

Problem 3-10

Packages:

```
• using DataFrames, CairoMakie
```

Data:

df =

	rate	temperature
1	0.002	300.0
2	0.046	320.0
3	0.72	340.0
4	8.33	360.0

```
• df = DataFrame(rate=[0.002, 0.046, 0.720, 8.33], temperature=[300., 320., 340., 360.] )
```

R = 1.987

```
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```

Reaction:



Rate law:

$$-r_A = kC_A^2C_B$$

Arrhenius equation:

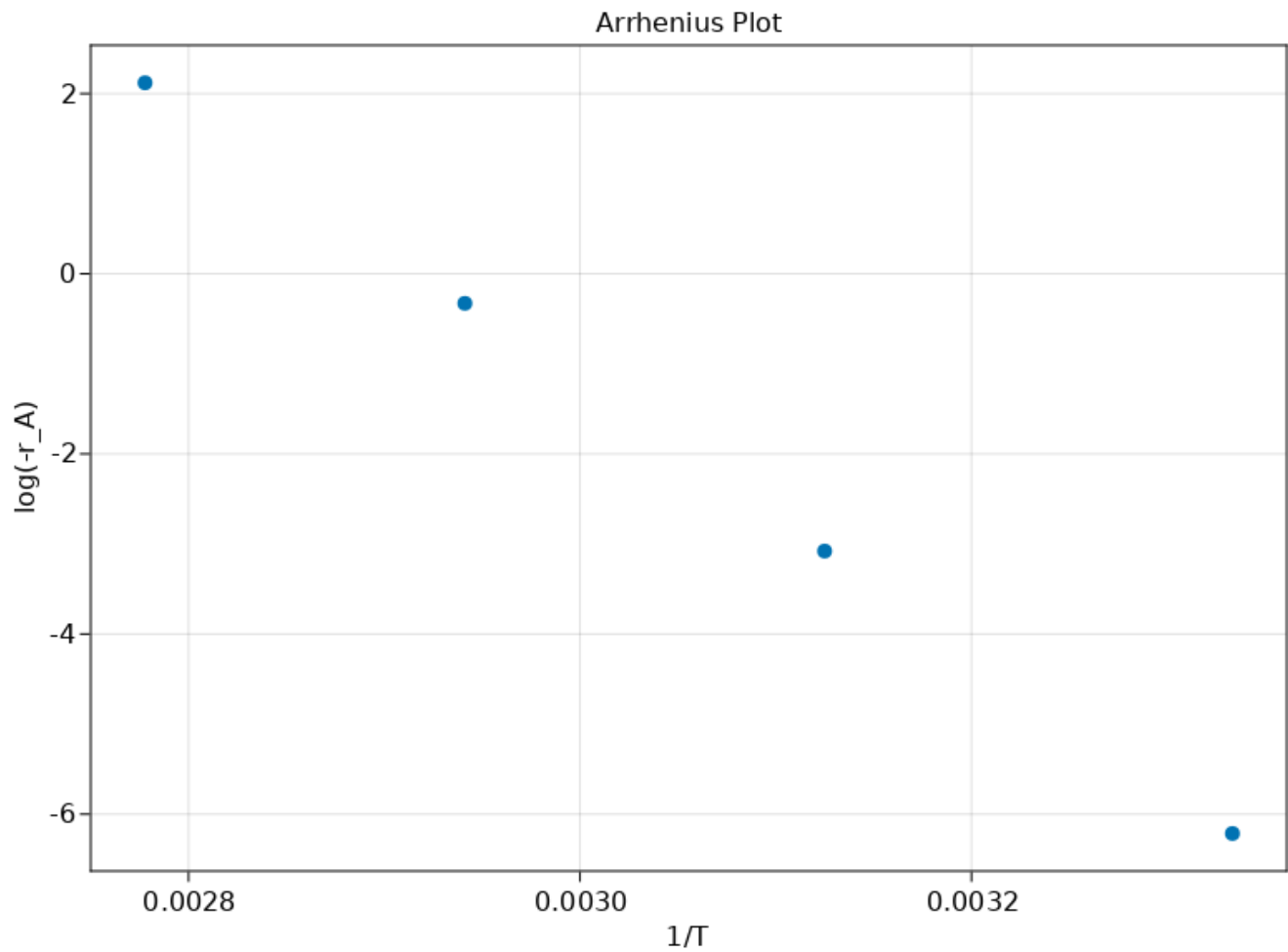
$$k = Ae^{-E_a/RT}$$

$$\ln(-r_A) = \frac{-E_a}{R} * \frac{1}{T} + \ln(6A)$$

Transform variables:

```
• begin
•   plot_x = 1 ./ df.temperature
•   plot_y = log.(df.rate)
• end;
```

Plot:



Solve linear system to get slope:

```
m = -682.4117882880058
```

```
• m = plot_x \ plot_y
```

Calculate activation energy from slope:

$$m = \frac{-E_a}{R}$$

$$E_a = 1355.9522233282676$$

- $E_a = -m * R$

Use slope and a data point to solve for intercept:

$$(0.00333333, -6.21461)$$

- $\text{plot_x}[1], \text{plot_y}[1]$

$$-6.215 = \frac{-1356}{1.987} * 0.00333 + \ln(6A)$$

$$b = \ln(6A) = 2.735$$

Calculate frequency factor from intercept:

$$A = 2.5682905726548864$$

- $A = \exp(2.735)/6$