

◆ The activation energy for the reaction  $2\text{HI}_{(g)} \rightarrow \text{H}_2 + \text{I}_{2(g)}$  is  $209.5 \text{ kJ mol}^{-1}$  at  $581 \text{ K}$ . Calculate the fraction of molecules of reactants having energy equal to or greater than activation energy.

Ans:

$$E_a = 209.5 \text{ kJ mol}^{-1} = 209500 \text{ J mol}^{-1}$$

$$T = 581 \text{ K}$$

$$R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$$

The percentage of reactant molecules with energy equal to or greater than activation energy is now:

$$x = e^{E_a/RT}$$

$$\ln x = -E_a/RT$$

$$\log x = -\frac{E_a}{2.303RT}$$

$$\log x = \frac{209500 \text{ J mol}^{-1}}{2.303 \times 8.314 \times \text{J K}^{-1} \text{ mol}^{-1} \times 581} = 18.8323$$

$$x = \text{Anti log}(-18.8323) = 1.47 \times 10^{-19}$$