Wkst 5a

① a) Rate = $k[H_2]^2[Br_2]^0$

Rate = $k[H_2]^2$

expt 1: $1.20 \cdot 10^{-4} \frac{M}{s} = k(.25M)^2$

$k = .0019 \frac{1}{M \cdot s}$

b) overall order = 2nd (2 + 0)

② a) Rate = $k[O_2]^1[NO]^2$

b) expt 1: $1.0 \frac{M}{s} = k(.20M)(.10M)^2$

$k = 5.0 \cdot 10^2 \frac{1}{M^2 \cdot s}$

③ a) Rate = $k[A]^3$

$\frac{M}{s} = \_ \, M^3$

units for k: $\frac{1}{M^2 \cdot s}$ OR $M^{-2} s^{-1}$

b) Rate = $k[A][B]$

$\frac{mol}{L \cdot min} = \_ \cdot M \cdot M$

$\frac{M}{min}$

units for k: $\frac{1}{M \cdot min}$ OR $M^{-1} min^{-1}$

c) Rate = $k[A]^0$

$\frac{g}{s} = \frac{g}{s} \cdot 1$

units for k: $\frac{g}{s}$ or $g \cdot s^{-1}$

④ Mix the reactants w/ known concentrations. Measure the amount of gas released per unit time (like s or min).

Repeat the experiment but change the concentration of 1 reactant. Leave the other reactant concentration the same.

Repeat again, this time leaving the concentration of the first reactant the same as the original experiment but changing the concentration of the second reactant.

Compare the concentrations of the reactants and the rate to determine Reaction order.

AP Question (4 pts)

a) i) NO – Reaction is 2nd order. If you compare expts 1 & 3, the concentration of O_2 is constant while [NO] increases by a factor of 3. The Rate increases by a factor of 9, or 3^2

1 pt w/ justification

ii) O_2 – 1st order. In Expts 1 & 2, [NO] is constant while $[O_2]$ increases by factor of 3. Rate increases by factor of 3.

1 pt w/ justification.

b) Rate = $k[NO]^2[O_2]$

1 pt

c) in the equation, the product is $2NO_2$.

the initial rate of NO_2 formation in expt 1 = $4.26 \cdot 10^{-2} \frac{M}{s}$.

Because of stoichiometry, the initial rate of the reaction is $\frac{1}{2} \cdot 4.26 \cdot 10^{-2} \frac{M}{s}$, OR $2.13 \cdot 10^{-2} \frac{M}{s}$

Rate = $k[NO]^2[O_2]$

$2.13 \cdot 10^{-2} \frac{M}{s} = k(.0100M)^2(.0150M)$ 1 pt – value of k

$k = 1.42 \cdot 10^4 \ M^{-2} s^{-1}$ 1 pt – units