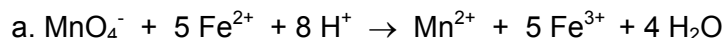## Appendix 4: Chemical Kinetics Problems (BLM)

1. State 3 examples of properties, directly related to reactants or products, that could be used to measure a reaction rate. (van Kessel 365)

2. What property would be appropriate to measure rate in each of the following reactions?

   a. $MnO_4^- + 5 Fe^{2+} + 8 H^+ \rightarrow Mn^{2+} + 5 Fe^{3+} + 4 H_2O$

   b. $Zn + H_2SO_4 \rightarrow H_2 + ZnSO_4$ (van Kessel 365)

3. What units are used to express reaction rate?

4. In the reaction $3 H_2 + N_2 \rightarrow 2 NH_3$, how does the rate of disappearance of hydrogen compare to the rate of disappearance of nitrogen?
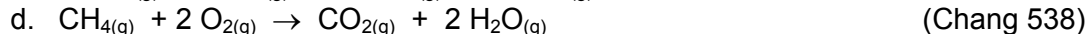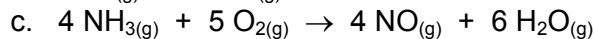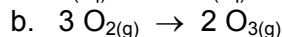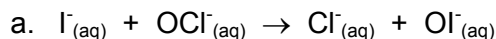   How does the rate of production of NH_3 compare to the rate of disappearance of nitrogen?

5. For the reaction $2 A + B \rightarrow 3 C$, it was found that the rate of consumption of B was 0.30 mol / L·s. What was the rate of consumption of A and the rate of formation of C?

6. At a certain temperature, the rate of consumption of N_2O_5 is 2.5×10^{-6} mol / L·s. How fast are NO_2 and O_2 being formed? $2 N_2O_5 \rightarrow 4 NO_2 + O_2$

7. Write the rate expressions for the following reactions in terms of the disappearance of the reactants
   and the appearance of the products:

   a. $I^-_{(aq)} + OCl^-_{(aq)} \rightarrow Cl^-_{(aq)} + OI^-_{(aq)}$
   b. $3 O_{2(g)} \rightarrow 2 O_{3(g)}$
   c. $4 NH_{3(g)} + 5 O_{2(g)} \rightarrow 4 NO_{(g)} + 6 H_2O_{(g)}$
   d. $CH_{4(g)} + 2 O_{2(g)} \rightarrow CO_{2(g)} + 2 H_2O_{(g)}$ (Chang 538)

8. In a combustion reaction, 8.0 mol of methane gas reacts completely in a 2.00 L container containing excess oxygen gas in 3.2 s.

$$CH_{4(g)} + 2 O_{2(g)} \rightarrow CO_{2(g)} + 2 H_2O_{(g)}$$
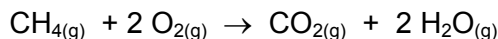
   a. Calculate the averate rate of consumption of methane gas in mol / L·s.
   b. Calculate the averate rate of consumption of oxygen gas in mol / L·s.
   c. Calculate the averate rate of production of carbon dioxide gas in mol / L·s.
   d. Calculate the averate rate of production of water vapour in mol / L·s. (van Kessel 366)

9. Hydrogen iodide and oxygen react to form iodine gas and water vapour. If oxygen gas reacts at a rate of 0.0042 mol / L·s,

   $$4 HI_{(g)} + O_{2\ (g)} \rightarrow 2 I_{2(g)} + 2 H_2O_{(g)}$$
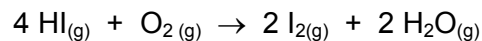
   a. what is the rate of formation of iodine gas in mol / L·s?
   b. what is the rate of formation of water vapour in mol / L·s?
   c. what is the rate of consumption of hydrogen iodide gas in mol / L·s?

10. Consider the reaction, $4 NO_{2(g)} + O_{2\ (g)} \rightarrow 2 N_2O_{5(g)}$. Suppose that at a particular moment during the reaction, oxygen is reacting at the rate of 0.024 mol / L·s. Calculate the rate at which N_2O_5 is being formed and calculate the rate at which NO_2 is being consumed.   (Chang 538)