Name: _____Block;_____ Unit 7 PhET Simulations

Describe each:

1. Soluble

2. Insoluble

3. Solute

4. Solvent

5. Concentrated

6. Dilute

7. Molarity

8. Saturated

9. Unsaturated

10. Supersaturated

11. Electrolyte

12. Nonelectrolyte

13. Electronegativity is a measure

14. An atom with:

high electronegativity means _____ **low** electronegativity means _____

Describe the electronegativity difference between:

15. Ionic bond: _____ Polar Covalent bond: _____ Nonpolar covalent bond: _____

PHET Molecular Polarity Simulation -Likes Dissolve Likes *PhET→Play with the Sims →Chemistry →Molecular Polarity*

Part 1: TWO ATOM TAB: In the **view** box have **partial charges** checked, in the **surface** box have **electron density** checked

1) Label polarity and Draw what you see when both atoms have:

similar, low electronegativities	**similar, high** electronegativities.	**very different** electronegativities
Circle: (polar/nonpolar **bond**)	(polar/nonpolar **bond**)	(polar/nonpolar **bond**)

2) In a very polar molecule, the δ- is _____ and δ+ is _____ when the electrostatic potential is added.

3) The electron density around a δ- is (more/less) compared to the density of a δ+. Therefore, the shared electron is (closer/farther away) to the δ- atom compared to δ+ atom.

Part 2: REAL MOLECULES TAB: "Like dissolves like" means that molecules with ***similar molecular polarity*** will tend to mix.

4.) Next, **use the simulation** to determine with of the species should dissolve in **polar** water.

H_2	N_2	O_2	F_2	HF	H_2O	CO_2	HCN	O_3	NH_3	BH_3	BF_3	CH_2O	CH_4	CH_3F	CH_2F_2	CHF_3	CF_4	$CHCl_3$
					√				√									

5) Explain why methane (CH_4) would not dissolve well into water.

6) Finally, what type of solvent would be required to dissolve **nonpolar** compounds?

PHET Molarity Simulation *PhET→Play with the Sims → Chemistry → Molarity*

$$Molarity\ (M) = \frac{amount\ of\ solute\ (mol)}{volume\ of\ solution\ (L)}$$

Part 3: Molarity

7) First, determine the **saturation concentration** of each of the solutions, that is, how concentrated can you get each solution before the solution is saturated. *(Click on show values)*

	Saturation concentration		Saturation concentration
Cobalt chloride		Potassium chromate	
Potassium dichromate		Copper (II) sulfate	
Gold (III) chloride		Potassium permanganate	

**Each substance has its own unique saturation concentration*

Part 4: Calculating Molarity

8) Use the simulation for **cobalt (II) nitrate** & the formula for Molarity (click on show values)

Moles of Compound (mol)	Liters of Solution (L)	Molarity of Solution (M)	Moles of Compound (mol)	Liters of Solution (L)	Molarity of Solution (M)
0.53	0.79			0.78	0.59
0.86	0.34		0.88		1.4

Calculations

9) What is the solution concentration formed from 3.6 moles NaCl dissolved into 1.3 L of water? (show work)

10) What is the solution concentration formed from 2.1 moles $BaCl_2$ dissolved into 1.9 L of water? (show work)

11) How many moles of solute are present in 0.75 L of a 0.89 M (molar) solution? (show work)

12) What volume of water would be required to dissolve 0.46 moles of solute to produce a 0.22 M solution? (show work)

PHET Concentration Simulation *PhET→Play with the Sims → Chemistry → Concentration*

Part5: Dissolution and Saturation Familiarize yourself with this simulation: click on everything and move all the sliders.

13) The concentration: (increases/decreases) when solid solute is added & (increases/decreases) when water is added.

14) How do you know when a solution is ***saturated***? _____

15) What happens when a solution *is* saturated, and additional solid solute is added? _____

16) How does adding this additional solute change the concentration of this saturated solution? _____

17) Click on the solution option (image of a dropper), add a ½ Liter of Drink Mix to an empty beaker.
What is the concentration? _____ Is this solution saturated? _____
How do you know? _____ Now, add ½ Liter of water. What is the new concentration? _____

18) Complete the table below, using **potassium chromate** in an empty beaker, write the concentration in the boxes .

Only 0.25L of dropper solution	0.25L dropper+0.25L water	0.25L dropper + .50 L water	0.25L dropper + 0.75 L water

19) As 0.25 L of water is added ,what do you observe about the concentration ?

The formula $M_1V_1 = M_2V_2$ *is a great way to calculate the concentration of a solution that undergoes dilution or concentration.* M_1V_1 *refers to the concentration and volume of the original solution, and* M_2V_2 *refers to that solution after it has been diluted or concentrated.*

20) 0.20 L of nickel (II) chloride has a concentration of 5.0 M. (M_1 = 5.0 M and V_1 = 0.20 L) If the solution's volume, V_2 is increased with water to 0.50 L, calculate the new concentration, M_2. **Check your work in the sim AFTER your calculation.**

Your Calculated M2: _____ . New concentration shown in the simulation: _____

21) Complete the table below using **potassium permanganate**. **Remember to calculate first, and then check in the sim.**

M_1	V_1	M_2	V_2
0.40 M	0.20 L		0.80 L
0.40 M	0.30 L	0.15 M	

Conclusion Questions and Calculations

22) Dilution causes the concentration of an unsaturated solution to (*increases / decreases / remains the same)*

23) As a saturated solution (with no solids) is diluted, its concentration (*increases / decreases / remains the same)*

24) 1.8 L of a 2.4 M solution of $NiCl_2$ is diluted to 4.5 L. What is the resulting concentration of the diluted solution? Show work

25) 0.5 L of a 4.00M solution of $CoCl_2$ needs to be diluted to a concentration of 0.86M. What is the total volume of the new solution? How much water needed to be added? Show work

PHET Sugar & Salt Solutions Simulation *PhET Simulations → Play With Sims → Chemistry → Sugar & Salt Solutions*

Play with the sim first, make sure you can move the light bulb into the beaker

Part 6: Electrolytes

26) (Metals/Nonmetals) conduct electricity and (Ionic/Covalent) have metal cations therefore (Ionic/Covalent) conducts electricity.

27) Now using PhET: (Sugar/Salt) is an ionic compound and (sugar/salt) turned on the light bulb therefore (Sugar/Salt) conducts electricity in liquid form and is considered to be a (electrolyte/nonelectrolyte).

28) When (Ionic/Covalent) compounds are dissolved in water they conduct an electric current and are considered to be (electrolyte/nonelectrolyte).

PHET Acid-Base Simulation *PhET Simulations → Play With Sims → Chemistry → Acid-Base Solutions*

Part 7: Acid and Bases

29) Fill in table

	Strong Acid	Weak Acid	Strong Base	Weak Base	Water
pH meter reading ***the value***					
pH paper ***the color***					
Conductivity ***Is bright or dim or none***					
ions or molecules are mostly present					

Conclusion Questions:

30) Acids have a (higher/lower) pH whereas Bases have a (higher/lower) pH.

Acids

31) H_3O^+ is a hydronium ion that is present in an acid solution. A strong acid has (more/less) hydronium ions then a weak acid.

32) A **strong acid** will have a (*higher / lower / the same)* pH than a weak acid.

33) A **strong acid** *is a* (*nonelectrolyte / weak electrolyte / strong electrolyte*)

34) A **weak acid** is a (*nonelectrolyte / weak electrolyte / strong electrolyte*)

Bases

35) OH^- is a hydroxide ion that is present in a base solution. A strong base has (more/less) hydroxide ions then a weak base.

36) A **strong base** will have a (*higher / lower / the same)* pH than a weak base.

37) A **strong base** is a (*nonelectrolyte / weak electrolyte / strong electrolyte*)

38) A **weak base** is a (*nonelectrolyte / weak electrolyte / strong electrolyte*

PHET pH scale simulation *PhET Simulations → Play With Sims → Chemistry → pH scale Solutions*

Click on ***H_3O^+/OH^- ratio*** box to view the hydronium and hydroxide molecules as model dots in solution. Spend a few minutes to become familiar with the simulation and its controls. Observe the pH of some common liquids.

Part 8: Changes in Hydronium H_3O^+ and Hydroxide OH^- Concentrations

- Make sure you are viewing concentrations in mol/L.
- Move the pH slider to create custom liquids with varying pH. Observe how increasing the pH on the slider affects the pH and concentrations of hydronium $[H_3O^+]$ and hydroxide $[OH^-]$.

Analysis

39) As pH increases, the concentration of hydronium $[H_3O^+]$(increases/decreases/stays the same)

40) As pH increases, the concentration of hydroxide $[OH^-]$(increases/decreases/stays the same)

41) For any substance, when I multiply $[H_3O^+]$ by $[OH^-]$ I always get _____.

42) How does adding more or less of a liquid change the $[H_3O^+]$? _____.

Part 8: pH – $[H_3O^+]$ Calculations *Choose several of the sample liquids and observe their H_3O^+ concentrations*

43) Fill in table

Sample Liquid Used	$[H_3O^+]$ Concentration [M]	calculate pH using formula: pH=-log $[H_3O^+]$ (show work)	check pH *using PhET*

Analysis

44). Do your calculations for pH match the pH identified in the simulation? _____

45) As $[H_3O^+]$ increases, the pH (increase/decrease/stays the same)