NAME: **HONORS CHEMISTRY**

SECTION: Bonding Unit Summative Assessment

Assignment overview

For the bonding unit final assessment, you will create a story called *A Tale of Four Electrons* that incorporates concepts from the unit. The story will consist of four parts: Life before bonding, the bonding experience, results of bonding, and a discussion. The total score for the sum of the four parts (out of a total of 130 points) will be recorded as a test grade for the bonding unit. You will be given three full periods of class time, plus considerable homework time, to complete all 4 parts of the story.

Details for the story: *A Tale of Four Electrons*

To consolidate your understanding of basic bonding principles, write a story about four electrons that start their life in individual atoms but end up in ionic, metallic, polar covalent, and nonpolar covalent bonds. There will be four parts to your story. For each part, incorporate all concepts listed below in a way that shows you understand them. Use analogies or the experiences of the electrons to describe each concept. If you simply list, define or paraphrase the concept, you will receive no credit. When you discuss a concept, list its concept number in brackets. The vocabulary words listed for each section must be incorporated in a way that shows you understand them. For each required vocabulary term, use the highlighter feature the first time the word appears in the text (a different color for each term). You are encouraged to creatively incorporate humor and dialogue, as well as scientifically correct content.

You will submit your work in Google Docs, by sharing each file with my email address, kvanderveen@psharvard.org. Your file name must include your name, period and project section. I must have editing privileges so that I can comment on your work.

Example: Trixie Belden, in D Period Honors Chem, is ready to submit her work for part II of the project. She saves the google doc as "trixiebeldendpartII" and shares the file with her instructor.

All work must be shared electronically by 2:20 pm on the assigned date, or standard late penalties will apply. Absence is not an excuse for missing a deadline; when in doubt, turn it in early.

Part I *Life before bonding*

Due Friday, 2/15

1. Name each electron. The name should creatively reflect the bond type the electron will experience.
2. To start, each electron should reside on an atom appropriate for its eventual bonding (an ionic, metallic, polar-covalent, or nonpolar covalent bond).
3. For each electron, briefly describe its atom using atomic theory (include Effective Nuclear Charge [ENC]) and describe the electron itself (which should be a valence electron) with an electron configuration.
4. Include at least two references, in standard format.

Bonding concepts

1. Bond formation is an exothermic process.

Vocabulary

- Chemical bond

Scoring:

- 4 pts Creative names for each electron that relate to eventual bond type
- 4 pts Description of each valence electron (on an appropriate type of atom for the bond it will eventually experience)
- 4 pts ENC for each valence electron (reported numerically)
- 4 pts Electron configuration for each atom
- 2 pts Bonding concept #1
- 2 pts Required vocabulary
- 2 pts References

Maximum Part I Points: 22 pts

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Part 2: The bonding experience

Part 2 Rough draft due in class Monday, 3/4 (bring a hard copy to class)
Part 2 Due Date: Wednesday, 3/6

1. Pick an appropriate atom to bond with each of your electron-containing atoms (described in part I) to form an ionic, metallic, polar-covalent, or nonpolar covalent bond.
2. For each bond type, describe the bond-forming process. Describe what your electron experiences as the bond is formed. You may use illustrations, but the illustrations cannot be the primary way used to describe the bonding process. You may introduce any characters, props, or situations necessary to tell your story. Remember, you are developing analogies for each type of bond.

Incorporate all concepts listed below in a way that shows you understand them. Use analogies or the experiences of the electrons to describe each concept. If you simply list, define or paraphrase the concept, you will receive no credit. When you discuss a concept, list its concept number in brackets. The vocabulary words listed for each section must be incorporated in a way that shows you understand them. Highlight each required vocabulary word the first time it is used, using a different color for each term. Concepts and terms may be used in any order that you wish for your story.

You will be given class time on Friday, 2/15 and Friday, 3/2 to plan and work on your Part 2 rough draft. On Monday 3/4, students will participate in a peer-editing process of the Part 2 rough draft.

Bonding concepts

2. The three major types of chemical bonding are ionic, covalent, and metallic.
3. In general, atoms of metals bond ionically with atoms of nonmetals, atoms of metals bond metallically with each other, and atoms of nonmetals bond covalently with each other.
4. Atoms in molecules are joined by covalent bonds.
5. The bond length between two atoms in a molecule is the distance at which the potential energy of the bonded atoms is minimized.
6. The octet rule states that many chemical compounds tend to form bonds so that each atom—by gaining, losing, or sharing electrons—shares or has eight electrons in its highest occupied energy level.
7. A single bond is a covalent bond in which a pair of electrons is shared between two atoms. Covalent bonds with more than one pair of shared electrons are called *multiple bonds.*
8. Bonding within many molecules and ions can be indicated by a Lewis structure. Molecules or ions that cannot be correctly represented by a single Lewis structure are represented by resonance structures.
9. An ionic compound is a three-dimensional network of multiple positive and negative ions that are mutually attracted to one another.
10. Polyatomic ions are charged groups of atoms held together by covalent bonds.
11. Metallic bonding is a type of chemical bonding that results from the attraction between metal atoms and mobile electrons floating in a conduction band between metal atoms.
12. In metallic bonding, the lack of a band gap between valence and conduction bands gives metals their properties of high electrical conductivity, malleability, ductility, and luster. Electrical conductivity involves a net movement of electrons.

Required Vocabulary	Optional Vocabulary for Extra Credit Opportunity
o Bond energy o Bond length o Octet rule o Lewis structure o Single bond o Double bond o Triple bond o Resonance o Lone pair electrons o Diatomic molecule o Non-polar covalent bonding o Polar covalent bonding o Polyatomic ion o Ionic bonding o Ionic lattice o Metallic bonding o Conduction band o Valence band o Band gap o Ductility o Electrical conductivity o Luster o Malleability	o Network covalent bonding o Sigma bond o Pi bond o Isomer o Hybridization o Formal charge o Heat of vaporization o Thermal conductivity Maximum +1/2 pt for each extra credit vocabulary term Remember, simply defining or including vocabulary terms does NOT earn credit

Scoring

- 22 points Correct analogies for bonding concepts #2-12
- 46 points Correct analogies for required vocabulary
- 4 pts Descriptions of each bond-formation process/what each electron experiences

Maximum Part II Points: 72 pts

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Part 3: Results of bonding
Due Date: Thursday 3/14

1. Have each electron describe (in their words) the results of the bonding on both a molecular and everyday level. Make sure you describe the expected physical properties for each type of bond. Also describe any intermolecular forces that the electron might experience. You may use illustrations but the illustrations cannot be the primary way used to describe the intermolecular attractions. You may introduce any characters, props, or situations necessary to tell your story. Remember, you are developing analogies for intermolecular attractions.

Incorporate all concepts listed below in a way that shows you understand them. Use analogies or the experiences of the electrons to describe each concept. If you simply list, define or paraphrase the concept, you will receive no credit. When you discuss a concept, list its concept number in brackets. The vocabulary words listed for each section must be incorporated in a way that shows you understand them. Highlight each required vocabulary word the first time it is used, using a different color for each term. Concepts and terms may be used in any order that you wish for your story.

Bonding Concepts

13. Because of the strong attraction between positive and negative ions, ionic compounds tend to be harder and more brittle and to have higher boiling points than materials containing only covalently bonded atoms.
14. Intermolecular attractions, such as ion-dipole attractions, dipole-dipole forces and London dispersion forces, exist between certain types of molecules. Hydrogen bonding is a special case of dipole-dipole forces.

Required Vocabulary

- Dipole (aka polar molecule)
- Hydrogen bonding
- Dipole-induced dipole attraction
- Permanent dipole-permanent dipole attraction
- London dispersion force
- Ion-dipole attraction
- Boiling point

Scoring

- 4 pts Bonding concepts 13 and 14
- 14 pts Required vocabulary
- 4 pts All 4 bond types described

Maximum Part III Points: 22 pts

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Part 4: Discussion
Due Date: Tuesday 3/19

1. Imagine that your four electrons meet for coffee at a local diner. Create a conversation comparing and contrasting their experiences. As part of the conversation, include a claim by the covalently bonded electron that *all bonding is really just different forms of covalent bonding*. Have the other electrons respond to that claim. Please be aware that there is no right answer to the question of the nature of bonding: both metallic bonding and ionic bonding can be viewed as either extensions of covalent bonding or different and unique types of bonding. I am looking for evidence-based reasoning that is incorporated into your characters' coffee shop discussions.

Scoring

- 5 pts Statement of claim and response by 3 other electrons
- 5 pts Evidence-based reasoning (What kinds of evidence support your claim?)
  - Consider solubility, hardness, boiling points, melting points, and other physical properties as you write this section

Overall Story:

- 4 pts Creativity

Maximum Part IV Points 14 pts

PROJECT TOTAL 130 points