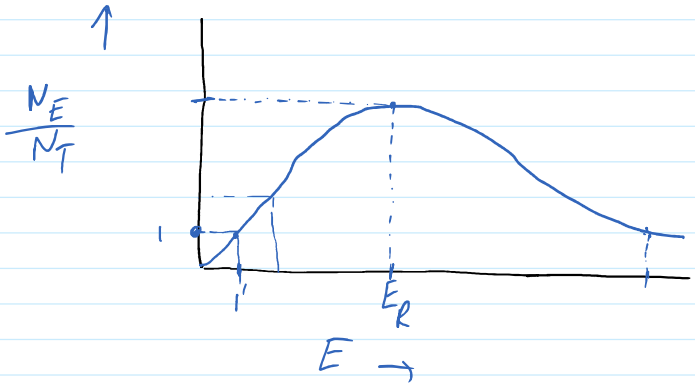
Effect of temperature on rate constant k

i) For a chemical reaction, the rate constant is nearly doubled with 10° rise in temperature.

ii) All the molecules in the reacting species do not have the same kinetic energy and it is difficult to predict the behaviour of any one molecule with precision.

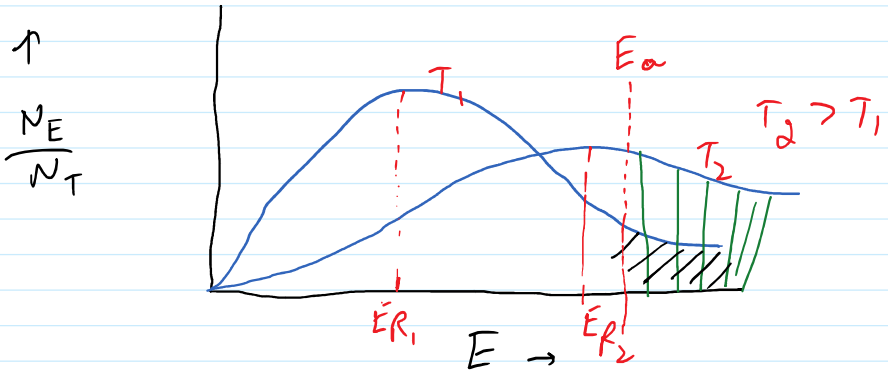
iii) Ludwig Boltzmann and James Clark Maxwell, described the distribution of kinetic energy by plotting the fraction of molecules (N_E / N_T) with a given kinetic energy (E) v/s kinetic energy (E). Here, N_E is the number of molecules with energy E and N_T is total number of molecules.



The peak of the curve corresponds to the most probable kinetic energy i.e kinetic energy of maximum fraction of molecules. There are decreasing number of molecules with energy higher or lower than this value.

iv) When the temperature is raised, the maximum of the curve moves to the higher energy value and the curve broadens out i.e. spreads to the right such that there is a greater proportion of molecules with much higher energies. Increasing the temperature of the

substance increases the fraction of molecules, which collide with energies greater than E_a.



$(T_2 = T_1 + 10)$

$e^{-E_a/RT}$

V) It is clear from the diagram that in the curve at $(t+10)$, the area showing the fraction of molecules having energy equal to or greater than activation energy gets doubled leading to doubling the rate of a reaction.