Chapter 4 Homework

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Notice of ADA Accommodation and Methods

I have an ADA accommodation to do my assignment on paper. This document is a utilization of that accommodation. In the *Chemistry: Atoms First, 2e* book, some homework questions have corresponding answers in the back. I am doing about half of those questions.

1 Ionic Bonding

Q.1: Does a cation gain protons to form a positive charge or does it lose electrons?

A cation loses electrons to form a positive charge.

Q.5: Predict the charge on the monatomic ions formed from the following atoms in binary ionic compounds:

P	Mg	Al	O	Cl	Cs
3-	2+	3+	2-	1-	1+

Q.9: Write out the electron configuration for each of the following atoms

Al	Br	Sr	Li	As	S
$[Ne]3s^2 3p^1$	$[Ar]4s^2 3d^{10} 4p^5$	$[Kr]5s^2$	$[He]2s^1$	$[Ar]4s^2 3d^{10} 4p^3$	$[Ne]3s^2 3p^3$

2 Covalent Bonding

Q.13: Predict which of the following compounds are ionic and which are covalent, based on the location of their constituent atoms in the periodic table:

Cl_2CO	MnO	NCl_3	$CoBr_2$	K_2S	CO	CaF_2	HI	CaO	IBr	CO_2
Covalent	Ionic	Covalent	Ionic	Ionic	Covalent	Ionic	Covalent	Ionic	Covalent	Covalent

Q.17: From their positions in the periodic table, arrange the atoms in each of the following series in order of increasing electronegativity:

C, F, H, N, O	Br, Cl, F, H, I	F, H, O, P, S	Al, H, Na, O, P	Ba, H, N, O, As
H, C, N, O, F	H, I, Br, Cl, F	P, H, S, O, F	Na, Al, P, H, O	Ba, As, H, N, O

Q.21: Identify the more polar bond in each of the following pairs of bonds:

HF or HCl	NO or CO	SH or OH	PCl or SCl	CH or NH	SO or PO	CN or NN
HF	CO	SH	PCl	NH	PO	CN

3 Chemical Nomenclature

Q.25: Write the formulas of the following compounds:

Rubidium Bromide	Magnesium Selenide	Sodium Oxide	Calcium Chloride
RbBr	MgSe	Na_2O	$CaCl_2$
Hydrogen Fluoride	Gallium Phosphide	Aluminum Bromide	Ammonium Sulfate
HF	GaP	$AlBr_3$	$(NH_4)_2SO_4$

Q.29: Each of the following compounds contains a metal that can exhibit more than one ionic charge. Name these compounds:

Cr_2O_3	$FeCl_2$	CrO_3
Chromium(III) Oxide	Iron(II) Chloride	Chromium(VI) Oxide
$TiCl_4$	$CoCl_2 \cdot 6\,H_2O$	MoS_2
Titanium(IV) Chloride	Cobalt(II) Chloride Hexahydrate	Molybdenum(II) Sulfide

4 Lewis Symbols and Structures

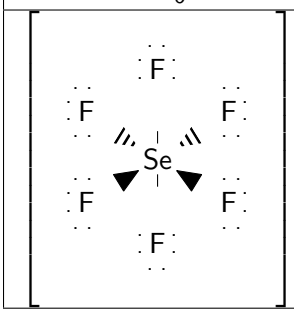
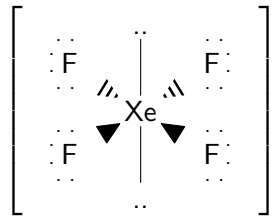
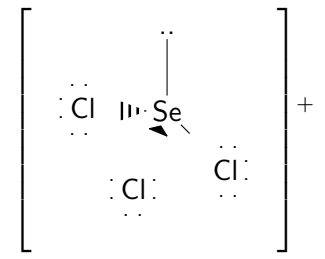
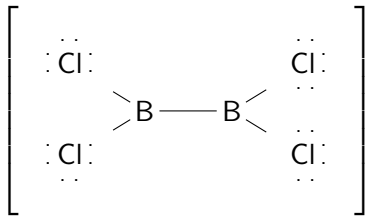
Q.34: Write the Lewis Symbols for each of the following ions:

As^{3-}	I^-	Be^{2+}	O^{2-}	Ga^{3+}	Li^+	N^{3-}
$[:\ddot{\underset{\cdot\cdot}{As}}:]^{3-}$	$[:\ddot{\underset{\cdot\cdot}{I}}:]^-$	Be^{2+}	$[:\ddot{\underset{\cdot\cdot}{O}}:]^{2-}$	Ga^{3+}	Li^+	$[:\ddot{\underset{\cdot\cdot}{N}}:]^{3-}$

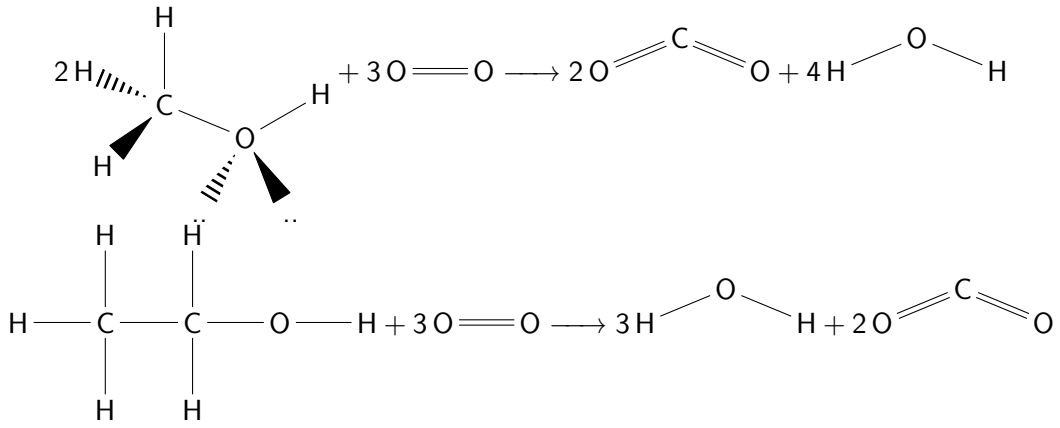
Q.38: Write the Lewis Structure for the diatomic molecule P_2, an unstable form of Phosphorus found in high-temperature phosphorus vapor:

$$:\mathbf{P} \equiv \mathbf{P}:$$

Q.42: Write the Lewis Structure for the following:

SeF_6	XeF_4	$SeCl_3^+$	Cl_2BBCl_2
			

Q.46: Methanol, H_3COH, is used as the fuel in some race cars. Ethanol, C_2H_5OH, is used extensively as motor fuel in Brazil. Both methanol and ethanol produce CO_2 and H_2O when they burn. Write the chemical equations for these combustion reactions using Lewis Structures instead of chemical formulas.

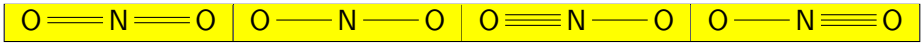


Q.54: How are single, double, and triple bonds similar? How do they differ?

Single, double, and triple bonds are similar in that they are all electron bonds that bind atoms together into molecules. They differ in their number of electrons involved and the number of π and σ bonds that occur.

5 Formal Charges and Resonance

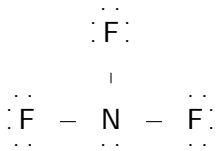
Q.58: Sodium Nitrite, which has been used to preserve bacon and other meats, is an ionic compound. Write the resonance forms of the nitrite ion, NO_2^-.



Q.62: Determine the formal charge of each element in the following:

HCl	CF_4	PCl_3	PF_5
H: 0, Cl: 0	C: 0, F: 0	P: 0, Cl: 0	P: 0, F: 0

Q.72: Write the Lewis structures and chemical formula of the compound with the molar mass of about 70 g/mol that contains 19.7% nitrogen and 80.3% Fluorine by mass, and determine the formal charge of the atoms in this compound.



6 Molecular Structure and Polarity

Q.75: Explain why HOH molecules are bent, whereas the HBeH molecule is linear.

HOH is bent because it contains four electron regions, where two of those electron regions are lone electron pairs. However, HBeH is instead linear because it only has two electron regions, both of which are single bonds. This is illustrated below.

Q.77: Explain the difference between electron-pair geometry and molecular structure.

Electron-Pair geometry describes where the electron-pair orbitals/regions are in relation to each atom, while the molecular structure describes the location of the atoms in relation to each other.

Q.83: What are the electron-pair geometry and molecular structure of each of the following molecules or ions?

	ClO_2^-	$TeCl_4^{2-}$	PH_2^-
e^- Pair Geometry	Tetrahedral	Octahedral	Tetrahedral
Molecular Structure	Bent	Square Planar	Bent

Q.87: Which of the following molecules and ions contain polar bonds? Which of these molecules and ions have dipole moments?

	ClO_2^-	$TeCl_4^{2-}$	PH_2^-
Bond Polarity	Polar Covalent	Polar Covalent	Polar Covalent
Dipole Moment?	No	No	No

Q.91: The molecule XF_3 has a dipole moment. Is X Boron or Phosphorus?

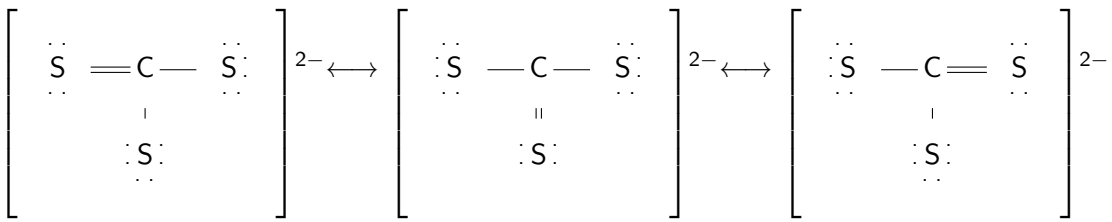
is Boron, since $|B - F| > |P - F|$

Q.95: Describe the molecular structure around the indicated atom or atoms:

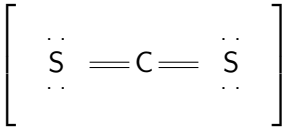
S in $(HO)_2SO_2$	Cl in $HOClO_2$	O in HOOH	N in $HONO_2$
Seesaw	Trigonal Pyramidal	Bent	Trigonal Pyramidal

Q.99: Draw the Lewis electron dot structures for these molecules, including resonance structures where appropriate:

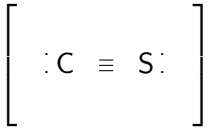
a. CS_3^{2-}



b. CS_2



c. CS



d. Predict the molecular structures for CS_3^{2-} and CS_2. Explain how you arrived at this hypothesis.

I predict that CS_3^{2-} is trigonal planar as it has three electron regions and no lone pairs, while CS_2 is Linear as it has two electron regions and no lone pairs.

Grading and Score

Points Possible	Points Earned	Score	Percentage
94	86	86/94	91%