Unit 7 · Chemical Bonding

WORKSHEET

Full marks 44

Name _____ Class _____ Roll no. _____ Date _____ Marks _____ / 44

1 Key words [4]

Fill in the blanks with words from the box. Two words in the box are not needed. Each blank carries 0.5 mark.

Avogadro number	**bond length**	**coordinate covalent bond**	**covalent bond**	**donor**
gram atom	**lone pair**	**molar volume**	**pi bond**	**sigma bond**

A bond formed by the mutual sharing of a pair of electrons, each atom giving one, is a _____. A pair of outer electrons that belongs to one atom alone is a _____. Head-on overlap of two orbitals gives a _____, and sideways overlap of two parallel p orbitals a _____. A shared pair whose two electrons both come from one atom makes a _____. The atom that gives that pair is the _____. The number of particles in one mole, 6.022×10^{23}, is the _____, and the volume of one mole of any gas at STP is its _____.

2 Multiple choice [5]

Choose the correct option for each of the following questions.

i. Which overlap gives a π bond? [1]

a. s–s **b.** s–p
c. p–p head-on **d.** p–p sideways

ii. The number of σ and π bonds in a nitrogen molecule, N_2, is: [1]

a. 3 σ **b.** 2 σ and 1 π
c. 1 σ and 2 π **d.** 3 π

iii. Which of these contains a coordinate covalent bond? [1]

a. CH_4 **b.** H_2O
c. NH_4^+ **d.** HCl

iv. Which contains the largest number of atoms? [1]

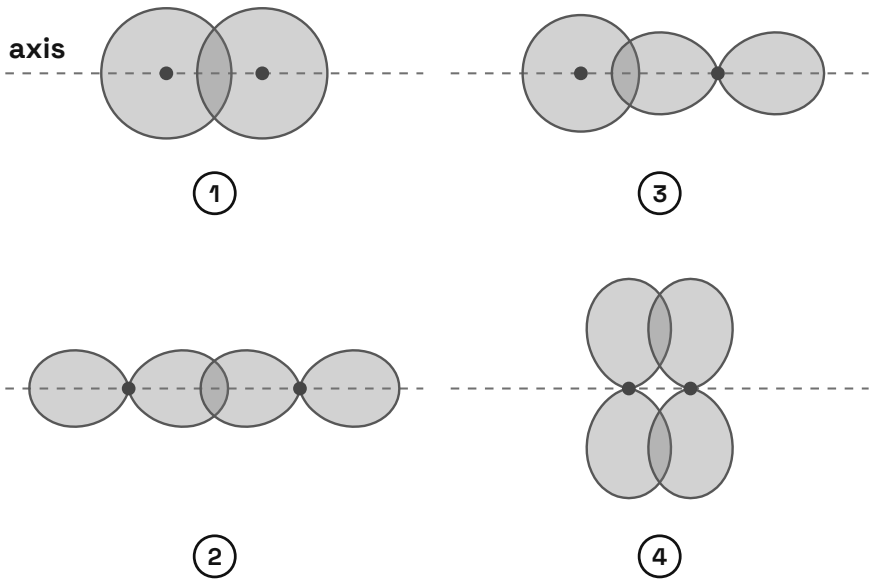
a. 1 g of hydrogen gas, H_2 **b.** 1 mol of ammonia, NH_3
c. 1 mol of oxygen gas, O_2 **d.** 12 g of carbon

v. The vapor density of sulphur dioxide, SO_2, is: [1]

a. 16 **b.** 32
c. 64 **d.** 128

3 Label the diagram [4]

The diagram shows how orbitals overlap to form bonds. In place of 1 to 4, write the orbitals that overlap, the bond they form and one example. Each carries 1 mark.



1. _____ **2.** _____

3. _____ **4.** _____

4 Very short answers [4]

Write very short answers to the following questions.

a. State Avogadro's law. [1]

_____

_____

b. How many σ and π bonds are there in hydrogen cyanide, H–C≡N? [1]

_____

_____

c. Why does a bare H^+ ion not stay free in water? [1]

_____

_____

d. What are the two things an atom can be in a coordinate bond, and what does each need? [1]

_____

_____

5 Short answers [8]

Write short answers to the following questions.

a. A π bond is weaker than a σ bond. Give a reason. [2]

b. Covalent compounds are poor conductors of electricity. Give a reason. [2]

c. In the ammonium ion all four N–H bonds are identical, though one of them is a coordinate bond. Give a reason. [2]

d. Organic compounds have lower melting and boiling points than inorganic compounds such as common salt. Give a reason. [2]

6 Long answers [8]

Write long answers to the following questions.

a. Explain the formation of a nitrogen molecule in terms of σ and π bonds. [4]

b. State Avogadro's law. Using it, show that molecular mass = 2 × vapor density. **[4]**

7 Numerical problems **[8]**

Solve the following problems. Show your working. (H = 1, C = 12, N = 14, O = 16, S = 32; Avogadro number = 6.022×10^{23}; molar volume at STP = 22.4 L.)

a. Find the mass and the number of molecules of 2.24 L of methane, CH_4, at STP. **[2]**

Answer:

b. How many atoms of each element are there in 4.9 g of sulphuric acid, H_2SO_4? **[3]**

Answer:

c. A gas has a vapor density of 8.5. Find its molecular mass, and the volume of 34 g of it at STP. Which gas could it be? **[3]**

Answer:

8 Think [3]

Mingma says, “A liter of hydrogen and a liter of oxygen at the same temperature and pressure must hold different numbers of molecules, because oxygen molecules are 16 times heavier and much bigger.” Explain what is wrong, and find how much heavier the liter of oxygen is.

9 Activity: Weigh a mole (not marked)

Work out the mass of one mole of each substance. Weigh it on a kitchen balance or find a packet that size, and put them in a row. (Na = 23, Cl = 35.5, Ca = 40; use the masses in the numerical problems for the rest.)

Substance	Formula	Mass of 1 mole (g)	Particles in it	What it looks like
water	H_2O			
common salt	NaCl			
urea	$CO(NH_2)_2$			
calcium carbonate (chalk or limestone)	$CaCO_3$			