Water Lab name: _____ (40/1200)

We will examine water and the water molecule, as well as the important properties of water in this lab. Full safety requires goggles at all time. Tie hair back when using Bunsen burners.

| 1. The water molecule is _____ (polar or non polar?) | | |
|---|---|---|
| Draw the electron dot diagram for water. | Draw a structural diagram for water | Draw another structural diagram for water, with dipole arrows. |

2. Why does oxygen becomes negative, and hydrogen positive, when water forms.

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3. Explain what a hydrogen bond is.

_____

3B. Draw 9 water molecules in this big box, use dotted lines to show hydrogen bonds between the molecules. Use pen for the water. **Use a colored pencil rather than a pen for the hydrogen bonds.**

4. There are symbols: $\delta^-$ and $\delta^+$ which stands for "slightly negative" and also "slightly positive". They are used to indicate the parts of a molecule that become + or — when the electrons move in a polar bond due to differences in electronegativity. The sign is read as "delta", the lower case Greek letter. Add them in proper place on the second structural diagram on the first page.

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5. Thermochem and water… Get 125 mL of deionized water into a clean beaker and set on black table. Accurately measure the temperature of the water in centigrade (to the 10th of a degree). Convert this temp to Kelvin. How much energy is required to raise the temperature of this water from its current temperature by 59.5°C. Show formula, show work, correct significant figures and units.

6. Specific Heat Capacity... What is the specific heat capacity of water constant? _____

Take 10.0 mL of your deionized water and put it into a clean dry beaker. Set it up on a ring stand with rind and mesh to be heated by a Bunsen Burner. Start Bunsen burner away from tube. Get the flame hot, blue and going well. Check clock, you are to time in seconds exactly how long it takes to completely vaporize this 10.0 mL of water.

Determine how many joules it took to vaporize this water. This is a 2 step thermo-chemistry problem, the heating of the water + the vaporizing of it. Show both formulas, both math setups, and combine the joules.

7. Pick up one of the reusable hand warmers. They are filled with an aqueous solution of sodium acetate. The packs are solid, because at room temp there is too much sodium acetate to dissolve into the water. We'll boil them for a while, and see what they look like when totally aqueous. Do this, then set aside to cool off.

When cool, find the metal tab inside the pack. This tab, when bent (gently) releases enough energy to disrupt the equilibrium of this supersaturated solution. It causes some ions to fall out of solution, into a solid. Once it starts, the rest of the ions fall out of solution too. When the ionic bonds form, energy is released.

Write the balanced thermo-chemical dynamic equilibrium equation for this reaction.

_____

8. When you boil the water away, what is going on with the water molecules? Explain how the liquid becomes gas (what bonds get broken by the heat of the Bunsen Burner?). When steam condenses onto your finger you get burned, what are the water molecules actually doing (what sort of bonds are reforming?) What's that great one liner I told you about concerning energy + bonding? (it's in #7 above, you write it now).

9. What is surface tension of water? What causes it?

10. Soap is a type of surfactant. Define surfactant: _____

_____

Take the rest of your deionized water and put some SULFUR powder onto the surface of the water in your beaker. Observe what you see and draw it in the box at left. List a few observations. Poke at the sulfur with your finger. Push it into the water. Can you? Squirt about 1-2 drops of soapy water onto the sulfur, what happens?

| | |
|---|---|
| 11. Draw your beaker with the sulfur powder. Label diagram. | Observations <u>before</u> soap is added to water and sulfur...<br><br>1<br><br>2 |
| Redraw, re-label the diagram. | Observations <u>after</u> soap is added to water and sulfur... |

**<u>WASH HANDS WITH SOAP NOW Do not eat the sulfur</u>.**
**Wash out the beakers with plenty of water down the drain.**
**Put away all equipment.**

12. TABLE G… Table G shows us how many grams of a solute can dissolve into exactly 100 g (or 100 mL) of pure water, at a variety of different temperatures.

Fill in this chart, telling how many grams of each compound will dissolve into 100 mL of water at the different temperatures listed here and on Table G.

*Note: 1 box will not going to be filled in as the value for it are quite literally "off the chart".*

| table G | number of grams of solute to saturate 100 mL water | | | | |
|---|---|---|---|---|---|
| temp in °C | $NH_4Cl$ | NaCl | KCl | $NaNO_3$ | $NH_3$ |
| 0°C | | | | | |
| 10°C | | | | | |
| 70°C | | | | | |
| 100°C | | | | x | |

Using Table G, answer the following questions, **SHOW WORK on loose leaf**.

A How much ammonia dissolves into 100 g water at 90°C? How much dissolves at 10°C?

B How much ammonia dissolves into just 40 g water at 10°C?

C How much NaCl dissolves into 420 mL water at 90°C?

D Which of the ten compounds dissolves the least well at 10°C?

E Which of the ten compounds dissolves the most at 20°C?

F List 3 compounds which appear to dissolve better into colder water than warm?

G Which compound seems to dissolve about the same at any temperature of solvent?

H If you have 100 mL saturated sodium nitrate solution at 70°C and you chilled this solution to 50°C very quickly calculate how much solute precipitates out of solution.

I If you dissolve 60.0 g potassium chlorate into 100. mL water at 100°C and then cool this solution to about 23°C, 50.0 grams precipitates out of solution as a solid. See this on table G before you read this question: Once this solute precipitates out of the solvent, does this chemical system "stop" or does something else happen? Use the words who's initials are DE in your answer.

12. Ice floats on water. How is it possible for the solid water to float in the liquid water?

_____

14. Get a water molecule magnet kit, get six water molecules, and see if you can arrange them in a hexagon, like ice crystals. Draw 6 structural diagrams, linked by hydrogen bonds [DRAW hydrogen bonds as DOTS with a colored pencil or marker] Draw 1 ice ring.

15. Calculate how many moles of water 125 grams is. Then, how many molecules are present this mass of water. What is the mass of one molecule of water? What is the mass of one mole of water molecules?

| This lab report needs | | points |
|---|---|---|
| Cover page | Title and a ONE SENTENCE objective. | 1 |
| Lab handout<br>Loose Leaf paper questions too | Fill in all drawings, do all math, answer all questions. Be neat | 19 |
| Conclusion | Write a few paragraphs about water, water molecules, water properties, solubility of solutes in water, heat capacity, etc.<br><br>**Show off** how much chemistry you know about water. | 5 |
| This lab is due on: _____ | | 25 points total |