

Unit 6/7 Kinetics, Equilibrium, Solutions, & Acids-Bases Review

Key

Kinetics & Equilibrium

(1) Reactants must have (1) enough energy & the (2) correct orientation in order to react

(2) Energy needed for reactants to react and become products

(3) (1) Nature of reactants - gases tend to react faster than liquids, which react faster than solids.

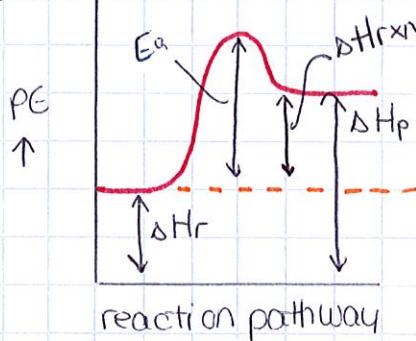
(2) Increase temperature - particles move faster and have more energy to react

(3) Increase surface area - more reactant is exposed so it reacts faster

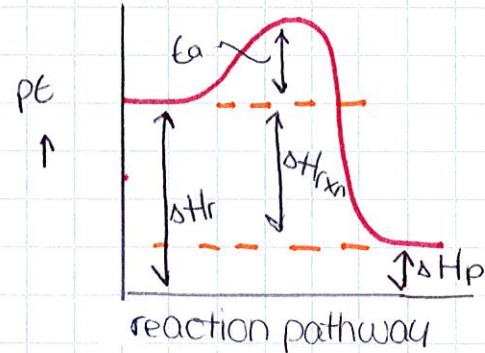
(4) Increase concentration - there are more reactants available to react

(5) Add a catalyst - lowers activation energy

(4) endothermic



Exothermic



$$(5) (A) K_{eq} = \frac{[CO_2]^2}{[CO]^2 [O_2]}$$

$$(B) K_{eq} = [O_2]^3$$

$$(C) K_{eq} = \frac{[NH_3]^2}{[N_2][H_2]^3}$$

$$(D) K_{eq} = \frac{[N_2]^2 [H_2O]^6}{[NH_3]^4 [O_2]^3}$$

$$(6) (A) K_{eq} = \frac{[CO_2]^2}{[CO]^2 [O_2]} = \frac{[2.610M]^2}{[1.456M]^2 [1.231M]} = 7.75 \text{ L/M}$$

$$(B) K_{eq} = \frac{[NH_3]^2}{[N_2][H_2]^3} = \frac{[2.10M]^2}{[1.20M][1.20M]^3} = 2.13 \text{ L/M}_2$$

$$(4) \text{ (C)} K_{\text{eq}} = \frac{[\text{N}_2\text{J}^2][\text{H}_2\text{O}]^6}{[\text{NH}_3]^4 [\text{O}_2\text{J}^3]} = \frac{[3.00\text{M}]^2 [2.00\text{M}]^6}{[1.00\text{M}]^4 [2.00\text{M}]^3} = 72.0 \text{ M}$$

- (7) (A) i Right iv Right
 ii Left v Right
 iii Left vi No shift

- (B) i Left iv Right
 ii Right v No shift
 iii Left vi No shift

Solutions :

- (1) (A) substance getting dissolved
 (B) substance doing the dissolving
 (C) maximum amount of solute has been dissolved in a specific amount of solvent at a specific temperature
 (D) less than the maximum amount of solute has been dissolved
 (E) more than the maximum amount of solute has been dissolved
 (F) a lot of solute is dissolved in solution
 (G) a little solute is dissolved in solution
 (H) properties dependent only on the # of solute particles dissolved in solution
 (I) Adding a solute to a pure solvent will lower the freezing point because the solute interferes w/ formation of the solid. Therefore the temperature must be even colder to freeze.
 (J) Adding a solute to a pure solvent will increase the boiling point because solute and solvent particles attract each other. Therefore, the temperature that will let solvent particles escape as a gas
- (2) (A) Agitation (stirring) - brings solute & solvent particles together more often
 (B) Surface area - increasing surface area means more solute touches solvent
 (C) Temperature - for a gas, lowering the temperature means the gas will stay dissolved in solution. For liquids & solids, raising the temperature increases the speed of particles so they interact more.

- (3) (A) $\sim 30 \text{ g KClO}_3$
 (B) $\sim (54 \text{ g NaCl}) \times 5 = \sim 270 \text{ g NaCl}$
 (C) saturated solution of NaNO_3 is more concentrated

(4) Yes. Dilute means only a small amount of solute has dissolved and saturated means the maximum amount of solute has dissolved.

$$(5) (A) n = 130.0 \text{ g Cu(NO}_3)_2 \left(\frac{1 \text{ mol}}{187.554 \text{ g}} \right) = .693 \text{ mol}$$

$$M = \frac{n}{V}$$

$$V = 2.32 \text{ L}$$

$$M = \frac{.693 \text{ mol}}{2.32 \text{ L}} = .299 \text{ mol/L}$$



$$(B) n = M \cdot V = (.75 \text{ mol/L})(.75 \text{ L}) = .56 \text{ mol}$$

$$(C) n = M \cdot V = (1.11 \text{ mol/L})(.10 \text{ L}) = .112 \text{ mol} \text{ MgSO}_4 \left(\frac{120.36 \text{ g}}{1 \text{ mol}} \right) = 13.5 \text{ g}$$

$$10 \text{ mL} = .01 \text{ L}$$

$$(6) (A) n = 25.0 \text{ g Na}_2\text{S} \left(\frac{1 \text{ mol}}{78.039 \text{ g}} \right) = .320 \text{ mol}$$

$$m = \frac{n}{kg}$$

$$\text{kg} = 1.45 \text{ kg}$$

$$m = \frac{.320 \text{ mol}}{1.45 \text{ kg}} = .221 \text{ mol/kg}$$



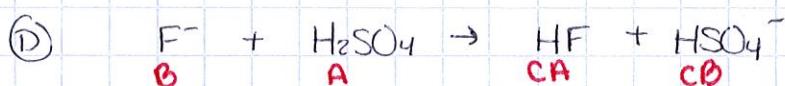
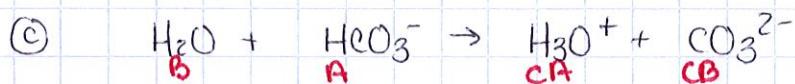
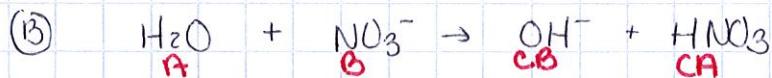
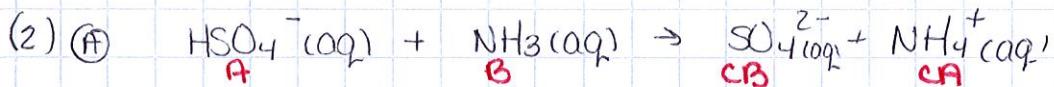
$$(B) n = m \cdot kg = (.88 \text{ mol/kg})(1.5 \text{ kg}) = 1.32 \text{ mol}$$

$$\text{kg} = 1500 \text{ g} = 1.5 \text{ kg}$$

$$(C) n = (1.25 \text{ mol/kg})(1.22 \text{ kg}) = 1.53 \text{ mol CO}_2 \left(\frac{44.009 \text{ g}}{1 \text{ mol}} \right) = 67.3 \text{ g}$$

Acids / Bases

- (1) (A) release H^+ ions in solution
 (B) release OH^- ions in solution
 (C) donate H^+ ions
 (D) accept H^+ ions
 (E) the substance the base becomes after accepting H^+
 (F) what remains after the acid donates H^+
 (G) can act as both an acid and a base



- (3) (A) breaks apart (ionizes) 100% in solution

- (B) less than 10% ionizes in solution

- (C) HBr, HI, HCl, HNO₃, HClO₃, HClO₄, & H₂SO₄

- (D) LiOH, NaOH, KOH, RbOH, CsOH, Ca(OH)₂, Ba(OH)₂, Sr(OH)₂

(5) You only have to do a, b, & c & d

(A) $pOH = 5.45$ $pH + pOH = 14.0$
 $pH + 5.45 = 14.0$

$pH = 8.55$

(B) $[H^+] = 6.56 \times 10^{-7} M$ $pH = -\log [H^+] = -\log 6.56 \times 10^{-7} = 6.18$

(C) $[OH^-] = 7.67 \times 10^{-11} M$ $pOH = -\log [OH^-] = -\log 7.67 \times 10^{-11} = 10.1$

(D) $[OH^-] = 8.78 \times 10^{-6} M$ $pOH = -\log 8.78 \times 10^{-6} = 5.06$
 $pH + pOH = 14.0$
 $pH + 5.06 = 14.0$
 $pH = 8.9$

(E) $[H^+] = 10^{-pH} = 10^{-2.32} = 4.79 \times 10^{-3} M$

(F) $[H^+] [OH^-] = 1.0 \times 10^{-14}$

$[9.89 \times 10^{-4} M] [OH^-] = 1.0 \times 10^{-14}$

$[OH^-] = 1.01 \times 10^{-11} M$

(G) $pH = 14.0 - 3.43 = 10.57$ $[H^+] = 10^{-pH} = 10^{-10.57} = 2.7$