21BDS0340

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chemistry

Digital Assignment - 1

1.

Temperature, T (K)	Rate constant, k (s^{-1})	1/T (K^{-1})	ln(k)
375	1.68×10^{-5}	0.00267	-10.99
400	3.5×10^{-5}	0.0025	-10.26
500	4.2×10^{-4}	0.0020	-7.77
600	2.11×10^{-3}	0.00167	-6.16

Slope from graph $= \dfrac{-3 - (-11.5)}{10 \times 10^{-4} - 28 \times 10^{-4}}$

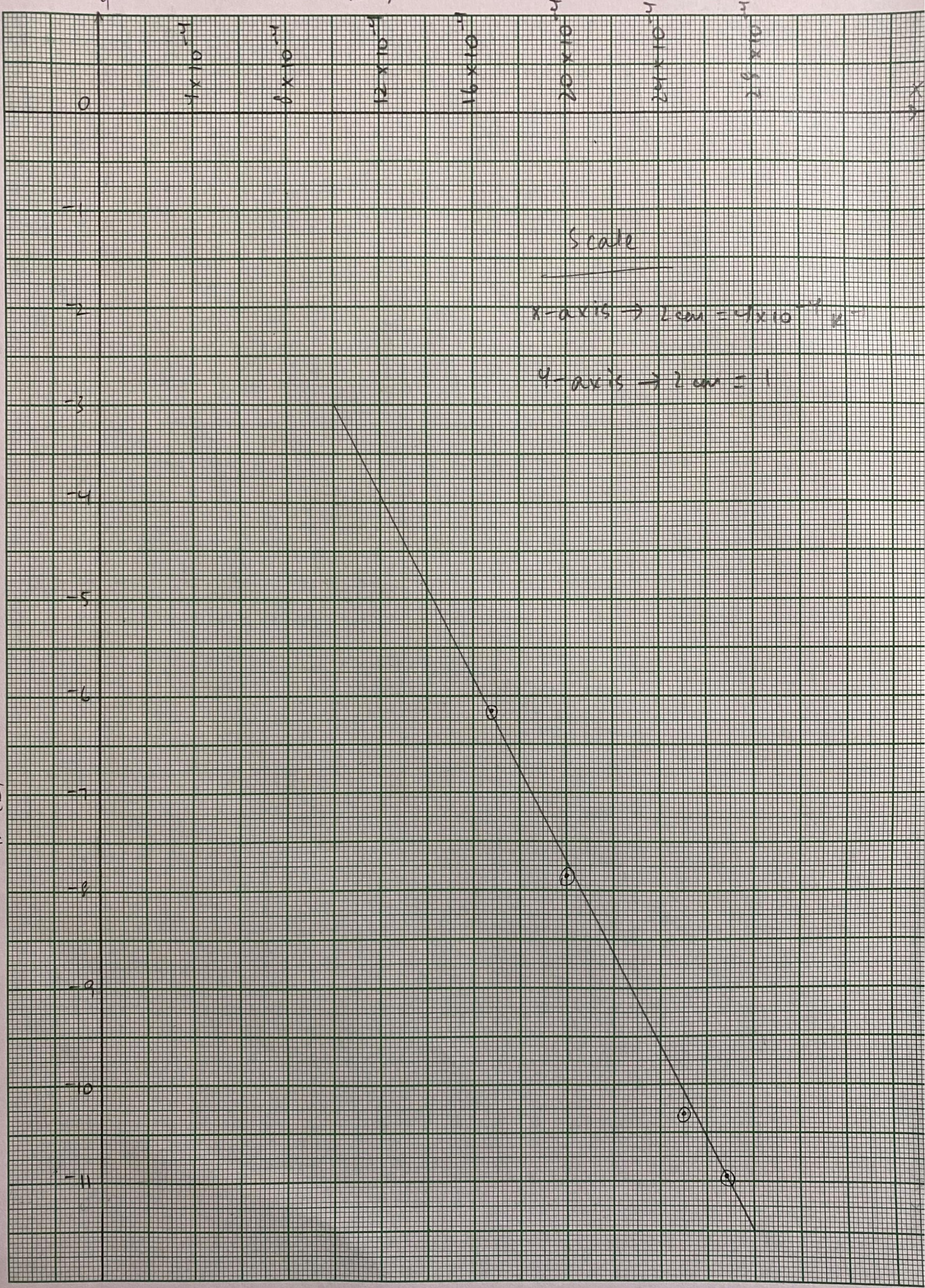
$= \dfrac{-8.5}{18 \times 10^{-4}}$

$= -4722.22$

$\text{Slope} = -\dfrac{E_a}{R}$

$\therefore E_a = 4722.22 \times R$

$= 39.3 \text{ kJ/mol}$



Scale
x-axis → 2 cm = 4×10^-4 K^-1
y-axis → 2 cm = 1
ln (k)
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
4×10^-4
8×10^-4
12×10^-4
16×10^-4
20×10^-4
24×10^-4
28×10^-4

2. Arrhenius Equation:

$$K = A e^{\left(\frac{-Ea}{RT}\right)}$$

$A \rightarrow A/10$

$Ea \rightarrow Ea/10$

$$K_1 = A e^{-Ea/RT}$$

$$K_2 = \frac{A}{10} e^{-Ea/10RT}$$

$$\Rightarrow \frac{K_1}{K_2} = 10 e^{-9Ea/RT}$$

At $T = 298\ K$

$$\Rightarrow \frac{K_1}{K_2} = 10 e^{-(Ea \times 0.0036)}$$

$$= 10 e^{-0.0036 Ea}$$

The final ratio depends on Ea

Activation energy has a higher influence in this function as $K \propto A$ but $K \propto e^{-Ea}$. Since the Ea is in the exponential, a change in that will have more influence.

3.

a. 2000 cm^{-1} to μm

$\mu m = 10000/cm^{-1}$

$\Rightarrow$ 2000 cm^{-1} = 5 μm

This is infrared radiation. This transition appears in molecular vibrations.

b. 0.15 nm to ν_2

$\nu_2 = 3 \times 10^8$/nm wavelength

$\Rightarrow$ 0.15 nm = 2×10^{18} ν_2

This is x-rays radiation. This appears in inner electron transitions.

c. 500 nm to cm^{-1}

500 nm = 20×10^3 cm^{-1}

This visible radiation. This appears in outer electron transitions.

d. 9 GHz to cm^{-1}

9 GHz = 33 mm

33 mm = 0.3 cm^{-1}

This is radio radiation. This appears in the excitement of a nucleus to a higher spin state.