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Name: Key
Blk:____Date:

Chemistry 11
Solution Chemistry Review

1. **Define** the following terms:

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

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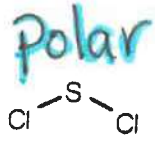
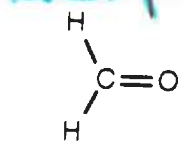
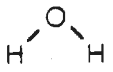
2. Indicate whether the following molecules are **polar** or **non-polar**



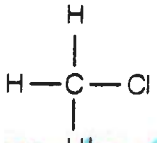
polar



polar

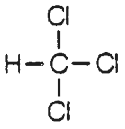


polar



polar

non-polar



polar

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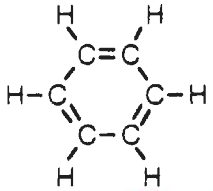
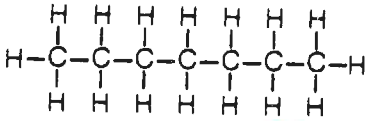
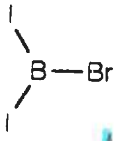


non-polar



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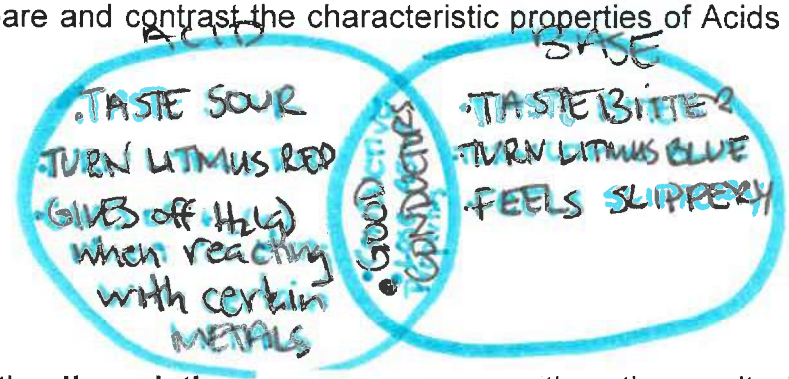
5. Compare and contrast the characteristic properties of Acids & Bases



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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

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

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

1/3 $\frac{0.20M \times 0.125L}{0.500L} = 0.050M\ Mg^{2+}$

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

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

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

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

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

1/2 $\frac{0.25M \times 4.0L}{10.0L} = 0.10M\ SO_4^{2-}$

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

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

$CrBr_3 \rightarrow Cr^{3+} + 3Br^-$; $CaBr_2 \rightarrow Ca^{2+} + 2Br^-$

c. 300 mL of 0.3 M $CrBr_3$ mixed with 700 mL of 0.1 M $CaBr_2$

$\frac{0.3M \times 0.3L}{1.0L} = 0.09\ M\ Cr^{3+}$; $\frac{0.1M \times 0.7L}{1.0L} = 0.07\ M\ Ca^{2+}$

1/3 $3\times \frac{0.3M \times 0.3L}{1.0L} = 0.27\ M\ Br^-$ → 0.3 M

$2\times \frac{0.1M \times 0.7L}{1.0L} = 0.1M + 0.3M\ Br^-$

0.4 M Br^-

9. What is the concentration of NaOH if 27.0 mL is neutralized by adding 35.0 mL 0f 0.500 M HCl?

$NaOH + HCl \rightarrow NaCl + H_2O$

1/2 $\frac{0.500\ mol\ HCl}{1L} \times 0.035L = 0.0175\ mol\ NaOH$; $\frac{0.0175\ mol\ NaOH}{0.0270L} = 0.648\ M\ NaOH$

10. If 35 mL of 0.25 M H_2SO_4 is titrated with 15.8 mL of unknown [ ] KOH, what is the concentration of the original KOH?

$H_2SO_4 + 2KOH \rightarrow K_2SO_4 + 2H_2O$

1/2 $\frac{0.25\ mol\ H_2SO_4}{1L} \times 0.035L = 0.00875\ mol\ H_2SO_4 \times \frac{2\ mol\ KOH}{1\ mol\ H_2SO_4}$

$= \frac{0.0176\ mol\ KOH}{0.0158L} = 1.1\ M\ KOH$

11. If 125 mL of 0.551 M H_3PO_4 is titrated to neutralize 50.0 mL of $Ca(OH)_2$, what is the concentration of $Ca(OH)_2$?

$2H_3PO_4 + 3Ca(OH)_2 \rightarrow Ca_3(PO_4)_2 + 6H_2O$

1/2 $\frac{0.551\ mol}{1L} \times 0.125L = 0.068875\ mol\ H_3PO_4 \times \frac{3\ mol\ Ca(OH)_2}{2\ mol\ H_3PO_4}$

$= \frac{0.103\ mol\ Ca(OH)_2}{0.0500L} = 2.06\ M\ Ca(OH)_2$

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