

Series N° 5

Exercise 1 :

1- Draw the Lewis structures of the following elements.

H, He, Li, Be, B, C, N, F, Ne.

2- Draw the Lewis structures of the following molecules and polyatomic ions.

H₂ ; Cl₂ ; H₂O ; H₃O⁺ ; NH₃ ; NH₄⁺ ; CH₄ ; C₂H₆ ; SF₄ ; SF₆ ; PCl₃ ; PCl₅ ; NCl₃

[Given: Atomic No. H=1, He=2, Li=3, Be=4, B=5, C=6, N=7, O=8, F = 9, Ne=10, P=15, S=16, Cl=17]

3. Which of these compounds does not follow the octet rule?

4- Based on the electronic structures of sulfur and phosphorus atoms, explain the formation of the molecules SF₆ and PCl₅

5- Predict the different possible valences of phosphorus. The two chlorides PCl₃ and PCl₅ exist .

Explain why only the compound NCl₃ is known, whereas the compound NCl₅ does not exist.

Exercise 2 :

1- Which of the following molecules have dipole moments? CS₂, SeS₂, CCl₂F₂, PCl₃, ClF₃, XeF₄, AsF₅.

2- Give the shapes of following covalent molecules using VSEPR theory:

[Given: Atomic No. C=6, F = 9, S=16, Cl = 17, P=15, Xe=54, As=33]

3- In the water molecule, the HÔH angle has an experimental value of 105° .

a- Calculate the dipole moment of this molecule, taking it to be equal to the vector sum of the dipole moments of the two O-H bonds.

b- Calculate the ionic percentage of the O-H bond in H₂O .

Given $\mu_{\text{O-H}} = 1.51\text{D}$ and $d_{\text{O-H}} = 0.96 \text{ \AA}$.

4- Give the energy diagram of the molecular orbitals (OM) of the heteronuclear molecules of:

He₂, N₂, N₂⁺, N₂²⁻.et N₂²⁺.

The energy of σ_{2p_z} molecular orbital is greater than π_{2p_x} and π_{2p_y} molecular orbitals in nitrogen molecule.

Write the complete sequence of energy levels in the increasing order of energy in the molecule.

Compare the relative stability and the magnetic behavior of the following species.

He₂, N₂, N₂⁺, N₂²⁻.et N₂²⁺.

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