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VCE Chemistry ½
Covalent Molecules [1.6]
Test Solutions

20 Marks. 1 Minute Reading. 16 Minutes Writing

Results:

Test Questions	_____ /15
Extension	_____ /5

Section A: Test Questions (15 Marks)

Question 1 (3 marks)

Tick whether the following statements are true or false:

	True	False
a. A Lewis structure for nitrogen molecule (N_2) consists of a triple bond between the nitrogen atoms.	✓	
b. In a Lewis structure, the dots represent the nucleus of the atoms.		✓
c. Carbon dioxide (CO_2) has a linear molecular shape according to VSEPR theory.	✓	
d. Water (H_2O) has a tetrahedral molecular shape due to the arrangement of electron pairs around the oxygen atom.		✓
e. In methane (CH_4), the central carbon atom forms single bonds with four hydrogen atoms resulting in a tetrahedral molecular and parent geometry.	✓	
f. In hydrogen chloride (HCl), the chlorine atom shares one pair of electrons with hydrogen, resulting in a linear molecular shape.	✓	

Space for Personal Notes

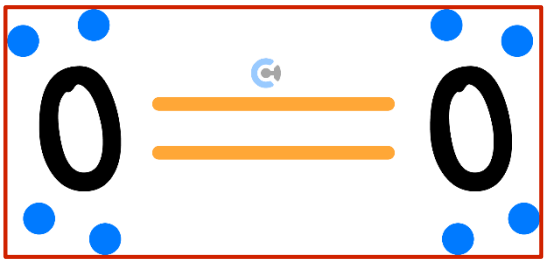
Question 2 (6 marks)

Khadija is investigating a simple yet intricate molecule - oxygen gas.

a. State what is meant by the term 'diatomic molecule'. (1 mark)

Molecules which have two atoms within their formula, such as O_2.

b. Draw the Lewis dot structure of oxygen gas. (2 marks)



c. Hence or otherwise, explain why oxygen exists diatomically in nature. (1 mark)

Because it ensures that each oxygen atom has a full outer shell by sharing two pairs of electrons (double bond) to fulfil the octet rule.

d. Complete the table below regarding the 3-dimensional shape of oxygen. (2 marks)

Molecular geometry of O_2	**Electron geometry for each O atom**
Linear	Trigonal planar

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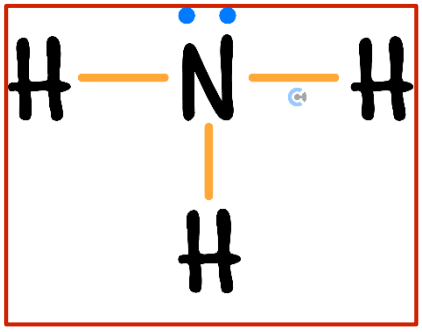
Question 3 (6 marks)

Ana is researching the Haber process, wherein ammonia, NH_3, is evolved.

a. Justify why nitrogen can form 3 covalent bonds. (1 mark)

Because nitrogen has 5 valence electrons, and needs 3 more to fulfil the octet rule and get a full valence shell.

b. Hence or otherwise, draw the Lewis structure of ammonia. You may use lines to depict covalent bonds. (2 marks)



c. State the molecular geometry of ammonia, and justify why it is as such, with reference to an appropriate theory. (3 marks)

Pyramidal (1).
This is because of the 3 bonding sites and one lone pair of electrons (2).
As such, the electron groups wish to be as far apart as possible, according to the Valence Shell Electron Pair Repulsion Theory (VSEPR Theory) (3).

Space for Personal Notes

Section B: Extension (5 Marks)

Question 4 (5 marks)

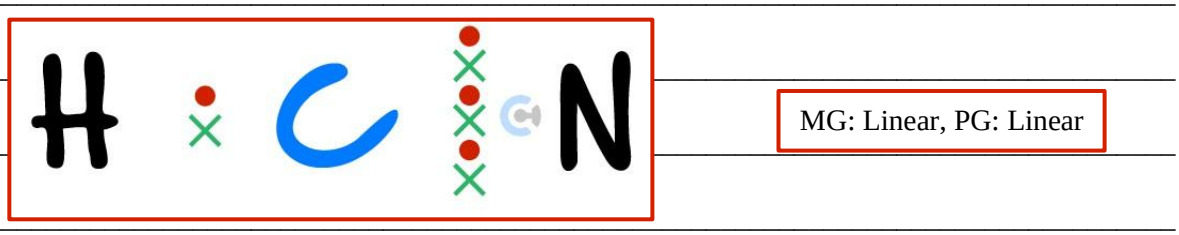
Jake is investigating some compounds and their 3-dimensional shapes.

For **parts a.** and **b.**:

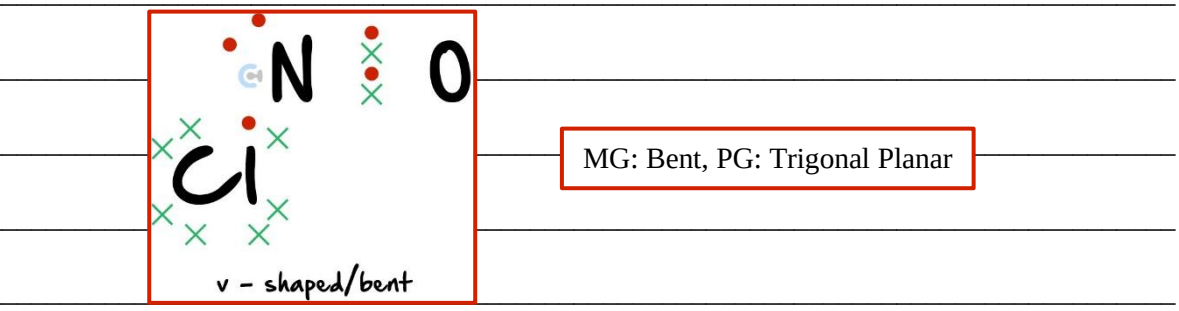
i. State the molecular geometry. (1 mark)

ii. State the parent geometry of the central atom. (1 mark)

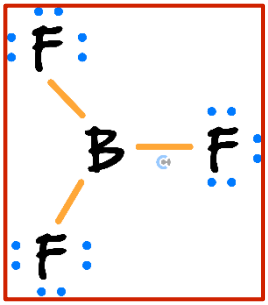
a. Hydrogen cyanide (HCN). (2 marks)



b. Nitrosyl chloride (NOCl). (2 marks)



c. Draw the structure of boron trifluoride (BF_3). (1 mark)



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