

Hints Chapter 5

N1. The Arrhenius equation is given in Section 5.1.1. The question does not ask for the rate itself, only for the rate increase. Therefore it is simpler to calculate the ratio of the rate at one temperature to the rate at another. Remember that dividing one exponential by another corresponds to taking the difference between two exponents: $\exp(A)/\exp(B) = \exp(A - B)$. The gas constant R is $8.31 \text{ J K}^{-1} \text{ mol}^{-1}$ (note that in the question the activation energy is in *kilojoules per mole*). The question also does not specify the temperature, so try the calculation for example going from the standard state (25°C) to 35°C . Because the temperature is given in kelvins, the answer will not be very different if you start at a slightly lower or higher temperature (try it and see!).

N2. If you want to go beyond a simple sketch, you can calculate the profile fairly easily using a spreadsheet, plus the equation

$$[\text{proportion deprotonated}] = 10^{\text{pH}-\text{pK}} / (1 + 10^{\text{pH}-\text{pK}}).$$

N3. Substitute these values for $[S]$ into the Michaelis–Menten equation. The maximum possible rate is V_{max} , so we are looking for rates as a fraction of V_{max} .

N4. You can do this either graphically or using the equation $A = A_0 \exp(-kt)$. If you do it graphically, you need to remember that this is an exponential decay so your y axis should be logarithmic (exponential), not linear. Check your answer to see whether it looks sensible: for example, what will it be 1 min later?

N5. As in Question N1, the question only wants the increase in rate, not the rate itself, so you do not need to work out (or know) A . It is simplest to work out the ratio of k for the uncatalyzed and catalyzed reactions. Remember that dividing one exponential by another corresponds to taking the difference between two exponents: $\exp(A)/\exp(B) = \exp(A - B)$.