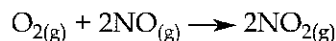


Appendix 3.2A: Chemical Kinetics: Assignment 1

A chemist is studying the formation of nitrogen dioxide from nitrogen monoxide and oxygen gas. The balanced equation for the reaction is:



The chemist measured the concentration of the three gases at various time intervals and recorded the data in the table below.

Change in Concentration of Reactants and Products Over Time			
Time (min)	Concentration (mol/L)		
	[O ₂]	[NO]	[NO ₂]
0	0.000343	0.000514	0
2	0.000317	0.000461	0.000053
4	0.000289	0.000406	0.000108
6	0.000271	0.000368	0.000146
10	0.000242	0.000311	0.000204
16	0.000216	0.000259	0.000256
26	0.000189	0.000206	0.000308
41	0.000167	0.000162	0.000353
51	0.000158	0.000143	0.000372
61	0.000150	0.000127	0.000387
71	0.000144	0.000116	0.000399

Questions

- Construct a graph to represent the data provided in the table above. Plot gas concentration along the y -axis and time on the x -axis.

Average rates over a period of time can be calculated by connecting two points on your curve with a straight line and determining the slope.

Instantaneous rates are determined by drawing a tangent line to the curve at the point of interest and determining the slope of the tangent line.

Appendix 3.2A: Chemical Kinetics: Assignment 1 (continued)

2. What is the average rate of reaction for nitrogen oxide and oxygen and the formation of nitrogen dioxide over the entire 71-minute interval? Determine the rate for each.
3. What is the average rate of the consumption of NO and O₂ and the production of NO₂ over the first 10 minutes and over the last 10 minutes?
4. Find the instantaneous rate of consumption of O₂ and NO and the instantaneous rate of formation of NO₂ at 4 minutes and at 41 minutes into the experiment. Show your work on the graph. Explain why the rate changes.
5. What do you notice about the ratios of the rates of oxygen and nitrogen monoxide consumption to the production of nitrogen dioxide?