

## Bonds, Lewis Structure, and IMF assignment

1. What properties of ionic compounds suggest that ionic bonds are strong? Which of the representative elements tend to form positive ions? Which tend to form negative ions?
2. How do electron dot diagrams of metal ions differ from those of non-metals? How are the electron dot diagrams of metal ions similar to those of non-metal ions?
3. Use electron dot diagrams to illustrate the formation of:
  - a. lithium iodide
  - b. barium chloride
  - c. calcium oxide
4. A Group 1 metal (atomic number 55) is reacted with the most reactive of the halogens. A very vigorous reaction results in the formation of a solid, white compound.
  - a. Represent the formation of the compound with electron dot diagrams.
  - b. Write the formula of the compound formed.
  - c. What type of compound is formed? How do you know?
  - d. Predict the physical properties of the resulting white compound.
  - e. Explain the properties of the compound in terms of the bonds formed.
  - f. Provide a theoretical explanation for the vigorous reaction.
5. Are the following pairs of atoms more likely to form an ionic or covalent bond? Explain your reasoning:
  - a. sulfur and oxygen
  - b. iodine and iodine
  - c. calcium and chlorine
  - d. boron and iodine
  - e. potassium and bromine
6. Distinguish between bonding electrons and lone pair electrons.
7. Compound A is formed when the element with the atomic number 3 combines with the element of atomic number 9. Compound B is formed when the element with atomic number 7 combine with the element with atomic number 9.
  - a. Compare the properties of compound A and B. What type of compounds are A and B. Give reasons for your answer.
  - b. Clearly show the structure of each compound formed, using electron dot diagrams and Lewis structures.
8. Which type of bond – ionic, covalent, or polar covalent – will form between each of the following pairs of atoms? If the bond is polar, use arrows to show the direction of the dipole moment (Electronegativity values are on the Periodic Table at the back of your text books).
  - a. H and Cl
  - b. Si and O
  - c. Mg and Cl
  - d. Li and O
  - e. N and O
  - f. O and O
  - g. I and Cl
  - h. Cr and O
  - i. C and Cl

9. Both boron and phosphorus form compounds with chlorine which involves 3 chlorine atoms bonded to a central atom (boron or phosphorus).
- Classify each of these compounds as ionic or covalent. Justify your answer.
  - How are the B – Cl bonds and N – Cl bonds similar? How are they different?
  - What other properties can you predict for the two compounds? Use the concepts of electronegativity and Lewis structures to justify your answers.
10. A forensic scientist was given samples of four unknown solutions, the identity of which could affect the outcome of a court case involving electrocution. The chemist had reason to believe that the four substances were  $\text{KCl}_{(aq)}$ ,  $\text{C}_2\text{H}_5\text{OH}_{(aq)}$ ,  $\text{HCl}_{(aq)}$ , and  $\text{Ba}(\text{OH})_{2(aq)}$ . The investigation was designed to identify the chemicals and the following data was collected:

| Solution | Conductivity | Litmus      |
|----------|--------------|-------------|
| water    | none         | no change   |
| 1        | high         | no change   |
| 2        | high         | blue to red |
| 3        | none         | no change   |
| 4        | high         | red to blue |

- Identify each of the solutions as either  $\text{KCl}_{(aq)}$ ,  $\text{C}_2\text{H}_5\text{OH}_{(aq)}$ ,  $\text{HCl}_{(aq)}$ , or  $\text{Ba}(\text{OH})_{2(aq)}$ . Justify your answer for each.
  - Why was water used to prepare the solutions also tested?
  - Which of the solutions could have been involved in somebody being electrocuted? Explain.
11. Complete the chart below for the following compounds or ions:

| Compound             | Lewis Structure | Show polar bonds | Show overall polarity of the molecule. If the molecule is non-polar state non-polar. | Intermolecular Forces |
|----------------------|-----------------|------------------|--|-----------------------|
| $\text{H}_2\text{O}$ |                 |                  |  |                       |
| $\text{CH}_4$        |                 |                  |  |                       |

|                        |  |  |  |  |
|------------------------|--|--|--|--|
| $\text{PCl}_3$         |  |  |  |  |
| $\text{H}_2\text{S}$   |  |  |  |  |
| $\text{SiO}_2$         |  |  |  |  |
| $\text{NF}_3$          |  |  |  |  |
| $\text{NF}_3$          |  |  |  |  |
| $\text{N}_2\text{H}_2$ |  |  |  |  |

|                                  |  |  |  |  |
|----------------------------------|--|--|--|--|
| HCN                              |  |  |  |  |
| C <sub>2</sub> H <sub>5</sub> OH |  |  |  |  |
| CH <sub>3</sub> OCH <sub>3</sub> |  |  |  |  |
| CH <sub>3</sub> NH <sub>2</sub>  |  |  |  |  |
| HBr                              |  |  |  |  |