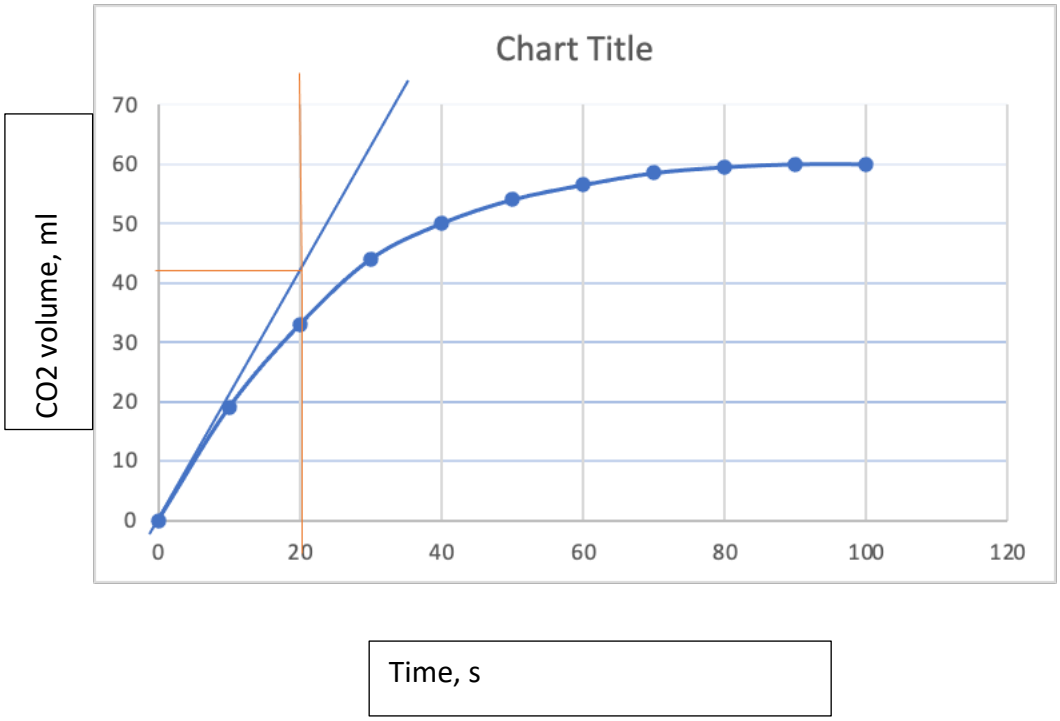
HW9

Time, s	Volume, ml
0	0
10	19
20	33
30	44
40	50
50	54
60	56.5
70	58.5
80	59.5
90	60
100	60

Let's consider the following reaction:

$CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + H_2O$

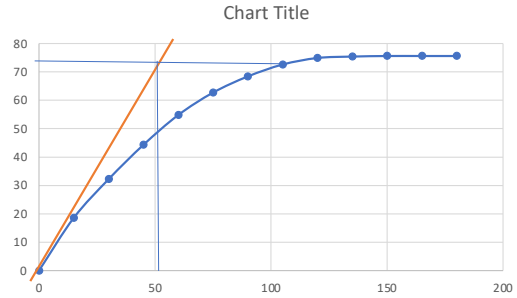
We measure the rate at which CO_2 is produced. On the left is the data points, below the graph. The reaction appears to finish at 90s. The average rate of the reaction can be calculated like that: Average rate = change in volume/time= 60/90=0.67 ml/s



To calculate the initial rate of the reaction we draw the tangent line (slope that touches our curve at 0 point), and then draw the lines to axes X and Y that intersect on the slope. The rate at point zero (initial rate) = 42/20 = 2.1 ml/s. So initially, the gas was produced at a rate of 2.1 ml per sec. The rate of reaction at any time can be found by drawing a slope at the particular time.

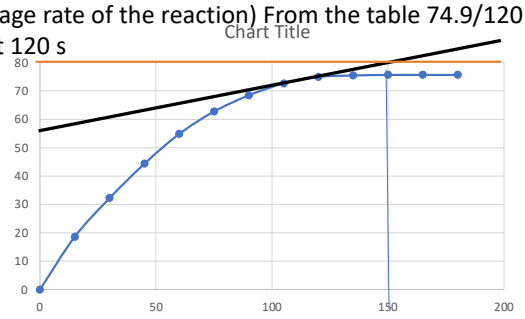
For the production of hydrogen gas (reaction: Mg +2HCl → MgCl2 +H2) we performed the following calculations:

Time,s	Volume, cm^3
0	0
15	18.6
30	32.2
45	44.3
60	54.8
75	62.7
90	68.4
105	72.6
120	74.9
135	75.4
150	75.6
165	75.6
180	75.6



Initial rate, from the graph 75/55= 1.36 cm^3/s
From the table **Δ** concentration/ **Δ**time 18.6/15=1.24 average rate from 0 to 15 s

Rate at 120 sec (average rate of the reaction) From the table 74.9/120 = 0.62
Instantaneous rate at 120 s
(80-57)/150 = 0.15



Questions:
Look at the data and graph for CO2 production.
Calculate the instantaneous rates at 20 s and 60 s.
Calculate the average rates of the reaction on the following time intervals: a) from 10 to 20 s, b) from 70 to 80 s.