barriers for the catalyzed and uncatalyzed reactions, respectively, in kJ/mol?

T (K)	460	520
Cat ( $M^{-1} s^{-1}$ )	130	504
Uncat ( $M^{-1} s^{-1}$ )	0.25	2.1

# Catalysis

Solution: Given the data

T (K)	460	520
Cat ( $\text{M}^{-1} \text{s}^{-1}$ )	130	504
Uncat ( $\text{M}^{-1} \text{s}^{-1}$ )	0.25	2.1

We will use the equation

$$E_a = \frac{-R \ln \frac{k_2}{k_1}}{\left(\frac{1}{T_2} - \frac{1}{T_1}\right)}$$

for each pair of data points.

# Catalysis

For the catalyzed reaction

$$E_a = \frac{-8.31 \ln \frac{504}{130}}{\left(\frac{1}{520} - \frac{1}{460}\right)} = 44,800 \text{ J/mol}$$

and for the uncatalyzed reaction

$$E_a = \frac{-8.31 \ln \frac{2.1}{0.25}}{\left(\frac{1}{520} - \frac{1}{460}\right)} = 70,500 \text{ J/mol}$$