

- Draw the Lewis structure for sulfur dichloride, SCl_2 .

- Draw the Lewis structure for nitrogen trichloride, NCl_3 .

- Draw Lewis structures of ozone, O_3 , and the formate anion, HCO_2^- , including resonance hybrids where appropriate.

Marks
3

O_3

HCO_2^-

<ul style="list-style-type: none">• Explain what is meant by hybridisation of atomic orbitals.	Marks 1
<ul style="list-style-type: none">• Carbon has atomic number $Z = 6$. What is the ground state electron configuration for an atom of carbon?	5
<p>What compound would you expect to form between a carbon atom with that electron configuration and hydrogen, <i>i.e.</i> what is the value of x in the formula CH_x? Explain.</p>	
<p>What shape would that molecule have? Explain.</p>	
<p>What molecule forms instead? Explain.</p>	

Marks
8

- What is the ground state electron configuration of oxygen?

The following diagram represents the relative energies of the atomic orbitals in the first three shells. Using arrows to represent electrons, show the most stable electron arrangement of the oxygen atom. Label the core electrons and the valence electrons.

Briefly explain how your diagram illustrates the Pauli exclusion principle, Aufbau principle and Hund's rule.

Draw an oxygen molecule showing the shapes of the σ -orbital and the π -orbital present.

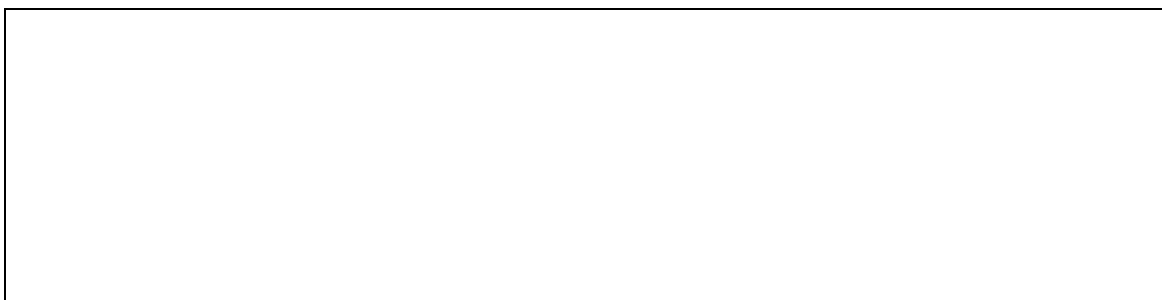
Oxygen and sulfur are both Group 16 elements with a valence of two. Oxygen is a diatomic molecule at room temperature, whilst the bonding in solid sulfur consists only of σ -bonds. Suggest reasons why, at room temperature, the O=O molecule is stable and the S=S molecule is not.

Marks
7

- Glycine, $\text{NH}_2\text{CH}_2\text{COOH}$, the simplest of all naturally occurring amino acids, has a melting point of $292\text{ }^\circ\text{C}$. The $\text{p}K_{\text{a}}$ of the acid group is 2.35 and the $\text{p}K_{\text{a}}$ associated with the amino group is 9.78. Draw a Lewis structure that indicates the charges on the molecule at the physiological pH of 7.4.



Use your structure to illustrate the concept of resonance.



Describe the hybridisation of the two carbon atoms and the nitrogen atom in glycine and the molecular geometry of the atoms surrounding these three atoms.

