

# Fall 2014 H. Chemistry Final Exam Review Answer Key

## PART TWO

### 27) Atomic Structure

<u>Element</u>	<u>atomic #</u>	<u>mass #</u>	<u># protons</u>	<u># electrons</u>	<u># neutrons</u>
sulfur	16	32	16	16	16
cadmium	48	112	48	48	64
tantalum	73	181	73	73	108
einsteinium	99	252	99	99	153

### 28) Electron Configurations

- a) Ti - (22e<sup>-</sup>)  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^2$  or  $[Ar] 4s^2 3d^2$   
 b) Ni - (28e<sup>-</sup>)  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^8$  or  $[Ar] 4s^2 3d^8$   
 c) Br - (35e<sup>-</sup>)  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5$  or  $[Ar] 4s^2 3d^{10} 4p^5$   
 d) Sr - (38e<sup>-</sup>)  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2$  or  $[Kr] 5s^2$

### 29) Bonds

- a)  $CO_2$  - covalent bonds ( $C \neq O$  are both nonmetals, so ions cannot form)
- b)  $FeF_2$  - ionic bonds ( $Fe$  is a metal &  $F$  is a nonmetal, so ions can form)
- c)  $NH_3$  - covalent bonds
- d)  $CaBr_2$  - ionic bonds
- e)  $MgSO_4$  - both types - the bond between  $Mg$  &  $S$  is ionic and the bonds between  $S$  &  $O$  are covalent.
- f)  $KC_2H_3O_2$  - both types - the bond between  $K$  &  $C$  is ionic and the bonds between  $C$  &  $H$  and  $C$  &  $O$  are covalent.

Periodic Table Groups & Elements

## GROUPS & PERIODS

### 30) Periodic Table

red Gp 1 - alkali metals

yellow Gp 2 - alkaline earth metals

green Gp 3-12 - transition metals

purple Gp 17 - halogens

blue Gp 18 - noble gases

orange bottom 2 rows - inner transition metals

diagonal - metalloids

31) groups - vertical columns (18)

32) periods - horizontal rows (7)

### 33) Periodic Trends

a) increasing atomic radius Br → Ni → Sc

b) decreasing ionic radius Sc → Ni → Br

c) increasing ionization energy Sc → Ni → Br

d) decreasing electronegativity Br → Ni → Sc

34) a) increasing atomic radius F → Se → Pb

b) decreasing ionic radius Pb → Se → F

c) increasing ionization energy Pb → Se → F

d) decreasing electronegativity F → Se → Pb

### 35) Reaction Rates

- a) Increasing pressure by making the container smaller would increase the rate of the reaction
- b) Increasing temperature increases particle speeds which leads to more collisions and an increase in reaction rate.
- c) Decreasing the concentration means there are less particles in the container so they don't collide as often which decreases the reaction rate.
- d) If the walls were a catalyst, then the amount of activation energy needed for a successful reaction would be lower so the reaction would occur much more quickly.

### 36) Heat

- a) The hot chocolate is exothermic, giving off heat
- b) Your hands are endothermic, absorbing the heat

37) It is exothermic.

38) The process is endothermic.

$$q = 1086.75 \text{ J}$$

$$m = 15.75 \text{ g}$$

$$C = ?$$

$$\Delta T = 175^\circ\text{C} - 25^\circ\text{C} = 150^\circ\text{C}$$

$$q = m C \Delta T$$

$$1086.75 \text{ J} = (15.75 \text{ g})(C)(150^\circ\text{C})$$

$$1086.75 \text{ J} = (2362.5 \text{ g }^\circ\text{C})(C)$$

$$2362.5 \text{ g }^\circ\text{C} \quad 2362.5 \text{ g }^\circ\text{C}$$

$$.46 \text{ J/g }^\circ\text{C} = C$$

$$(\text{CH}_3\text{CO}_2\text{O})_2 = \text{PbO}_2 + \text{CH}_3\text{CO}_2\text{O}$$

40)  $q = ?$

$$m = 2300 \text{ g}$$

$$C = 0.90 \text{ J/g°C}$$

$$\Delta T = 16°C - 2°C = 14°C$$

$$q = m C \Delta T$$

$$q = (2300 \text{ g})(0.90 \text{ J/g°C})(14°C)$$

$$q = 29000 \text{ J}$$

41)  $q = ?$

$$m = 454 \text{ g}$$

$$C = 0.386 \text{ J/g°C}$$

$$\Delta T = 28.0°C - 96.0°C = -68°C$$

$$q = m C \Delta T$$

$$q = (454 \text{ g})(0.386 \text{ J/g°C})(-68°C)$$

$$q = -11,900 \text{ J}$$

### Solutions

Factors that affect the rate a solute dissolves in a solvent

1. temperature (solids:  $\uparrow$  Temp. =  $\uparrow$  rate, gases  $\uparrow$  temp =  $\downarrow$  rate)
2. agitation (stirring  $\uparrow$  contact b/w solute & solvent =  $\uparrow$  rate)
3. surface area (crushing -  $\uparrow$  surface area =  $\uparrow$  rate)
4. See above

### Molarity

$$n = \frac{15.0 \text{ g Mg(OH)}_2}{58.33 \text{ g}} / 1 \text{ mol} = .25716 \text{ mol}$$

$$V = 400 \text{ mL} = .400 \text{ L}$$

$$M = n/V$$

$$M = \frac{.25716 \text{ mol}}{.400 \text{ L}} = (.643 \text{ M})$$

43)  $M = .76 \text{ mol/L}$

$$n = \frac{5.00 \text{ g HCl}}{36.46 \text{ g}} / 1 \text{ mol} = .13714 \text{ mol}$$

$$V = ? \quad 5^\circ \text{C.SSES} \quad 5^\circ \text{C.SSES}$$

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

$$V = \frac{.13714 \text{ mol}}{.76 \text{ mol/L}} = .180 \text{ L}$$

44)  $M = 1.23 \text{ mol/L}$

$$n = ?$$

$$V = 1.00 \text{ L}$$

$$n = M \cdot V$$

$$n = (1.23 \text{ mol/L})(1.00 \text{ L})$$

$$n = 1.23 \text{ mol}$$

$$\frac{1.23 \text{ mol NH}_3}{1 \text{ mol}} / 17.04 \text{ g} = [21.0 \text{ g NH}_3]$$

$$\Delta P_{\text{F}} = M^{\delta} \cdot 0.5 \times 10.1 \text{ atm} = H_2 \text{ (i) } (80)$$

\* 45 & 46 - skip - not on the final

$$\Delta O.F. = M^{\delta} \cdot 0.5 \times 88.8 \text{ atm} = H_2 \text{ (ii) } (80)$$

- 47 a) If you increase the molality (concentration) of a solution, the boiling point will be higher.  
 b) The freezing pt. will be lower

48) skip - not on the final

#### 49) Acids and Bases

Arrhenius acid - gives off  $H^+$  ions in solution

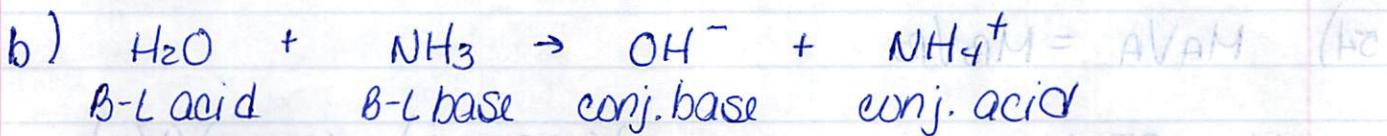
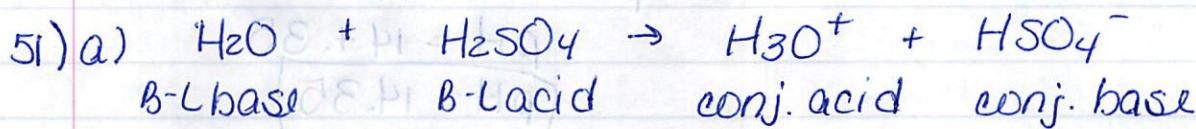
Arrhenius base - gives off  $OH^-$  ions in solution.

50) Bronsted-Lowry acid - donates a  $H^+$  ion

Bronsted-Lowry base - accepts an  $H^+$  ion

conjugate acid - what the base becomes after receiving a  $H^+$  ion.

conjugate base - what the acid becomes after losing an  $H^+$  ion.



52) Strong acids - dissociate (break apart) 100% in solution

z. strong acids are  $HCl$ ,  $HBr$ ,  $HI$ ,  $HNO_3$ ,  $H_2SO_4$ ,  $HClO_3$ ,  $\approx HClO_4$

Weak acids - dissociate 5% in solution

$$53) \text{i)} \quad \text{pH} = -\log 4.04 \times 10^{-5} \text{M} = \boxed{4.39}$$

$$\text{ii)} \quad \text{pOH} = -\log 8.88 \times 10^{-8} \text{M} = 7.05$$

$$\text{pH} + \text{pOH} = 14$$

$$\text{pH} + 7.05 = 14$$

$$\text{pH} = 14 - 7.05 = \boxed{6.95}$$

$$\text{iii)} \quad M = n/V$$

$$n = \frac{45.0 \text{ g HNO}_3}{63.02 \text{ g}} / 1 \text{ mol} = .714 \text{ mol}$$

$$V = 500. \text{ mL} = .500 \text{ L}$$

$$M = \frac{.714 \text{ mol}}{.500 \text{ L}} = 1.43 \text{ M}$$

$$\text{pH} = -\log 1.43 = \boxed{-1.6}$$

$$\text{iv)} \quad M = n/V$$

$$n = \frac{45.0 \text{ g NaOH}}{40.00 \text{ g}} / 1 \text{ mol} = 1.125 \text{ mol}$$

$$V = 500. \text{ mL} = .500 \text{ L}$$

$$M = \frac{1.125 \text{ mol}}{.500 \text{ L}} = 2.25 \text{ M}$$

$$\text{pOH} = -\log 2.25$$

$$\text{pOH} = -.35$$

$$\text{pH} + \text{pOH} = 14$$

$$\text{pH} + -.35 = 14$$

$$\text{pH} = 14 + .35$$

$$\text{pH} = \boxed{14.35}$$

$$54) \quad M_A V_A = M_B V_B + \text{H}_2\text{O} + \text{CH}_3\text{COOH} + \text{NaCl}$$

$$M_A = .85 \text{ M} \quad (.85 \text{ M})(.0250 \text{ L}) = (.75 \text{ M})(V_B)$$

$$V_A = 0.0250 \text{ L} \quad \underline{.02125 \text{ M} \cdot \text{L}} = \cancel{(.75 \text{ M})(V_B)}$$

$$M_B = .75 \text{ M} \quad \underline{.75 \text{ M}} = \cancel{.75 \text{ M}}$$

$$V_B = ? \quad \underline{.028 \text{ L}} = V_B$$