Marks
4

- At a certain temperature the following data were collected for the decomposition of HI.

$$2HI \rightarrow H_2 + I_2$$

Experiment	Initial [HI] (mol L^{-1})	Initial rate of reaction (mol L^{-1} s^{-1})
1	1.0×10^{-2}	4.0×10^{-6}
2	2.0×10^{-2}	1.6×10^{-5}
3	3.0×10^{-2}	3.6×10^{-5}

Determine the rate law for the reaction.

Between experiment (1) and (2), the concentration of HI is doubled. This leads to the rate increasing by a factor of 4.

Between experiment (1) and (3), the concentration of HI is trebled. This leads the to rate increasing by a factor 9.

The rate is proportional to $[HI]^2$:

rate = $k[HI]^2$

What is the value of the rate constant for the decomposition of HI?

Using experiment (1), [HI] = 1.0×10^{-2} mol L^{-1} and rate = 4.0×10^{-6} mol L^{-1} s^{-1}:

rate = $k[HI]^2$
4.0×10^{-6} mol L^{-1} s^{-1} = (k) × (1.0×10^{-2} mol $L^{-1})^2$

k = (4.0×10^{-6} mol L^{-1} s^{-1}) / (1.0×10^{-2} mol $L^{-1})^2$ = 4.0×10^{-2} mol^{-1} L s^{-1}

Answer: **4.0×10^{-2} mol^{-1} L s^{-1}**