Class 11 Chemistry · Chapter 4: Chemical Bonding and Molecular Structure

Worksheet · 20 marks · about 40 minutes · based on NCERT

Name _____ Class and section _____ Date _____

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1. In which of the following molecules does the central atom have fewer than eight electrons around it? [1]

(a) PCl_3 (b) H_2S
(c) $AlCl_3$ (d) SiF_4

2. In which species are there twelve electrons around the central atom? [1]

(a) H_2SO_4 (b) SCl_2
(c) NF_3 (d) CCl_4

3. The total number of valence electrons to be placed in the Lewis structure of the sulphate ion, SO_4^{2-}, is [1]

(a) 30 (b) 40
(c) 31 (d) 32

4. The enthalpies needed to remove the first, second and third hydrogen atoms from $NH_3(g)$ are 449, 385 and 339 kJ mol^{-1}. The average N–H bond enthalpy in NH_3 is [1]

(a) 449 kJ mol^{-1} (b) 391 kJ mol^{-1}
(c) 1173 kJ mol^{-1} (d) 339 kJ mol^{-1}

5. The number of σ bonds and π bonds in a molecule of acrylonitrile, $CH_2{=}CH{-}C{\equiv}N$, is [1]

(a) 3 σ and 6 π (b) 6 σ and 2 π
(c) 6 σ and 3 π (d) 7 σ and 3 π

6. For KBr, the ionization enthalpy of K(g) is 419 kJ mol^{-1}, the electron gain enthalpy of Br(g) is −325 kJ mol^{-1} and the enthalpy of lattice formation is −671 kJ mol^{-1}. Show that making the gaseous ions costs energy, and explain why solid KBr still forms. [2]

7. Taking z as the internuclear axis, state whether each pair of atomic orbitals can combine to form molecular orbitals, with a reason: (i) 1s of one hydrogen atom with 2s of another; (ii) 2pz of one oxygen atom with 2px of the other. [2]

8. Using H = ½(V + M − C + A), find the hybridisation of the central atom and the number of lone pairs on it in (i) ICl_2^- and (ii) SiF_6^{2-}. [2]

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9. Using the molecular orbital energy order for B_2, C_2 and N_2, find the bond orders of C_2 and C_2^{2-} and state the magnetic behaviour of each. Adding two electrons to O_2 to give O_2^{2-} lowers the bond order from 2 to 1; explain why adding two electrons to C_2 has the opposite effect. [3]

10. Describe the bonding in the linear HCN molecule in terms of hybridisation: name the hybridisation of carbon, the orbitals that overlap to form each σ bond, and how the π bonds arise. [3]

11. State three conditions or features of hybridisation, and correct the statement: 'Only half-filled orbitals can take part in hybridisation.' [3]