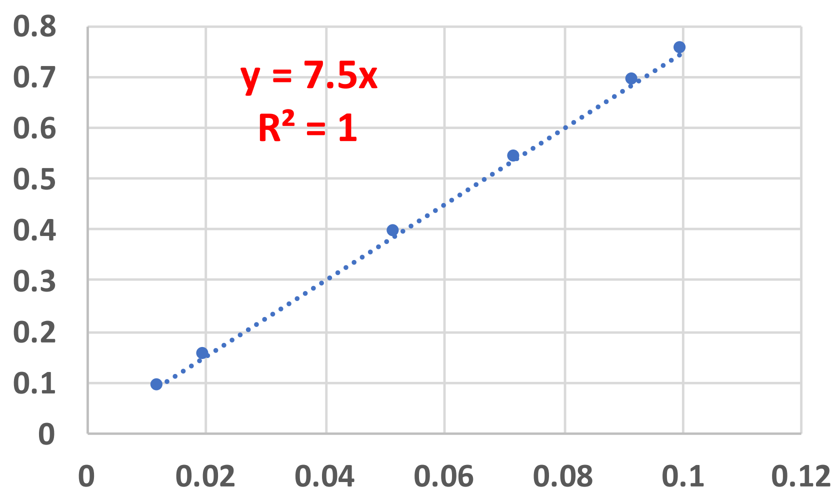
A researcher would like to know concentration of a chemical he had synthesized to determine the overall yield. However, since it is a liquid that couldn't be purified further and he knows that the impurities, if any, do not absorb UV light he is resorting to using UV-visible spectrophotometry for this purpose. Fortunately, he is able to obtain the same chemical (a liquid) from a chemical inventory with which he calibrates the instrument. For the values given below, perform a linear fit using a spreadsheet program and provide the slope, intercept and R^2 value.



c (M) = 0.012, 0.020, 0.052, 0.072, 0.092, 0.100

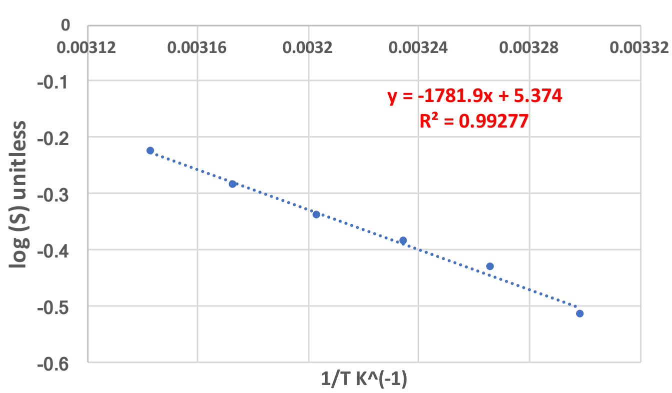
A (units) = 0.090, 0.150, 0.390, 0.540, 0.690, 0.750

Slope = 7.5 units
Intercept = 0
R^2 = 1

Determine the heat of dissolution of a fictitious weak monoprotic acid (165 g/mol) for the data provided below using a spreadsheet program. Assume that NaOH has been standardized and the concentration equal to 0.025 N. V_NaOH is the volume of standardized NaOH (mL) required for 10 mL aliquots of the weak acid at the given temperature. Concordant values, so provided only once in this example

Temp (ºC) : 30, 33, 36, 39, 42, 45
V_NaOH (mL) : 10.0, 12.1, 13.5, 15.0, 17.0, 19.5

S. No.	Temperature (T)		1/T	Volume of standardized NaOH titrated (mL)		Concentration of Benzoic Acid	Solubility of Benzoic Acid in 100g water (s)	log(s)
	(ºC)	(K)	(K^{-1})	Trial 1	Trial 2	(N)	(g)	unit less
1	30	303.15	0.003298697	10	10	0.025	0.3053	-0.5152732
2	33	306.15	0.003266373	12.1	12.1	0.03025	0.369413	-0.432487825
3	36	309.15	0.003234676	13.5	13.5	0.03375	0.412155	-0.384939427
4	39	312.15	0.003203588	15	15	0.0375	0.45795	-0.339181937
5	42	315.15	0.003173092	17	17	0.0425	0.51901	-0.284824274
6	45	318.15	0.003143171	19.5	19.5	0.04875	0.595335	-0.225238584



ΔH^o = -2.303 * 8.314 J/K/mol * slope (K) = 34.1 kJ/mol

R^2 = 0.993

From the list of provided data, determine the order of reaction and also its rate constant (units not required, round off to two decimals). Hint: all data are simulated and expected to yield R^2 of close to 1.0 to make the problem easy

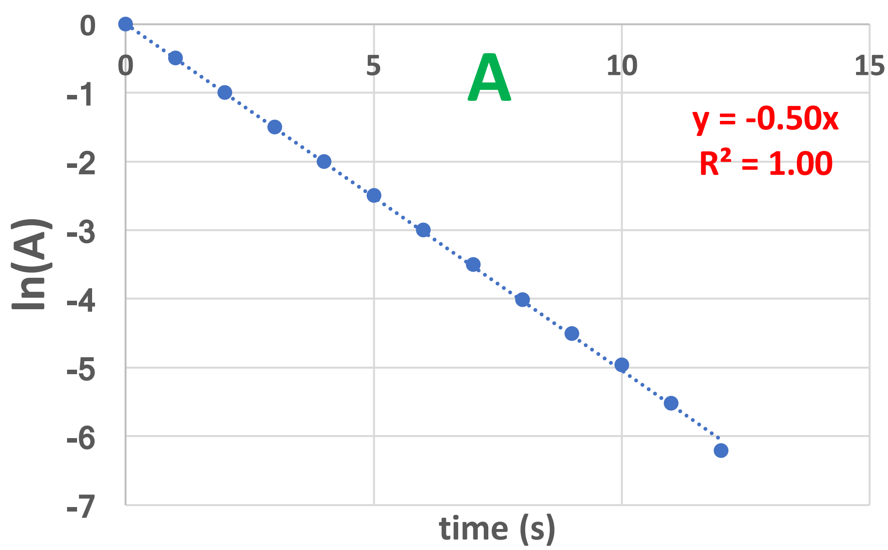
time (s) = 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15

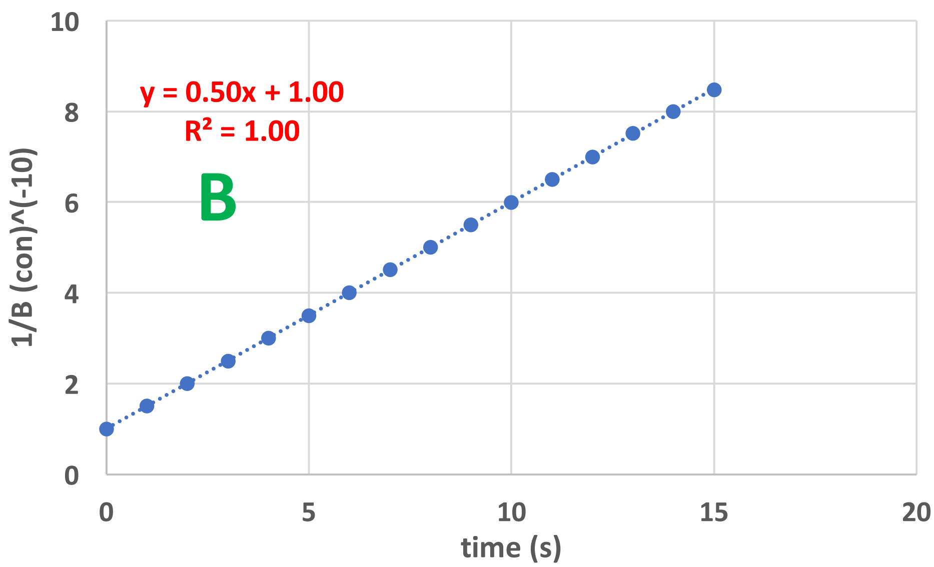
conc_A = 1.000, 0.607, 0.368, 0.223, 0.135, 0.082, 0.050, 0.030, 0.018, 0.011, 0.007, 0.004, 0.002, 0.002, 0.001, 0.001

conc_B = 1.000, 0.667, 0.500, 0.400, 0.333, 0.286, 0.250, 0.222, 0.200, 0.182, 0.167, 0.154, 0.143, 0.133, 0.125, 0.118

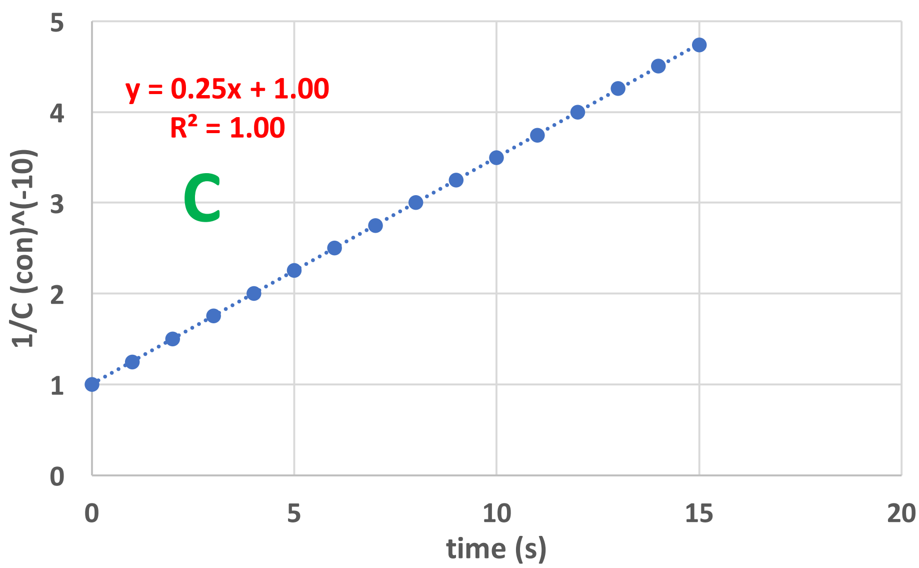
conc_C = 1.000, 0.800, 0.667, 0.571, 0.500, 0.444, 0.400, 0.364, 0.333, 0.308, 0.286, 0.267, 0.250, 0.235, 0.222, 0.211

conc_D = 1.000, 0.779, 0.607, 0.472, 0.368, 0.287, 0.223, 0.174, 0.135, 0.105, 0.082, 0.064, 0.050, 0.039, 0.030, 0.024

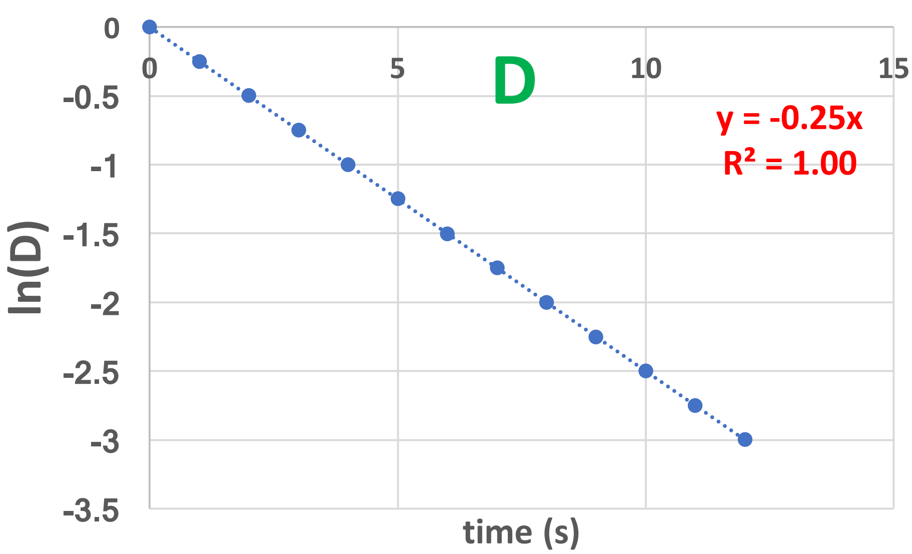




y = 0.50x + 1.00
R² = 1.00
B
1/B (con)^(-10)
time (s)
0
2
4
6
8
10
0
5
10
15
20



y = 0.25x + 1.00
R² = 1.00
C
1/C (con)^(-10)
time (s)
0
1
2
3
4
5
0
5
10
15
20



D
y = -0.25x
R² = 1.00
ln(D)
time (s)
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
0
5
10
15

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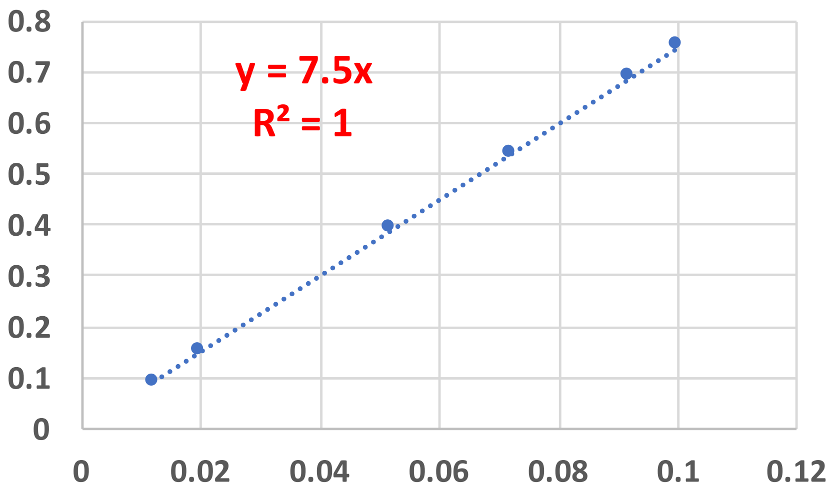

Would it be wise to use the above calibration curve for concentrations less than 0.010 M or greater than 0.150 M? Hint: this point of linearity of Lambert Beers law was discussed at length in the live session. **Upload a text/document file with your answer in not more than 150 words**.

Check the live session for answers.