Ionic Bonding

1) **The octet rule says that atoms bond to form compounds so that each atom contains an octet of electrons in _____.**

2) **(a) What are cations?**

(b) What are anions?

3) **What is ionic bonding?**

4) **Chemical formulas for ionic compounds are _____.**

5) **(a) To form calcium chloride, the electrons transferred from the calcium atom have the electron configuration _____.**

(b) The number of chloride ions needed to form calcium chloride is _____ because each chloride has a charge of _____.

(c) The chemical formula for a formula unit of calcium chloride is _____.

6) **(a) One property of metals is their (high/low) _____ electronegativity.**

(b) The smaller the electronegativity of a metal, the (more/less) _____ active the metal.

7) **The pair of elements that forms a bond with the most ionic character is:**

(a) K and Cl

(b) H and Br

(c) O and I

(d) Br and I

8) **Draw the Lewis Diagram for the following ionic compounds.**

(a) NaCl

(b) $CaBr_2$

(c) Al_2O_3

9) Ionic compounds do not have molecular formulas because ionic compounds _____.

10) (a) What is bond energy?

(b) Is there a relationship between bond energy and the stability of a compound?

(c) The energy transfer in the formation of an ionic compound from its elements is _____.

Solutions

1) **The octet rule says that atoms bond to form compounds so that each atom contains an octet of electrons in their valence shell or their highest numbered principal energy level.**

2) **(a) Cations are positively charged ions resulting from a metallic element losing its valence electrons to become isoelectronic with the noble gas in the previous period.**

(b) Anions are negatively charged ions resulting from a nonmetallic element gaining electrons to become isoelectronic with the noble gas in the same period.

3) **Ionic bonding results when valence electrons are transferred between a metallic element and a nonmetallic element. This transfer results in the formation of a cation and an anion which results in the mutual force of electrostatic attraction.**

4) **Empirical formulas which contains the lowest whole number ratio of the different atoms in the compound.**

5) **To form calcium chloride, the electrons transferred from the calcium atom have the electron configuration $4s^2$.**

The number of chloride ions needed to form calcium chloride is 2 because each chloride has a charge of -1.

The chemical formula for a formula unit of calcium chloride is $CaCl_2$.

6) **(a) One property of metals is their low electronegativity.**

(b) The smaller the electronegativity of a metal, the more active the metal.

7) To determine the amount of ionic character, determine the difference in electronegativities of the two elements and use the scale:

0.0 – 0.3 nonpolar covalent

0.4 – 1.7 polar covalent

1.8 – 4.0 ionic

(a) K and Cl

ΔE.N. = 3.2 – 0.8 = 2.4

ΔE.N. is the greatest for K and Cl, therefore KCl contains the most ionic character.

(b) H and Br

ΔE.N. = 2.9 – 2.2 = 0.7

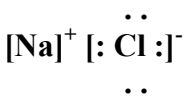
(c) O and I

ΔE.N. = 3.5 – 2.7 = 0.8

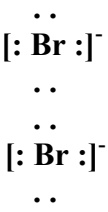
(d) Br and I

ΔE.N. = 2.9 – 2.7 = 0.2

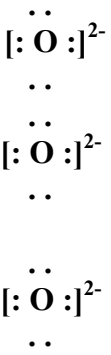
8) **(a) NaCl**



(b) $CaBr_2$



(c) Al_2O_3



9) **Ionic compounds do not have molecular formulas because ionic compounds consist of formula units and not molecules.**

10) **(a) Bond energy is the energy required to break a chemical bond (ionic or covalent) and is measured in kJ/mol.**

(b) Bond energy is a measure of bond strength. The greater the energy required to break a chemical bond, the more stable the compound.

(c) Bond formation is exothermic (energy is released) and breaking bonds is endothermic (energy is required).