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<u>Exercises Series N°5</u>

<u>Exercise 1 :</u>

1. Write the following atoms in Lewis form:
$_1H$, $_5B$, $_6C$, $_8O$, $_9F$, $_{15}P$, $_{16}S$.
2. Establish the Lewis diagram of the following molecules and molecular ions, specifying the number of bonding pairs (BP) and non-bonding pairs (NBP) of the central atom.
$C_2H_2O_2$, H_3PO_4, SO_2, BF_4^-, SH_3^+.

<u>Exercise 2 :</u>

The dipole moment of the OF_2 molecule is equal to 0.3 Debye.
1. Calculate the FOF angle knowing that the dipole moment of the O-F bond is 0.24 D.
2. Determine the percentage of the partial ionic character of the O-F bond knowing that its length is 1.41 Å.
3. Deduce the net charge carried by each atom in the OF_2 molecule.
<u>Data :</u> $e = 1.6\ 10^{-19}$C, $1D = 3.33\ 10^{-30}$ C.m

<u>Exercise 3 :</u>

The dipole moment of CO is 0.112D and its intermolecular distance is equal to 1.128A°.
1. Calculate the electric charge carried by each atom and express it in terms of the charge of the electron.
2. Explain why the dipole moment of SCO is not zero, while that of CS_2 is zero.

<u>Exercise 4 :</u>

An element X belongs to the period of carbon $_6C$ or group of $_{16}S$.
1. Determine its atomic number, identify element X.
We consider the molecule XC.
2. Provide its energy diagram.
3. Provide the electronic configuration of XC, deduce those of XC^+ and XC^-.
4. Calculate the bond orders, as well as the δ and π bond numbers in the three previous species.

<u>Exercise 5 :</u>

We are interested in the isolated diatomic sulfur molecule S_2 (gas), given S (Z = 16).
1. By applying molecular orbital theory, establish an energy diagram of the MO of S_2 obtained through linear combinations of atomic orbitals.
2. Is this molecule paramagnetic or diamagnetic? Why.
3. For the molecule S_2 and the derived molecular ions: S_2^+, $S_2$2+, S_2-, S_2^{2-}, the following bond lengths (in Å) are found for the S-S bond: 1.72, 1.79, 1.88, 2.00, 2.20. Assign each species its bond length.

<u>Exercise 6 :</u>

Provide the Lewis diagram for the following molecules and ions:
SiO_2, H_2O, CH_4, HCN, NH_4^+.
Write the central atom in the form AX_nE_m, specify the hybridization state, deduce the bond angle, and predict the geometry of each molecule or ion.