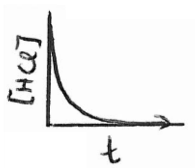
Unit Homework – Reaction Kinetics – Solutions

Measuring Reaction Rates

1. Zinc and hydrochloric acid
    a. Rate = -0.0005 g/s
    b. Rate = -7.65×10^{-6} mol/s
    c. Concentration will decrease
    d. Nothing – it is a spectator ion (concentration will remain constant)
2. HCl is a reactant, so it will decrease quickly at first, then more slowly until it reaches zero



3. Pentane…
    a. $C_5H_{12} + 8\ O_2 \rightarrow 5\ CO_2 + 6\ H_2O$
    b. Rate = 0.0299 mol/s
    c. Rate = 0.24 mol/s
4. Zinc and nitric acid
    a. Rate = -0.11 g/s
    b. Rate = -0.05 g/s
    c. As the reaction proceeds, the rate will decrease (fewer reactant molecules)
5. Nitrogen and hydrogen
    a. Rate = 0.09 mol/L·s
    b. Rate = 0.06 mol/L·s
6. Graph
    a. Rate = -0.05 mol/L·s
    b. Rate = -0.0144 mol/L·s

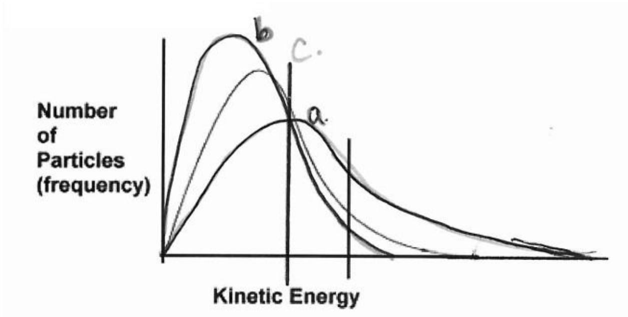
Collision Theory and Energy Diagrams

7. See notes
8. Energy diagram
    a. Endothermic
    b. ΔH = -100 kJ
    c. E_A = 50 kJ

Factors Affecting Reaction Rates

9. Hydrochloric acid and zinc
    a. 6M, because there is a higher number of reactant molecules, so they will collide more frequently
    b. The 6M reaction will probably take longer because it will take more time for the reactants to run out
10. The molecules will be moving faster, so there will be more collisions (increase rate) and more molecules will have enough energy to react (increase rate)
11. Compare energy curves
    a. B, since more molecules have enough energy to react (right of the E_A line)
    b. A, since B is already reacting quickly, and increased temperature for A will move a lot of particles past the E_A line

12.



13. Inhibitors
    a. Lower temperature, less surface area (e.g. solid instead of solution), lower concentration
    b. If products are undesirable (like rust or rot)
14. Room filled with hydrogen
    a. High E_A, temperature is too low
    b. Increase temperature, add a catalyst
15. A_2 (g) + C_2 (g) → 2AC (g), intermediate are A, B, AB, ABC
16. Hydrogen peroxide
    a. $H^+ + H_2O_2 + I^- \rightarrow H_2O + HOI$
    b. I^-, because it is a reactant in the slow step
17. Phosgene
    a. $CO + Cl_2 \rightarrow COCl_2$
    b. COCl, Cl
    c. Cl (reactant in step 1, product in step 2)
18. Energy diagram
    a. ΔH = -20kJ
    b. ΔH_1 = 20 kJ, ΔH_2 = -40 kJ
    c. E_{A1} = 80 kJ
    d. E_{A2} = 40 kJ
    e. Step 1, has a higher E_A
    f. Exothermic
19. HCOOH
    a. High E_A
    b. H^+, $HCOOH_2^+$, HCO^+
    c. H^+
    d. No, since this step is already fast – it would be better to speed up step 2
    e. Step 2