GUIDED READING - *Ch. 3.1 – **Polar covalent bonds in water molecules results in hydrogen bonding** (between one water molecule and another or between one water molecule and other charged substances)*

NAME: _____

- **Please PHYSICALLY PRINT OUT these pages and HANDWRITE the answers directly on the printouts.** *Typed work or digitally-produced answers will not be accepted.*
- **Importantly, guided readings are NOT GROUP PROJECTS!!!** *You, and you alone, are to answer the questions as you read. You are **not** to share them with another students or work together on filling it out. You are **not** to copy any answers from any other source including the internet. Please report any dishonest behavior to your instructor to be dealt with accordingly.*
- **Get in the habit of writing legibly, neatly, and in a NORMAL, MEDIUM-SIZED FONT.** *AP essay readers and I will skip grading anything that cannot be easily and quickly read so start perfect your handwriting.*
- **Please SCAN documents properly and upload them to Archie.** *Avoid taking photographs of or uploading dark, washed out, side ways, or upside down homework. Please use the scanner in the school's media lab if one is not at your disposal and keep completed guides organized in your binder to use as study and review tools.*
- **READ FOR UNDERSTANDING and not merely to complete an assignment.** *Though all the answers are in your textbook, you should try to put answers in your own words, maintaining accuracy and the proper use of terminology, rather than blindly copying the textbook whenever possible.*

1. Which **types of bonds** and which **types of atoms** make up one individual water molecule?

2. Are the **bonds within the water molecule** polar or non-polar and why?

3. What is the **shape** of a water molecule?

4. For life, water is essential. Life began in water and evolved there for 3 billion years before spreading onto land and modern life, even terrestrial life, remains tied to water [1]. Most cells are surrounded by water and are made up of 70-95% water [1]. **Water displays many emergent properties as a result of its structure and molecular interaction as a polar molecule** [1]. Explain in detail, why **the water molecule (as a whole) is considered polar**?

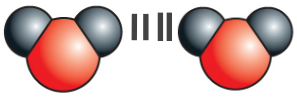
5. Draw a large water molecule in the space below. Add all the **partial charges** (δ^+ and δ^-) that exist on a water molecule given its polarity *(P.S. there should be **four** areas labeled in total)*.

6. a. What kind of **bonding is responsible for the emergent properties of water?**

b. How does this type of bonding **differ from covalent bonding** as far as the way this bond forms, where it forms, what atoms are involved?

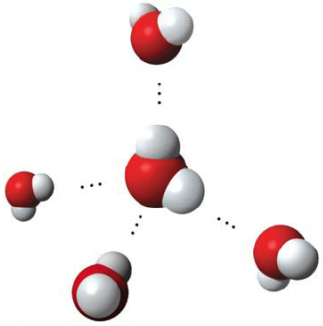
c. In liquid water, **how strong are these hydrogen bonds between water molecules** compared to the covalent bonds within the water molecule?

7. Why is it unlikely that two neighboring water molecules would be found arranged like the picture below?



8. What would be the effect on the property of water if oxygen and hydrogen had equal electronegativities instead? Explain why you say what you say, explaining fully all the changes that would occur **BOTH WITHIN AND BETWEEN** water molecules.

9. Indicate the location of all hydrogen bonds that would form in the illustration below.



10. Why can liquid water molecules hydrogen bond with with up to four water molecules and not two or six water molecules?