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Name: Key
Blk:____Date:

Chemistry 11
Solution Chemistry Review

1. **Define** the following terms:

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solution
solute
solvent
saturated
unsaturated
solvation
polar
non-polar
ionic compound
molecular compound
Vander Waals Forces
dipole-dipole force
H bond
london force
AMPHIPROTIC
Bronsted-Lowry acid
Bronsted-Lowry base
Arrhenius acid
Arrhenius base

2. Indicate whether the following molecules are **polar** or **non-polar**

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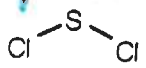
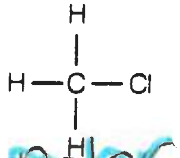
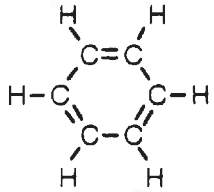


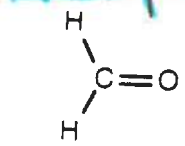
polar



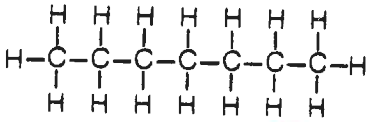
polar



non-polar

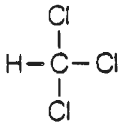


non-polar

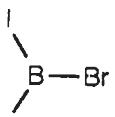


non-polar

polar



polar



polar

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3. List the most important INTER Molecular or **INTRA-MOLECULAR FORCE** that exists between:

a. 2 atoms of He in He (g) — London forces
b. 2 molecules of $CH_3CH_3NH_2$ in $CH_3CH_3NH_2$ — H-bond
c. 2 molecules of CCl_4 (symmetric) in CCl_4 — London forces
d. The atom Na and the atom Cl in NaCl (s) — ionic bonds
e. 2 molecules of CH_3F in CH_3F (l) — H-bond

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4. Explain why **WATER** is the universal SOLVENT:

Water is the universal solvent because it is a polar molecule but it can also dissolve non-polar molecules. Water is abundant, cheap, not harmful and non-toxic.

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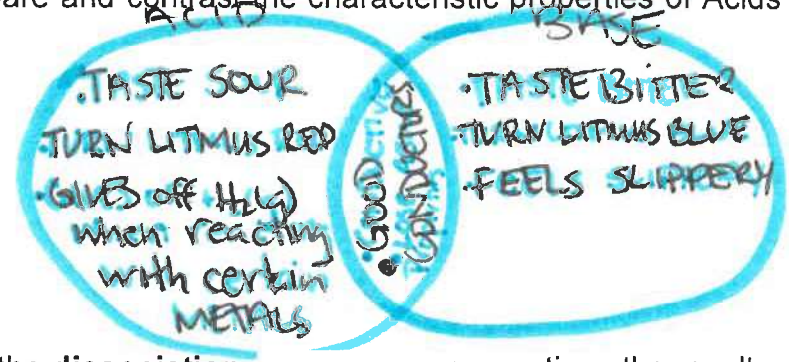
5. Compare and contrast the characteristic properties of Acids & Bases



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6. Write the **dissociation** equations the result when the following compounds are dissolved in water:

a. $NaBr \longrightarrow Na^+(aq) + Br^-(aq)$
b. $HNO_3 \longrightarrow H^+(aq) + NO_3^-(aq)$
c. $AlBr_3 \longrightarrow Al^{3+}(aq) + 3Br^-(aq)$
d. $(NH_4)_2SO_4 \longrightarrow 2NH_4^+(aq) + SO_4^{2-}(aq)$
e. $Ba(OH)_2 \longrightarrow Ba^{2+}(aq) + 2OH^-(aq)$
f. $Cr_2(SO_4)_3 \longrightarrow 2Cr^{3+}(aq) + 3SO_4^{2-}(aq)$
g. $H_3PO_4 \longrightarrow 3H^+(aq) + PO_4^{3-}(aq)$

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7. Write the dissociation equation for each of the following solutions, then calculate the concentration of each ION in the solution:

a. 0.18 M $Hg(NO_3)_2$ $\longrightarrow$ $Hg^{2+}(aq) + 2NO_3^-(aq)$

1/2 0.18 M Hg^{2+} ; 0.36 M NO_3^-

b. 0.35 M $(NH_4)_2SO_4$ $\longrightarrow$ $2NH_4^+(aq) + SO_4^{2-}(aq)$

1/2 0.70 M NH_4^+ ; 0.35 M SO_4^{2-}

c. 0.070 M $Fe(ClO_4)_3$ $\longrightarrow$ $Fe^{3+}(aq) + 3ClO_4^-(aq)$

1/2 0.070 M Fe^{3+} ; 0.21 M ClO_4^-

8. Calculate the final concentration of <u>each ion</u> when the following solutions are mixed

a. 125 mL of 0.20 M $MgCl_2$ mixed with 375 mL of 0.40 M KCl

$MgCl_2 \rightarrow Mg^{2+} + 2Cl^-$

$KCl \rightarrow K^+ + Cl^-$

$\frac{0.20M \times 0.125L}{0.500L} = 0.050M\ Mg^{2+}$

$\frac{0.40M \times 0.375L}{0.500L} = 0.30\ M\ K^+$

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2x $\frac{0.20M \times 0.125L}{0.500L} = 0.10M\ Cl^-$

$\frac{0.40M \times 0.375L}{0.500L} = 0.30\ M\ Cl^-$

$0.10\ M\ Cl^- + 0.30\ M\ Cl^- = 0.40\ M\ Cl^-$

b. 4.0 L of 0.25 M $CuSO_4$ mixed with 6.0 L if 0.75 M Na_2SO_4

$CuSO_4 \rightarrow Cu^{2+} + SO_4^{2-}$

$Na_2SO_4 \rightarrow 2Na^+ + SO_4^{2-}$

1/3 $\frac{0.25M \times 4.0L}{10.0L} = 0.10M\ Cu^{2+}$

2x $\frac{0.75 \times 6.0L}{10.0L} = 0.90\ M\ Na^+$

$\frac{0.25M \times 4.0L}{10.0L} = 0.10M\ SO_4^{2-}$

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$\frac{0.75M \times 6.0L}{10.0L} = 0.45\ M + 0.10M$

$0.55\ M\ SO_4^{2-}$

FLASHBACK QUESTIONS: TITRATIONS!!!!

$2\,NaOH(aq) + H_2SO_4(aq) \rightarrow Na_2SO_4(aq) + 2\,H_2O(l)$

Molarity of NaOH: 0.15 M	Trial #1	Trial #2	Trial #3
Initial burette reading (mL)	0.50	12.31	23.75
Final burette reading (mL)	12.31	23.75	35.22
Volume of NaOH added (mL)	11.81	11.44	11.47
Average volume NaOH (mL)	11.46		

(discard)

1. The Above data was collected when titrating 10.00 mL of Sulfuric acid with the Sodium Hydroxide. Use it to Calculate the concentration of H_2SO_4.

$\frac{11.44 + 11.47}{2} = 11.46\,mL$

$11.46\,mL \cdot \frac{1 \cdot 10^{-3}\,L}{1\,mL} \cdot \frac{0.15\,mol\,NaOH}{1\,L} \cdot \frac{1\,mol\,H_2SO_4}{2\,mol\,NaOH} \cdot \frac{1}{10.0\,mL} \cdot \frac{1\,mL}{1 \cdot 10^{-3}\,L} =$

$= 0.086\,M\,H_2SO_4$

2. A student titrated 10.00 mL HCl with 0.050 M $Sr(OH)_2$. The table below shows the data collected. Calculate the [HCl].

$1\,Sr(OH)_2(aq) + 2\,HCl(aq) \rightarrow SrCl_2(aq) + 2\,H_2O(l)$

Molarity of $Sr(OH)_2$: 0.050 M	Trial #1	Trial #2	Trial #3
Initial burette reading (mL)	0.00	16.05	32.93
Final burette reading (mL)	16.05	32.93	49.68
Volume of $Sr(OH)_2$ added (mL)	16.05	16.88 mL	16.75 mL
Average volume $Sr(OH)_2$ (mL)	16.82 mL		

(discard)

$\frac{16.88 + 16.75}{2} = 16.82\,mL$

$16.82\,mL \cdot \frac{1 \cdot 10^{-3}\,L}{1\,mL} \cdot \frac{0.050\,mol\,Sr(OH)_2}{1\,L} \cdot \frac{2\,mol\,HCl}{1\,mol\,Sr(OH)_2} \cdot \frac{1}{10.00\,mL} \cdot \frac{1\,mL}{1 \cdot 10^{-3}\,L}$

$= 0.17\,M\,HCl$