CO_2 Analysis Spreadsheet

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ENGR 115

This spreadsheet analyzes CO_2 data obtained in a college dorm room and calculates a ventilation rate. This data analysis is then used to determine the air exchange rate of the dorm room.

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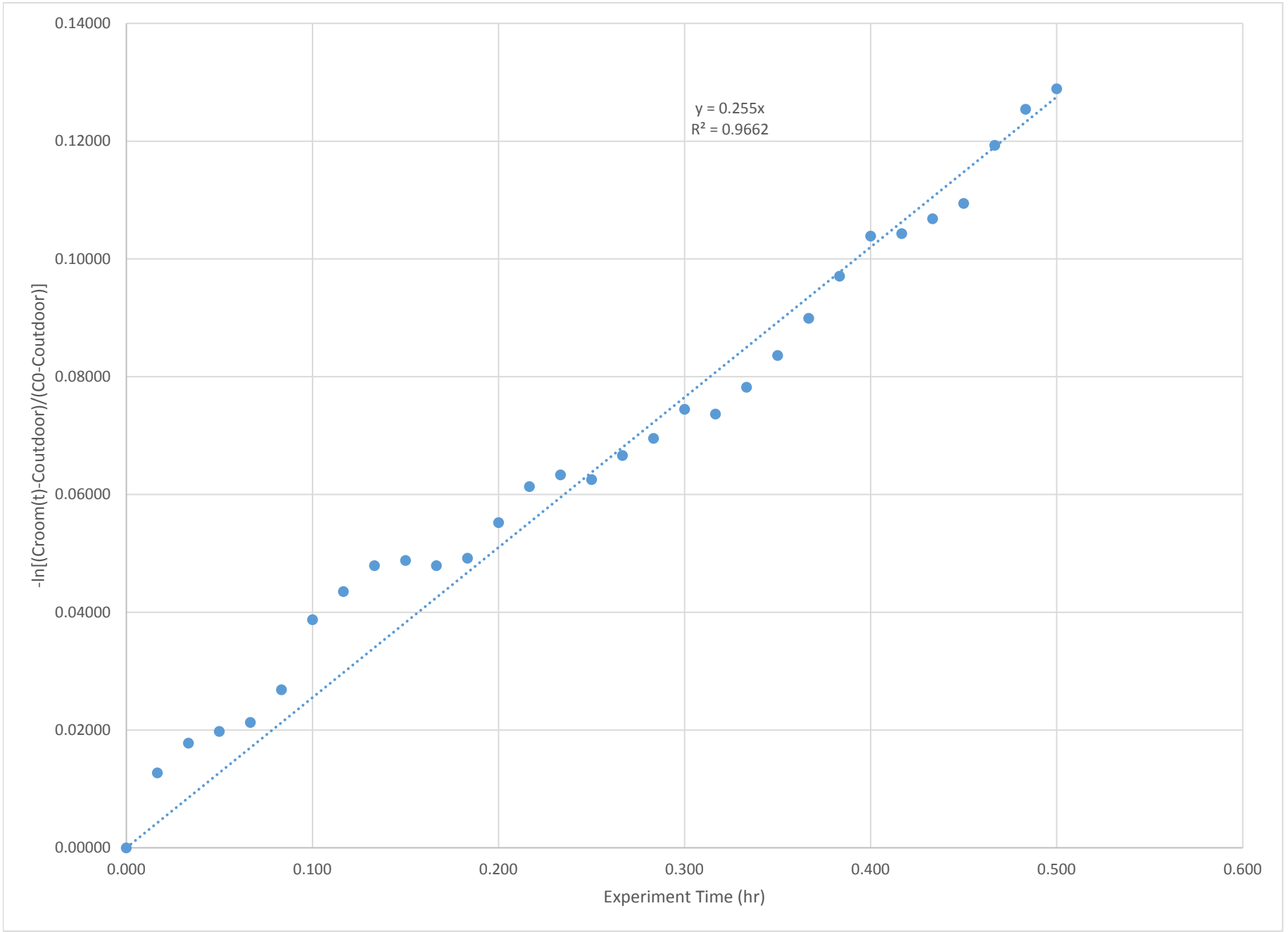
Input Parameters	
Measured $C_{outside}$ (ppm)	529
Assumed $C_{outside}$ (ppm)	400
Correction Factor (ppm)	-129
Room Volume (ft^3)	1320
Room Capacity (people)	6

Calculations	
Air Exchange Rate (1/hr)	0.2550
Time to remove non-reactive chemical (hr)	11.76
Ventilation Rate (ft^3/min/person)	0.935

Analysis

Measurement	Date and Time	HOBO CO_2 Concentration	Actual CO_2 Concentration (ppm)	Experiment Time (hr)	$-\ln[(C_{room}(t)-C_{outdoor})/(C_0-C_{outdoor})]$
0	10/21/2016 3:28 PM	2119	1990	0.000	0.00000
1	10/21/2016 3:29 PM	2098.9	1969.9	0.017	0.01272
2	10/21/2016 3:30 PM	2091	1962	0.033	0.01777
3	10/21/2016 3:31 PM	2087.9	1958.9	0.050	0.01975
4	10/21/2016 3:32 PM	2085.5	1956.5	0.067	0.02129
5	10/21/2016 3:33 PM	2076.9	1947.9	0.083	0.02683
6	10/21/2016 3:34 PM	2058.6	1929.6	0.100	0.03873
7	10/21/2016 3:35 PM	2051.3	1922.3	0.117	0.04351
8	10/21/2016 3:36 PM	2044.6	1915.6	0.133	0.04792
9	10/21/2016 3:37 PM	2043.3	1914.3	0.150	0.04878
10	10/21/2016 3:38 PM	2044.6	1915.6	0.167	0.04792
11	10/21/2016 3:39 PM	2042.7	1913.7	0.183	0.04918
12	10/21/2016 3:40 PM	2033.6	1904.6	0.200	0.05521
13	10/21/2016 3:41 PM	2024.4	1895.4	0.217	0.06134
14	10/21/2016 3:42 PM	2021.4	1892.4	0.233	0.06335
15	10/21/2016 3:43 PM	2022.6	1893.6	0.250	0.06254
16	10/21/2016 3:44 PM	2016.5	1887.5	0.267	0.06664
17	10/21/2016 3:45 PM	2012.2	1883.2	0.283	0.06953
18	10/21/2016 3:46 PM	2004.9	1875.9	0.300	0.07447
19	10/21/2016 3:47 PM	2006.1	1877.1	0.317	0.07365
20	10/21/2016 3:48 PM	1999.4	1870.4	0.333	0.07820
21	10/21/2016 3:49 PM	1991.5	1862.5	0.350	0.08359
22	10/21/2016 3:50 PM	1982.3	1853.3	0.367	0.08990
23	10/21/2016 3:51 PM	1971.9	1842.9	0.383	0.09708
24	10/21/2016 3:52 PM	1962.1	1833.1	0.400	0.10389
25	10/21/2016 3:53 PM	1961.5	1832.5	0.417	0.10431
26	10/21/2016 3:54 PM	1957.9	1828.9	0.433	0.10683
27	10/21/2016 3:55 PM	1954.2	1825.2	0.450	0.10942
28	10/21/2016 3:56 PM	1940.2	1811.2	0.467	0.11929
29	10/21/2016 3:57 PM	1931.6	1802.6	0.483	0.12541
30	10/21/2016 3:58 PM	1926.7	1797.7	0.500	0.12891


y = 0.255x
R² = 0.9662
-ln[(Croom(t)-Coutdoor)/(C0-Coutdoor)]
Experiment Time (hr)
0.14000
0.12000
0.10000
0.08000
0.06000
0.04000
0.02000
0.00000
0.000
0.100
0.200
0.300
0.400
0.500
0.600

1.What is the air exchange rate (λ) of the room you tested? Be sure to include the units for the air exchange rate in your answer.
The air exchange rate (λ) of the room we tested is 0.255/hr.

2.In general it takes 3/λ hours to remove a non-reactive chemical from indoor air. Based on this time, what recommendations would you make to the occupants of the room?
According to my calculations, it would take approximately 12 hours to remove a non-reactive chemical from the indoor air of the room. Based on this time, I would recommend that the occupants of the room increase the amount of ventilation. This increase in ventilation can come from opening windows, doors, and anything that would allow air to flow through the room, instead of having all doors and windows closed. In addition, I would recommend that the occupants leave the room in order to give the chemical in the air time to ventilate out.

3.Compare your ventilation rate for a typical number of occupants to the ASHRAE recommended ventilation rate. Based on this comparison, are the occupants wasting energy heating and cooling the air or are the occupants being too cheap and not supplying enough air? Justify your answer.
Based on the comparison of ventilation rates, I believe that the occupants are being too cheap and not supplying enough air. Compared to the ASHRAE recommended ventilation rate of 15 scfm, my ventilation rate of approximately 1 cfm was far below the minimum ASHRAE standard; thus, the occupants should definitely be supplying more air into the room than they currently are in order to meet the ASHRAE standard.

4.Given the ASHRAE standard ventilation standard, what is the maximum number of people you would recommend having in this room at one time? Use your model to determine this number.
Given the ASHRAE ventilation standard and my model, I would recommend the maximum number of people present in this room at one time to be approximatley 1/3 of a person (0.374). This number indicates that an increase of ventilation in the room is definitley needed if the occupants want to limit/decrease their exposure time to non-reactive chemicals from the indoor air.