

# Activation energy

It takes about 3.0 minutes to cook a hard-boiled egg in Los Angeles, but at the higher altitude of Denver, where water boils at  $92^{\circ}\text{C}$ , the cooking time is 4.5 minutes. Use this information to estimate the activation energy for the coagulation of egg albumin protein.

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**Solution:** To determine the activation when the reaction rate increases by a factor of 1.5 we can For a temperature increase from 92 °C to 100 °C. We calculate  $E_a$  using the equation

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

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Solution: Remember that we also need to convert from Celsius to Kelvin in order to use the Arrhenius equation.

In this problem  $T_1 = 365 \text{ K}$ ,  $T_2 = 373 \text{ K}$  and  $k_2/k_1 = 1.5$ .

$$E_a = \frac{-8.31 \ln(1.5)}{\left(\frac{1}{373} - \frac{1}{365}\right)} = 57,300 \text{ J/mol}$$