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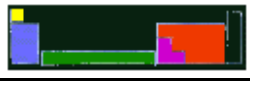
HONORS WORKSHEET 13a: Orders of reaction & rate constants



1. The following data were collected for the reaction below.

$$H_{2(g)} + Br_{2(g)} \rightarrow 2HBr_{(g)}$$

Experiment	[H_2]	[Br_2]	Rate in M s^{-1}
1	0.25 M	0.0012 M	1.20×10^{-4}
2	0.50 M	0.0012 M	4.80×10^{-4}
3	0.50 M	0.0048 M	4.80×10^{-4}

(a) Write the rate equation and calculate the value of the rate constant, k and include units. (6)

(b) What is the overall order of this reaction? (1)

2. Nitrogen monoxide can be oxidized to nitrogen dioxide in the reaction below.

$$2NO_{(g)} + O_{2(g)} \rightarrow 2NO_{2(g)}$$

The following data were collected in a kinetics experiment.

Experiment	Initial [O_2] (M)	Initial [NO] (M)	Rate (M s^{-1})
1	0.20	0.10	1.0
2	0.80	0.10	4.0
3	0.80	0.30	36

(a) Write the rate law. (4)

(b) Calculate the rate constant and give its units. (2)

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3. In each of the following cases where the rate law and units used are described, suggest units for the rate constant, k.(6)

   (a) A third order reaction overall, where the rate is measured in mol L^{-1} s^{-1} and the concentrations of all reactants are measured in units of mol L^{-1}.

   (b) A rate law that has the concentration of two reactants measured in M, each first order and a rate that is measured in mol L^{-1} min^{-1}

   (c) A reaction where there are multiple products but only a single reactant that is found to be zero order. The rate is measured in units of g s^{-1}

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4. Describe how the orders with respect to two different reactants might be determined in a simple experiment where a gas is produced as a result of mixing two solutions together. Carefully describe the measurements that should be recorded and suggest a method of measuring the rate of the reaction. (4)