

## BONDING PRACTICE FREE RESPONSE

1. Use the principles of bonding and molecular structure to explain the following statements.

- The boiling point of argon is -186 deg. C, whereas the boiling point of neon is -246 deg. C.
- Solid sodium melts at 98 deg. C, but solid potassium melts at 64 deg. C.
- More energy is required to break up a CaO(s) crystal into ions than to break up a KF(s) crystal into ions.
- Molten KF conducts electricity, but solid KF does not.

2. The Carbonate ion  $\text{CO}_3^{2-}$  is formed when carbon dioxide,  $\text{CO}_2$ , reacts with slightly basic cold water.

- Draw the Lewis electron dot structure for the carbonate ion. Include resonance forms if they apply.
  - Draw the Lewis electron dot structure for the carbon dioxide.
- Describe the hybridization of carbon in the carbonate ion.
- Describe the relative lengths of the three C-O bonds in the carbonate ion.
  - Compare the average length of the C-O bonds in the carbonate ion to the average length of the C-O bonds in carbon dioxide.

3.

Substance	Boiling Point (deg. C)	Bond Length (Å)	Bond Strength (kcal/mol)
H <sub>2</sub>	-253	0.75	104.2
N <sub>2</sub>	-196	1.10	226.8
O <sub>2</sub>	-186	1.21	118.9
Cl <sub>2</sub>	-34	1.99	58.0

- Explain the differences in the properties given in the table above for each of the following pairs.
  - The bond strengths of N<sub>2</sub> and O<sub>2</sub>
  - The bond lengths of H<sub>2</sub> and Cl<sub>2</sub>
  - The boiling points of O<sub>2</sub> and Cl<sub>2</sub>
- Use the principles of molecular bonding to explain why H<sub>2</sub> and O<sub>2</sub> are gases at room temperature, while H<sub>2</sub>O is a liquid at room temperature.

4. H<sub>2</sub>S, SO<sub>4</sub><sup>2-</sup>, XeF<sub>2</sub>, ICl<sub>4</sub><sup>-</sup>

- Draw a Lewis electron dot diagram for each of the molecules listed above.
- Use the valence shell electron-pair repulsion (VSEPR) model to predict the geometry of each of the molecules.

5. Use the principle of bonding and molecular structure to explain the following statements.

- The angle between the N-F bonds in NF<sub>3</sub> is smaller than the angle between the B-F bonds in BF<sub>3</sub>.
- I<sub>2</sub>(s) is insoluble in water, but it is soluble in carbon tetrachloride.
- Diamond is one of the hardest substances on Earth.
- HCl has a lower boiling point than either HF or HBr.